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Les déterminants de la consommation d'alcool

Les traits de personnalité, l'orientation temporelle et les motivations

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Etiological models of problematic alcohol consumption among Francophone college students:

Personality, Temporality and Motivation

By Tianna Loose

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Forward and Acknowledgements

It's not often that we get to formally thank all of those who have played a part making us who we are today. I'm going to start by acknowledging the countless people and experiences that contributed to my thesis coming into being.

In the beginning, I come from Santa Cruz, California, the small beach town in which I was born and raised. I want to start by acknowledging my culture of origin (e.g. English is my first language) and by thanking people who meaningfully influenced me in the past, as they indirectly influence my work in the present. Though the list of people who fit these criteria is much too long to cite, I'd like to formally thank some of the adults who cultivated my quest for knowledge and for the arts, above and beyond their obligations. In chronological order, Mary Toscano (mother), Rich Loose (father), Susan Toohey (aunt), Sarah Borchelt (babysitter), Tess Weisbarth (3rd grade teacher), Kurt Almendras (5th grade teacher), Catherine Frankie (high school English), Stuart Kumaishi (high school math), as well as and a high school history teacher (veteran) and Pr. Chris Gray Hobles. I think it mattered. My peers were as influential, if not more so. I thank a some of my Santa Cruz friends for keeping it real and for letting me go, in chronological order : Haley Brown, Eli Peckman, Joey Thomas, Lily Perry, Karen Zaricor, Matt Barnett, Shayna Taylor, Tida Lane Howe, Zack Grayson, Cristine Coffee, Cassandra Boyd and Andreas Nicholas.

When I was 17 years old, I re-enrolled in college, took classes in Philosophy and elementary French, and I moved to Nantes (France). I thank the love of my life, Geoffroy Baumier, and his wonderful parents, Catherine and Patrice Baumier, quite frankly for their miraculous existence and steady support. I thank those at the IRFFLE program at the university of Nantes for teaching me French, for opening my eyes to cultural differences, and to the

wonderful foreigners who shaped me along the way, notably Amanda John (UK), Andréa Barbosa (Brazil), Amara Plasto (Bosnia), Sedep Torogeldieva (Kirgizstan) andYuta Ishikawa (Japan). After having learned French, I entered into the university along side the other French students. I thank all the students, especially Isabelle Lorioux, Agathe Mahé and Solene Drean for accompanying me throughout those early years. After my first year in psychology, I went back to California for three months. I interned at the Chief Marketing Officer Council / GlobalFluency in Palo Alto, and I thank Donovan Neale-May (president) for recruiting me as well as Brian Derose (VP business development) and Kamilla Nosovitskaya (program coordinator) for their guidance and supervision. I ended up with an outstanding experience in research aggregation (marketing intelligence) that serves me to this day. I thank the company for allowing me to work from a distance throughout my undergraduate studies, not knowing if I would ever come back.

I met Pr. Didier Acier when I took his class in psychopathology in my third year of psychology. I was immediately sold on his North American teaching style and felt at home. I went on to work more closely with Didier after my third year of psychology when I did a summer internship under his leadership. Though I did not know it at the time, this was the beginning of a six-year long mentorship for which I am immensely grateful. I thank Didier for his ongoing availability and for answering 6-years-worth of my lists of questions, and for doing so with a smile. During this internship, Didier introduced me to a model of drinking motives and a corresponding questionnaire. The questionnaire had not yet been psychometrically validated in French. Didier had gotten the questionnaire translated and had administered it to high school and college students along side a measure of alcohol consumption. Over that summer, I worked on the project and in my fourth year, I took it on as my memoire.

When researching for that project, I took a particular interest in studies that included analyses of "mediation". I gained a rudimentary understanding of what "mediation" was

supposed to mean, and concluded that it was very important to add in mediational analyses to the study design in order to show if drinking motives led to alcohol-related problems directly or indirectly, through frequency of alcohol consumption. At the time, I was also particularly taken with one specific theoretical article explaining the processes leading up to drinking behaviors, in addition to another that used structural equation modeling in order to examine drinking motives as mediators between distal factors, like personality traits, and alcohol consumption. I knew that such a framework was too ambitious for my level, but I kept the idea in the back of my head. I did not know at the time that these two articles would end up providing a foundation for my thesis.

Part of my interest in these two studies came from earlier, when I had taken interest in personality traits, in the context of an internship in social psychology research. At the time, I was interested in discrimination and prejudice, and I thought personality traits would be a meaningful determinant (the best). I looked into the topic and was disappointed to find that studies examining "racist personality types" for example in social research were very outdated to the point that they could almost be considered taboo. I had adopted a purely internalizing approach to the behavior and environmental/social factors must be taken into account. I'd like to thank Dr. Alice Faure-Levoux and Dr. Tiphaine Robin for accepting my unconventional request for this internship and for helping me better grasp the individual-situational interaction.

In the first year of my masters in clinical psychology, I wanted to do an internship in behavioral addictions and was accepted for an interview, but I did not get the position. Instead, Pr. Marie Grall-Bronnec (psychiatrist) kindly referred me to a colleague of hers who could use some help with an international project about "biopsychosocial complexity" in "liaison psychiatry." I had no idea what any of that was, but it sounded fascinating, especially the "complexity" and "international" part, and it indeed was, to the point that I ended up staying in

Francophone scientific community and I am wholeheartedly thankful for being provided with the opportunity.

With my doctoral contract, I enrolled in a PhD, PsyD program in the Behavioral Psychology section at the UQÀM.I was excited to learn the approach in North America, and upon completion of the program, I would be able to practice as a clinical psychologist in or outside of Europe. The world would be my oyster. I was accepted at the UQÀM, accepted by Ghassan El-Baalbakki and flew to Montréal, Québec in August 2014 for the first year of my doctorate. I was immediately taken with Ghassan's authenticity and intensity. I was a full time student and I enrolled in classes on the subjects of cognitive behavioral evaluation, intervention and theory, as well as classes in personality, statistics, and deontology. I also had the honor of taking Ghassan's class in methodology, which was a rich learning experience to say the least. I got to work more closely with Ghassan in the context of a critique of a randomly selected high impact article, which was an experience that I thoroughly enjoyed.

Ghassan integrated me into his Laboratory on Studies on Personality. I thank all the members of his laboratory for their warm welcome, as well as others I met in Montréal. From the UQÀM, I give special thanks Jean Bégin for helping us out with the article critique, for the calculations for statistical power that I used in my doctoral research project and for the diversely enriching conversations we had about statistics. Beyond those in my lab, I thank everyone who accompanied me in my Canadian endeavors, including but not limited to Hélène (and the artists), Matt (and the engineers), Pascal, Benjamin, Julie, Léo, Julien, Jessie, Eileene, and Yassine as well as Marta, Karine, Hélène, Jeff, and Flo. I look forward to the day when our paths will cross again.

Unexpectedly, a saga of administrative and ethics related issues led me to not return to Canada as I had once planned. In brief and in part, ethics boards in Canada do not follow the

same rules as in France, and if I was enrolled as a student at the UQÀM, I would not have been

able to finish my thesis within an acceptable delay. I figured out that I would not have this issue

if I was under a co-direction instead of a cotutelle, I respected my contract and I made the switch.

I thank Ghassan for helping me navigate through the change in ethics. Undeniably, this decision

was also moderated by the eye-opening rise of Donald Trump, which I followed attentively from

the get-go and was able to foresee bigly. I returned to France for the last two years of my thesis

and I am no longer planning on moving back to the United States. I thank both Ghassan and

Didier for their flexibility.

As explained earlier, I had thought it would be interesting to study personality and

motivation in the context of alcohol consumption, but quite honestly, I had been fascinated with

another variable ever since I was a child: *time*. In 2012, I had bought the *Time Paradox*. I was

very excited to have found a book on the topic of time written by the great Pr. Zimbardo, creator

of the infamous Stanford prison experiment, among other things. I read the book on vacation at

the shore in Connecticut and I loved it, but I was also disappointed in many respects and ranted

about it in length to my poor family members. Miraculously, I later found out that Didier had

been running a study group on temporality for almost a decade in relationship to addictive

behaviors. Thankfully, he wanted to integrate me into his project and to hand me the reins when I

got back to Nantes.

In my second year of doctoral studies, I cleaned up and psychometrically validated the

time questionnaire that had been drawn up when I was in Montréal, and wrote up a corresponding

article that was recently published. In my second and third year, we reworked the temporal

dimensions, generated new items and administered a 104-item questionnaire to students. After

much thought, obsession and statistics, I reduced the questionnaire to 15 items that had

impressively good psychometric proprieties. I was pleased with the theoretical constructs that

underpinned by these items, in part because some of my original critiques of the dominant model of time perspective were incorporated. At the last minute, I decided to use this version of the questionnaire in my thesis and gained the ethical clearance to do so. I have written up an article on the latest version, which I am admittedly excited about. The work has not yet been published and is in annex 2.

I'm going to take the liberty to formally thank Dr. Anna Sircova (independent researcher, etc.) because I would really like to throw money at her, but the best I can do is throw flowers. Aside from being a radiant human being, she organized the last conference on Time Perspective in Copenhagen which I had the honor of attending. More profoundly, I'd like to thank her for the warm, open environment she provided for conference attendees, and for poking fun at us narrow-minded scientists. I was not aware that such things still existed and it was absolutely heart-warming. I'd also like to thank Dr. Anna for putting me into contact others who I found inspirational including Inanna Riccardi (anthropologist), Dr. Elisabeth Schilling (sociologist), Seda Ozcetinand, Seyda Ozcetin (designers, etc.), and for allowing me to present my own theories about culture, time and identity, in addition to my more "scientific" work.

I thank others I met in Copenhagen with whom I am still in touch quite simply for being enriching. At the top of the list, I am grateful to Dr. Michael McKay (University of Liverpool, UK) for collaborating on the temporal profiling project, and for his insights, generosity and network. By extension, I'd like to thank the others that he brought into the project for their collaboration and help: Pr. Frank Worrell (University of Berkeley, USA), Dr. James Andretta (Child guidance clinic, USA) and Dr. Jon Cole (Liverpool John Moores University, UK). I take the liberty to thank a few others for their insights and with whom I'm still in contact, including Dr. Lening Olivera (Yale University, USA) for reviewing a pilot study for chapter 2, and Dr. Antanas Kairys (University of Vilnius, Lithuania) for his sharing his thoughts about personality,

walked in on him and a regression-based machine-learning course in the winter of 2016. Unknowingly, we had drawn nearly the same picture that day and I thank him for insisting, throughout the hours of subsequent discussion, that despite the subtle differences, we were indeed working with (almost) the same thing (see page 184).

Last but not least, I'd like to thank all the students who participated in my thesis study, as well as all of the Universities in France and in Québec that accepted to diffuse my questionnaire to their students. I wish I could have paid everyone for his or her time.

I am well aware that it was only with the help and support of all these actors and experiences, among countless others I did not take the time or space to cite, that I have come to be what and where I am today. I know that, in the future, my directors and others will continue to provide their support and I thank them in advance. I will be forever grateful. Thus, I have decided to use the pronoun "we" instead of "I" throughout the chapters in reference to my acknowledgement of Didier and Ghassan (in the past and future), but also in honor of all those who have impacted me along the way. This lengthily forward can also be helpful in understanding the fourth chapter of my thesis, in that it explained in part the processes leading up to a specific outcome, this document, which is an indirect product of my self. I took great pleasure in writing this document (especially the fourth chapter) and I sincerely hope that you enjoy the read.

Looking ahead, I thank Didier for putting together the jury for my dissertation defense. I thank the members of my jury, Pr. Romain Moirand (University of Bordeaux), Pr. Marie Grall-Bronnec (University of Nantes), Pr. Marc Auriacombe (University of Rennes), and Pr. Estelle Michinov (University of Rennes) for accepting to come on board. I thank them in advance for their precious time and I look forward to hearing their insights moving forward.

Before moving forward, there are a couple other specificities of my thesis that should be brought to the reader's attention. First of all, though this project was conducted among Francophone participants and under the supervision of francophone directors, the main chapters of this document were written in English. English happens to be my first language and writing the document in English right off the bat will allow us to publish the work in English directly.

I decided to write up the work by dividing findings into four different scientific articles, each of which will be submitted for publication. However, over the course of my post-graduate studies, I conducted several other studies that have already been published that were peripheral to my main project. Several of these articles are cited throughout my dissertation as interested readers can find these articles themselves. I also wrote up three other peripheral articles that have not yet been published. These three articles were annexed to the current document in order to be able to reference the findings when necessary throughout the chapters. Lastly, as I am aware that my scientific endeavors over the years have been atypical and widespread, I have decided to provide the reader with the course of my life formatted as a curriculum vita in French (Annex 1). I hope that this will allow French readers to better understand how this dissertation fits into my work at large. A list of my scientific communications is figured therein.

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List of abbreviations and acronyms

AI : Artificial Intelligence

APA :American Psychiatric Association

AUD : Alcohol Use Disorder

AUDIT: Alcohol Use Disorders Identification Test

CBT: Cognitive Behavioral Therapy

CFCS: Consideration of Future Consequences Scale

ICAP: International Center For Alcohol Policies

MDMQR: Modified Drinking Motives Questionnaire Revised

TCT-5D: Temporal Competency Test - 5 Dimensions

TOT-R: Test d'Orientation Temporelle Revisé / Temporal Orientation Test Revised

TOT: Test d'Orientation Temporelle / Temporal Orientation Test

TP: Time Perspective

TPT: Time Perspective Therapy

WHO : World Health Organization

ZTPI-SF: Zimbardo Time Perspective Inventory Short Form

ZTPI: Zimbardo Time Perspective Inventory

Abstract

Introduction: In the interest of positively impacting alcohol consumption among college students, we studied determinants of consumption behaviors within an etiological framework. Personality traits would be associated with alcohol consumption, but the association would be mediated by other more proximal variables. Drinking motives are theorized to be the most proximal predictive factor of alcohol consumption through which all other distal factors exert their influence. There has been a recent spark of interest in "time perspective" meaning the organization of experience into temporal frames (past, present, future). Some have theorized that time perspectives would stem from personality traits, whereas others theorized that time perspective would give rise to motivated behavior. As time perspective has been viewed as a situational-dispositional construct, we advanced the hypothesis they would be etiologically situated between personality and motivation.

Methods: Students living in France or in Québec were administered questionnaires online. Measures included Big 5 personality, time perspective, temporal competency, drinking motives and problematic alcohol consumption. Our main aim was to draw up multiple parallel mediator models reflecting different etiological relationships. In study 1, personality traits led to alcohol use through drinking motives. In study 2, personality traits led to alcohol consumption through temporalities. In study 3, temporalities led to drinking behaviors through drinking motives. In study 4, these results were taken collectively in order to derive and test hypotheses relating serial mediation (personality, temporality, drinking motives, alcohol consumption).

Results: Cultural differences were identified in study 1. French students drank alcohol in larger quantities than those in Canada, but Canadians drank with a higher frequency. Canadians scored higher on openness, conscientiousness, emotional stability and extraversion in comparison to the French, whereas the French scored higher on specific drinking motives (coping-depression,

conformity, social). There were indirect effects of personality traits on alcohol consumption through drinking motives. Every motive, except coping-anxiety, was identified as a significant mediator, and all traits led to alcohol consumption in part through drinking motives. In study 2 we used regressions to identify temporalities that were best associated with drinking behaviors: anticipation, temporal rupture, past negative and present hedonist. We explored their relationships with personality traits and confirmed our hypothesis that traits would lead to alcohol consumption through specific temporalities. In the third study, specific drinking motives explained the relationship between temporalities and alcohol consumption. The fourth study compiled positive results from studies 1-3 in a result matrix that was then used to generate a hypothesis matrix about serial mediational relationships. We found that nearly all hypotheses grounded in sufficient logical assumptions were true. We also proposed hypotheses that implied that we must take into account the full serial chain in order for a part of the chain to yield positive results and found that 40% of such relationships were significant.

Discussion: Understanding specific etiological pathways leading up to problematic alcohol consumption could aide practitioners and policy makers to positively impact drinking behaviors among students in Canada or in France. We found that the reasons why people drink alcohol best explained drinking behaviors. Personality traits would be related to alcohol consumption but mostly just because they led to drinking motives. However, before personality traits develop into drinking motives, they would give rise to specific temporalities. As our study advanced the existent literature on the processes leading up to drinking behaviors, we may be able to better foresee among which students problems will develop and prevent the onset or the aggravation of problematic alcohol use through emerging adulthood.

Key words : alcohol, student, France, Québec, personality, temporality, drinking motives, mediation

Résumé en français

Les déterminants de la consommation d'alcool: les traits de personnalité, l'orientation temporelle

et les motivations

Introduction

La consommation d'alcool chez les jeunes est un phénomène bien étudié, surtout au niveau des conséquences psychologiques, sociales et de santé. L'OMS (2011) considère que jusqu'à quatre unités d'alcool pur par jour pour un homme (soit 40 grammes) et jusqu'à deux unités pour une femme (soit 20 grammes), la consommation d'alcool présente une consommation peu à risque. Au-delà de ce volume, la probabilité de développer une pathologie liée à la consommation d'alcool devient significative (O'Connor & Schottenfeld, 1998). Cette information permet de poser une limite et de considérer qu'au-delà de ces normes, la consommation devient excessive. Néanmoins, ces normes et recommandations peuvent changer d'un pays à un autre. Certaines modalités de consommation peuvent également être problématiques, notamment l'alcoolisation massive et rapide (*binge drinking*), phénomène qui se développe chez les jeunes et pour lequel les pouvoirs publics agissent. Entre 1999 et 2011, 34 pays ont adopté des lois régulant la place de l'alcool dans la société, comme par exemple les restrictions publicitaires ou l'obligation de disposer d'un éthylotest (OMS, 2011). La consommation excessive chez les étudiants étant constatée au niveau mondial, il est évidement nécessaire de déterminer les individus à risque pour l'usage problématique d'alcool (Grant, Stewart, O'Connor, Blackwell, & Conrod, 2007).

De nombreux chercheurs ont établi des liens entre la consommation d'alcool et les motivations à en consommer (Cooper, 1994; Cox & Klinger, 1988). Les motivations sont

distinguées selon la source de renforcement visée, en l'occurrence interne ou externe, ainsi que selon la valence de ce renforcement, qui peut être de nature positive ou négative. Les attentes sont envisagées comme le facteur le plus proximal des motivations, à travers lesquelles la consommation est prédite. Les facteurs plus distaux, tels la personnalité, détermine également la consommation, mais ce ne serait que parce que la présence de certains traits favorise la survenue des motivations spécifiques (e.g. Kuntsche, Knibbe, Gmel, & Engels, 2005).

Quatre facteurs motivationnels permettent de mieux comprendre la consommation et correspondent à un tableau croisé source (externe, interne) et valence (positif, négatif) : 1) une motivation « *sociale* » répond à un stimulus externe avec une attente de renforcement positif. Il s'agit de boire parce que le contexte s'y prête, comme pour mieux célébrer ou fêter une occasion spéciale grâce à la consommation d'alcool. 2) Si l'individu boit selon une motivation de renforcement externe négatif, il boit pour éviter l'exclusion sociale. Il s'agit du « conformisme » et de consommer pour suivre le groupe. 3) Avec une motivation « d'*enhancement* », la personne sera motivée à boire lors de la survenue d'un stimulus interne de renforcement positif, c'est-à-dire que ces sujets boivent pour intensifier des affects positifs. 4) Ceux qui boivent pour réduire un affect négatif (par exemple, la tristesse ou l'anxiété) choisissent une motivation de « *coping* » qui est soutenue par un renforcement interne, à valence négative. Lors de l'emploi d'une telle motivation, le sujet ne confronte pas ses problèmes, ni agit directement dessus ; ce qui donne lieu à leur persistance voire leur aggravation (Cooper, 1994). En se basant sur une lecture de plusieurs études scientifiques menées auprès des adolescents ou des jeunes adultes (Cooper, 1994; Grant et al., 2007; Lyvers, Hasking, Hani, Rhodes, & Trew, 2010; Read, Wood, Kahler, Maddock, & Palfai, 2003), il peut être postulé que la motivation sociale et d'*enhancement* conduit à l'usage d'alcool et indirectement aux problèmes associés, alors que la motivation du *coping* conduit

directement aux problèmes associés, indépendamment du volume consommé (Hauck-Filho, Teixeira, & Cooper, 2012; Kong & Bergman, 2010; Kuntsche, Knibbe, Gmel, & Engels, 2006).

Un intérêt croissant pour mieux comprendre ces phénomènes réside dans les liens entre la consommation de substances psychoactives et la temporalité (Fieulaine & Martinez, 2010). L'orientation temporelle est la perception, dans le ici et maintenant, du ressenti à l'égard de situations passées, présentes ou futures. Il s'agit d'une dimension subjective à travers laquelle l'ensemble des expériences de vie sont intériorisées afin de donner de la cohérence et du sens à ces dites expériences (Loose, Acier, Pilet, & Sysaykeo, 2017). D'après ces auteurs, pour les jeunes, elle est composée de l'anticipation, de la rupture temporelle et de l'avenir. D'autres auteurs ont défini le passé négatif, le passé positif, le présent hédoniste, le présent fataliste et le futur (Zimbardo & Boyd, 1999). Dans deux études, Keough, Zimbardo and Boyd (1999) démontrent qu'il existe des liens significatifs entre alcool et temporalité au sein d'un échantillon de 2627 participants ($r = .34$, $p<.001$). Les étudiants qui consommaient le plus montraient un score important sur l'échelle de présent hédoniste et un score faible sur l'échelle de futur. Autrement dit, plus les participants sentent un besoin de nouveauté et de nouvelles sensations, plus ils consomment.

Plusieurs recherches s'accordent sur le fait que les motivations à consommer de l'alcool expliquent la relation entre traits de personnalité et la consommation d'alcool. À l'inverse, le statut de la temporalité fait l'objet des débats récents (Mello, Worrell, & Buhl, 2016). La temporalité peut être considérée comme une disposition stable, comme les traits de personnalité, mais est aussi malléable et dépend du contexte, tout comme la motivation. Certains ont étudié les liens entre les traits de personnalité et les temporalités (Kairys & Liniauskaite, 2015), alors que d'autres ont suggéré que l'orientation temporelle génère des motivations (Mello & Worrell, 2015). D'une manière développementale, nous postulons l'hypothèse que la personnalité

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développe la temporalité, qui donne lieu ensuite à la motivation à consommer de l'alcool, qui

détermine enfin la consommation d'alcool. Autrement dit, d'une manière étiologique, la

temporalité sera située entre les traits de personnalité et les motivations à consommer de l'alcool,

mais aucune recherche à ce jour n'a investigué l'hypothèse.

Méthodologie

Mesures

Le *Alcohol use disorders identification test,* version française a été utilisé pour mesurer

l'utilisation problématique d'alcool (Gache et al., 2005).

Le *Modified drinking motives questionnaire revised,* version française, a été utilisé pour

mesurer les motivations à consommer de l'alcool (Loose & Acier, 2017). Cinq motivations sont

prises en compte : social, conformisme, coping anxiété, coping dépression, et d'amélioration.

Le *Big 5 Inventory – français* a été utilisé pour mesurer les traits de personnalité

(Plaisant, Courtois, Réveillère, Mendelsohn, & John, 2010). Cinq traits sont pris en compte :

l'ouverture, le caractère consciencieux, l'extraversion, le stabilité émotionnel, et l'agréabilité.

Le *Zimbardo Time Perspective Inventory* version française a été utilisé pour mesurer cinq

dimensions de perspective temporelle (Apostolidis & Fieulaine, 2004). Cinq perspectives

temporelles sont mesurés : passé négatif, passé positif, présent fataliste, présent hédoniste, et le

futur.

Le *Test de Compétence Temporelle-5D* a été utilisé pour mesurer cinq dimensions de

temporalité. Il s'agit d'une nouvelle version de l'outil du test d'orientation temporelle (Loose et

al., 2017). Cinq dimensions sont prises en compte : le passé, le présent plein, la rupture

temporelle, l'anticipation, et l'avenir.

Nous avons également mesuré des variables sociodémographiques, ainsi que l'attention des participants par l'inclusion des « pièges d'attention », ce qui permet de mieux contrôler pour des réponses aléatoires.

Population et procédure

Dans cette étude, nous avons inclus des étudiants francophones vivant en France ou au Québec. Pour participer, il fallait avoir donné son consentement, avoir consommé de l'alcool au moins une fois dans l'année, avoir entre 18 et 29 ans, être actuellement étudiant, et avoir répondu correctement à des « pièges d'attention ». Les participants ont été invités à participer à un tirage au sort pour un chèque cadeau à l'issue de la passation. Des questionnaires ont été administrés en ligne en utilisant la plateforme sécurisé LimeSurvey. Le recrutement des participants a été fait par sollicitation via les réseaux sociaux et les listes de diffusion fournies par certaines universités. Le protocole a été approuvé par deux comités d'éthique l'un Québécois et l'autre Français : Le comité institutionnel d'éthique de la recherche avec les êtres humains (CIEREH) de l'Université du Québec à Montréal (numéro de certificat 2016_e_1175; Novembre 28, 2016) ainsi que le Comité d'Évaluation Éthique de l'Inserm (IRB00003888) (numéro de certificat16-296bis; Decembre 12, 2016).

Analyse des données

Notre objectif premier a été d'élaborer des modèles de médiation parallèle dans lesquels figurent un facteur distal (X), des médiateurs (M) et la consommation d'alcool (Y), ainsi que des variables de contrôle (âge, sexe et pays de résidence). Ce type de techniques d'analyse de médiation est relativement récent et permet de tirer des conclusions qui n'étaient pas possibles auparavant (Hayes, 2013).

Dans une première étude, nous avons postulé que les traits de personnalité (*X*) conduisent à la consommation d'alcool (*Y*) à travers les motivations à consommer (*M*). En objectif secondaire, nous avons étudié les différences en fonction des pays de résidence (France / Québec). Dans la deuxième étude, nous avons émis l'hypothèse que les traits de personnalité (*X*) conduisent à la consommation d'alcool (*Y*) à travers les temporalités (*M*). En objectif secondaire, nous avons comparé nos deux mesures de temporalité dans leurs relations aux traits de personnalité et à la consommation d'alcool. La troisième étude avait pour objectif de vérifier si les temporalités (*X*) conduisent à la consommation d'alcool (*Y*) à travers les motivations à consommer (*M*). Il n'y avait pas d'objectifs secondaires à cette étude. Dans une quatrième étude, nous avons investigué des relations de médiation sérielle qui incorporent l'ensemble de niveaux (trait, temporalité, motivation, consommation d'alcool). Nous avons aussi commenté la méthodologie utilisée aux chapitres précédents et avons proposé d'autres avancements méthodologiques qui pourraient être étendus à d'autres sujets ou domaines de recherches.

Résultats

*Échantillon.*867 participants ont été inclus dont 389 étudiants résident en France (M_{age}=21.49; SD_{age}=2.50 ; 74% femmes) et 478 étudiants résidant au Québec (M_{age}=23.94; SD_{age}=2.57 ; 80% femmes). Quatre études ont été menées avec cet échantillon.

*Étude 1.*Nous avons repéré certaines différences de moyennes en comparant l'échantillon Français à l'échantillon Québécois. La différence dans l'utilisation problématique d'alcool (score total obtenu à l'AUDIT) n'a pas été significative entre ces deux groupes, mais ces derniers se distinguaient sur des aspects précis de la consommation. Les français, comparativement aux canadiens, consommaient plus d'alcool par occasion et buvaient plus fréquemment six verres ou plus lors d'une même occasion. Les canadiens pour leur part, consommait de l'alcool avec une

fréquence plus élevée. En ce qui concerne les traits de personnalité et les motivations à consommer, nous avons également repéré des différences entre les échantillons. Les français ont rapporté des taux moins élevés que les canadiens sur les traits d'ouverture, de caractère consciencieux, de stabilité émotionnelle et de l'extraversion. Les français ont également rapporté des taux de motivation à consommer plus élevés que les Canadiens en ce qui concerne la motivation sociale, d'amélioration et de conformisme. Nous avons ensuite étudié des relations de médiation entre les traits de personnalité, les motivations et la consommation d'alcool. Nous avons trouvé qu'à travers des motivations spécifiques chaque trait de personnalité était lié à la consommation d'alcool. Chaque motivation, sauf le coping anxiété, a été identifiée comme un médiateur significatif au moins une fois. Pour certains traits de personnalité, comme l'ouverture, il fallait obligatoirement prendre en compte les motivations pour voir apparaître une relation entre un trait et la consommation d'alcool. D'autres traits, comme l'extraversion, pourraient être considérés comme des facteurs de vulnérabilité ou des facteurs protecteurs, en fonction de la motivation spécifique qui émerge.

Étude 2. Nous avons étudié des corrélations entre les traits de personnalité, la consommation d'alcool et deux différentes mesures de temporalité. Ensuite, nous avons utilisé des analyses de régression pour repérer les dimensions comprises dans ces deux mesures qui ont été les plus reliées à la consommation d'alcool et qui ne seraient pas redondantes entre elles. Quatre temporalités ont ainsi été identifiées: la rupture temporelle, l'anticipation (TCT-5D), le passé négatif et le présent hédoniste (ZTPI). Ces quatre temporalités ont été conservées pour la suite des analyses. Nous avons ensuite élaboré des modèles de médiation parallèle où les traits de personnalité menaient à la consommation d'alcool à travers les quatre temporalités choisies. Nous avons trouvé que tous les traits de personnalité ont conduit à la consommation d'alcool à

travers des temporalités spécifiques, et chaque temporalité a été identifiée comme un médiateur au moins une fois.

Étude 3. Nous avons repris les quatre temporalités identifiées dans l'étude 2, et nous avons analysé les relations de médiation. Nos résultats montrent que chaque temporalité (*X*) conduit à la consommation d'alcool (*Y*) à travers des motivations spécifiques (*M*). Chaque motivation, à l'exception de coping anxiété, explique l'effet entre des temporalités spécifiques et la consommation d'alcool.

Étude 4. Nous avons réalisé une compilation des résultats significatifs des études 1 à 3 sous forme d'une matrice. À partir de cette matrice, nous avons généré des hypothèses sur des relations de médiation sérielle qui incluait un trait, une temporalité, une motivation et la consommation d'alcool. Nous avons catégorisé 39 hypothèses qui ont été plus ou moins appuyés. Des tests de médiation sérielle ont montré que parfois il faut prendre en compte l'ensemble de niveaux (distal, intermédiaire, et proximal) pour voir apparaître une relation entre des déterminants et la consommation d'alcool.

Discussion

Nous avons étudié les processus conduisant à l'utilisation problématique d'alcool auprès de populations à risque : les étudiants Français et Québécois. Il s'avère que certains traits de personnalité , parce qu'ils favorisent le développement des motivations à consommer de l'alcool, peuvent être considérer comme des facteurs de risque.

Cette recherche, est la première à démontrer que des dimensions de temporalité sont présentes entre les traits de personnalité et les motivations à consommer de l'alcool. Cela peut éclaircir des débats au tour du statut étiologique de cette variable « intermédiaire » entre une disposition stable, et une caractéristique malléable ou situationnelle. Auprès des jeunes, utiliser la

temporalité comme médiateur de l'intervention clinique peut être moins moralisateur que de parler directement de la consommation, ce qui peut favoriser l'alliance, dans un contexte de prévention ou d'intervention thérapeutique. Dernièrement, nous avons trouvé que, dans certains cas, les trois niveaux de déterminants ne pourraient pas être dissociés, ce qui souligne l'importance de prendre en compte l'ensemble de ces facteurs.

Étudier les traits de personnalité sans prendre en compte des facteurs plus proximaux explique peu de variance dans la consommation d'alcool. Par extension, cibler les motivations chez les jeunes adultes serait plus efficace que de cibler les traits de personnalité. Auprès des mineurs, qui sont trop jeunes pour être motivés à consommer de l'alcool, nous pouvons observer leurs traits de personnalité et être attentif à la manière que celle-ci génère des motivations à consommer de l'alcool avec l'avancée en âge. Comme les relations observées diffèrent en fonction du pays de résidence, il serait important de prendre en compte le contexte culturel des étudiants lorsqu'on conceptualise les implications de ces résultats.

Mots clés : alcool, étudiant, France, Québec, personnalité, temporalité, motivations à consommer, médiation

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INTRODUCTION

In the interest of positively impacting problematic drinking behaviors among college students living in France or in Canada, we aimed to investigate determinants of alcohol consumption as well as the interrelationships of these determinants within an etiological framework. In this general introduction, we will first give an overview of research problem at hand. Then, we will provide general information about the prevalence and dangers of alcohol consumption, followed by an overview of the plethora of factors that have been identified as determinants of problematic drinking behaviors. Next, we will draw the focus to three different levels of determinants that will be used throughout the subsequent chapters: drinking motives, time perspectives and personality traits. We decided to use this general introduction to provide a more complete review of the literature on the topic because chapters one to three were written as scientific articles, and were accordingly structured and restrained.

In the introduction, we will take the time to review the constructs, their measures, as well as their relationships with health related behaviors, notably addictive behaviors and alcohol consumption among young people. Then we will provide a detailed account of the state of research on three different interrelationships that correspond to the main aims of chapters one to three. Here again, the information provided in the introductive sections differs from that in the corresponding chapters because the wider scope. Throughout these introductive sections, hypotheses pertaining specific direct and indirect effects will be stated. Chapter four could be classified as a methodological commentary and was not written up within the conventional framework of scientific articles. We did not have any supplementary introductive material to add because the chapter itself was conceptual. After this detailed theoretical introduction, a comprehensive overview of studies and methods will be provided. This will allow us to proceed

into the four main chapters that will finally be closed in a general conclusion. Note that the core information in this thesis can be found in chapters one to four, and that the introduction mostly provides peripheral information for interested readers. The introductory information could also help readers understand how the subsequent chapters emerged, because the information was almost all aggregated prior to conducting the study.

1. Research problem

Identifying and preventing patterns of hazardous alcohol use among college students is a key concern for clinical psychology. In North America and in Europe, excessive alcohol use and misuse cause a wide range of problems to self and others including physical or psychological harm. Positively impacting hazardous or problematic alcohol consumption among at risk populations is a high priority for prevention techniques grounded in health and clinical psychology. Detecting individuals who show signs of hazardous drinking habits in young adulthood may be a viable means to decrease the prevalence of alcoholism through emerging adulthood. The psychological processes leading to hazardous alcohol use must be finely identified and understood in order to intervene effectively. This work focused on this problem among college students (18-29 years old) because they have been identified as an at risk population. It can be argued that cultural influences on problematic alcohol use should be considered when evaluating risk and vulnerability factors in a global population. Thus, this work aimed to account for potential cultural differences in problematic alcohol use in North America and Europe by studying French-speaking college students living in Québec (Canada) and in France.

In order to effectively prevent problematic alcohol use from a clinical standpoint, relevant determinants should to be understood empirically. It holds that problematic alcohol use is

determined by an interaction of numerous psychological, biological, social and environmental factors. Among psychological determinants, it has been demonstrated that many factors, including personality traits, time perspectives and motivations to consume alcohol, are capable of predicting problematic alcohol use among college students. The different dimensions of these variables transcribe pertinent vulnerability and protective factors relevant to problematic alcohol consumption.

However, clinical frameworks that lay out determinants of alcohol consumption are complex as they often figure several levels of determinants, some of which are more proximally associated with use than are others. It would be beneficial for research to take into account these complex mediational relationships instead of simply investigating the bivariate relationships between various determinants and problematic alcohol use. For example, some of the most distal factors related to problematic alcohol use are personality traits, whereas motives to drink are viewed as the most proximal factor. Multiple studies suggest that motives to drink mediate the relationship between personality traits and problematic alcohol use. However, between these two poles, many other intermediary factors have been identified.

Recent advances in research about "time perspective" suggested that this concept could be a meaningful intermediary factor determinant of alcohol use, situated somewhere between personality traits and drinking motives. However, research on time perspective has only recently been flourishing and the topic clearly merits further investigation. A few studies indirectly allude to the fact that time perspectives, like drinking motives, mediate the relationship between personality traits and problematic alcohol use. In order to advance this budding domain of research, the present study aims to further examine this potential mediational relationship. It is plausible that the relationship between time perspectives and problematic alcohol use is mediated by drinking motives, yet this possible mediational role has not yet been studied.

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It stands that there are multilevel interrelationships between determinants of problematic alcohol use in which the relationship between distal and proximal factors is mediated by intermediary factors. Here, personality traits are studied as the most distal factor, time perspective as an intermediary factor and motives to drink as the most proximal factor determinant of problematic alcohol use among college students. In sum, this work aims to investigate mediational models of problematic alcohol use which include distal, intermediary and proximal determinants through emerging adulthood while accounting for differences in culture, age and sex.

2. Problematic alcohol use: Definitions and prevalence

Problems stemming from alcohol use are serious public health concerns that merit international action. 4% of global deaths can be attributed to alcohol intake. Suicide, fatal car accidents and violence are more frequent when problems with alcohol are present (American Psychiatric Association, 2013). There is no agreed upon definition of problematic alcohol use or risky alcohol use (Dawson, 2011). Babor, Higgins-Biddle, Saunders and Monteiro (2001) define hazardous drinking as « a pattern of alcohol consumption that increases the risk of harmful consequences for the user or others ». People who are considered « hazardous » drinkers typically consume at least 3-4 drinks per occasion or have consumed at least 6 drinks on at least one occasion over the last year (Babor et al., 2001). Alcohol use becomes "harmful" when it causes damage to one's mental or physical health (World Health Organization (WHO), 2014). More specifically, there are three key negative consequences of harmful alcohol use: damage to internal organs and tissues which can cause various diseases, cognitive and behavioral impairment while intoxicated and loss of control over one's alcohol use. In the context of this

report, « problematic alcohol use » refers to a pattern of use that meets or exceeds the criteria for hazardous drinking defined by Barbor et al. (2001).

Hazardous alcohol use precedes the onset of mental disorders associated with alcohol intake. DSM 5 alcohol related disorders include Alcohol Use Disorder (AUD), alcohol intoxication, alcohol withdrawal, other alcohol induced disorders and unspecified alcohol related disorder. AUD necessarily includes clinically significant impairment or distress and at least two of the following symptoms over a 12 month period: unintended increases in the quantity of alcohol use or time spent consuming; desire or failed attempts to control alcohol use; excessive amounts of time spent engaging in alcohol related activities; cravings for alcohol; lacking to respect major obligations because of alcohol use; use of alcohol despite one's knowledge of negative psychosocial effects; abandoning habitual activities because of alcohol use; alcohol use in physically dangerous situations; continuing use despite negative psychological or medical effects; tolerance ; and withdrawal. AUD can be mild (2-3 symptoms), moderate (4-5 symptoms) or severe (6+ symptoms). Symptoms of anxiety and depression as well as conduct problems and insomnia often proceed or succeed an AUD. The most frequent comorbidities include bipolar disorder, schizophrenia, antisocial personality, anxiety disorders and depressive disorders (APA, 2013).

In light of the gravity of this public health concern, over the last 15 years, 34 new countries have adopted formal policies destined to reduce negative effects of alcohol use (WHO, 2014). However, problematic alcohol use cannot always be prevented. Thus, on a clinical level, various psychological interventions are employed in order to prevent and treat alcohol use disorders. One meta-analysis demonstrates that among studied therapies, motivational interviewing and cognitive behavioral therapy were the most effective interventions for people diagnosed with alcohol dependence and comorbid anxiety or depression (Baker, 2012). A second

meta-analysis demonstrated that motivational interviewing works better than other studied interventions among college students meeting criteria for an AUD (Carey, Scott-Sheldon, Carey, & DeMartini, 2007). In order to intervene effectively, it is pertinent to advance clinical research and practice which aims to study cognitive-behavioral and motivational aspects of problematic alcohol use. Prevention among those with risky drinking habits is also important for policies destined to reduce alcohol dependence before it occurs (WHO, 2014). Thus, identifying and screening for clinically relevant and culturally tailored vulnerability factors can help get college students the care they need before their problems with alcohol further develop.

3. Determinants of problematic alcohol use

3.1. Biopsychosocial determinants

The International Center for Alcohol Policies defines four categories of determinants of drinking behavior that have been brought to light notably among young people: genetic predispositions, individual characteristics, social and economic factors, and environmental determinants (International Center For Alcohol Policies (ICAP), 2009). According to the WHO, determinants of Alcohol Use Disorders (AUD) include socioeconomic status, gender, age, culture and context, economic development, family risk factors, and alcohol regulation and control (WHO, 2014).

Genetic predispositions influence peoples' physiological response to alcohol, metabolism of alcohol and physiological risk of dependence. Adoption studies demonstrate that 18% of children with alcohol dependent birth parents will also develop alcohol dependency. Genetic factors also shape personality traits and general mental health (International Center For Alcohol Policies (ICAP), 2009). Specific phenotypes associated with at risk genes include bipolar disorder, schizophrenia, high impulsivity and low sensitivity to rewards (dopamine) (APA, 2013).

Individual differences determinant of drinking behavior include age, personality traits, alcohol expectancies, drinking motives as well as physical and mental health status (ICAP, 2009). Comorbidity between other mental health disorders and AUD is estimated at 50%. More specifically, 60% young people with AUD also have another psychiatric issues (notably, anxiety and depression). In these cases, alcohol can be used to cope with severe negative affect (ICAP, 2009). Mediocre coping strategies were identified as a vulnerability factor (WHO, 2014). Tendency towards risk taking, impulsivity, sensation seeking, behavioral dis-inhibition, conduct disorder, aggression, depression and antisocial behavior have been cited as vulnerability factors independently of culture and age. Positive expectancies of the effects of alcohol were also consistently tied to increased alcohol consumption. Drinking motives are also an important determinant of alcohol use and related problems (ICAP, 2009) and the most proximal predictive factor of alcohol use behavior(Cox & Klinger, 1988).

Being young or male have also been identified as risk factors. Females have been known to drink less, are more likely to be abstinent than men (WHO, 2014). More men (12.4%) have AUD than women (4.9%) (APA, 2013). However, it seems that the gender gap has been diminishing (WHO, 2014). Young people are known to drink more heavily and engage in more risky behavior when drunk than would adults. They were at increased risk for accidents and injuries because they have an increased sensitivity to alcohol and have little experience with the substance (ICAP, 2009). For example, binge drinking, reckless behavior while intoxicated and over-intoxication characterize problematic alcohol use among this age group (WHO, 2014). Young people have a heightened risk of developing AUD. Over a 12 month period in the United States, 4.6% of 12-17 years old and 8.5% of adults have been diagnosed with AUD, but prevalence is highest among 18-29-year-olds: 16.2% of this age group are diagnosed (APA, 2013).

Social and economic risk factors include socioeconomic status and social relationships. Social marginalization (e.g. native Americans) and economic deprivation (e.g. homeless) are positively associated with alcohol related problems. In general low socio-economic status would be related to increased alcohol consumption and problems, but some studies find a U shape relationship between these variables, such that people with either high or low socioeconomic status would be the most at risk. Social relationships also progressively shape alcohol related behavior. Family bonds and family structure are important determinants in childhood and early adolescence. As age advances, peers become increasingly important. Engagement in activities with family (instead of peers), stable partner relationships, strong social networks and responsibilities that are incompatible with heavy drinking have been cited as protective factors related to peers. On the other hand, living with a dysfunctional family, parental rejection and lack of parental support have been identified as social risk factors. Some studies suggest that the influence of social factors is dependent on culture (ICAP, 2009).

Environmental determinants of alcohol related behavior include drinking culture and alcohol regulations, exposure and education. This category of determinants is said to underlie the influence of other determinants as a function of norms. Social norms and groups can shape drinking behavior in a positive or negative manner. Belonging to a religion was a protective factor, even independently of the religion's views on alcohol. The encouragement or rejection of social groups also shapes drinking behavior. For example, Mediterranean countries encourage frequent drinking at meals but stigmatize heavy alcohol use, whereas in Northern European countries, habitual drinking is looked down upon but episodes of binge drinking are accepted (ICAP, 2009). Likewise, problematic alcohol consummation could differ between French and Canadian populations. In Europe, 25% of people above 15 years old engage in heavy episodic drinking whereas this is true for 21% of North America's population. Furthermore, the average

Canadian consumed an estimated 9.77 liters of pure alcohol per year, whereas the average French person consumed an estimated 13.66 liters (WHO, 2014). Alcohol regulations differ between these two countries. Notably, there is a government monopoly on alcohol sales in Québec, but no such regulations exist in France.

Alcohol consumption would be influenced by a myriad of factors including but not limited to those stated above. Determinants interact in a complex manner but unfortunately this is something studies most often neglect. Instead, research mostly focuses exclusively on one group (level) of determinants. For example some studies accentuate the role of peers, family and drinking culture when explaining young adult drinking behavior, while others underline the role of marketing and alcohol availability. A substantial body of research is still needed in order to resolve debates regarding the relative importance of each level of determinants as well as specific interrelationships between determinants (ICAP, 2009).

This study aimed in part to place a specific conceptualization of time perspective (TP), a relatively understudied variable, in the context of an existing etiological framework of alcohol use originally developed by Cox and Klinger (1988). However there are still substantial questions being raised about time perspective. For example, even the very "nature" of TP is still undergoing debate. Questions are currently being raised concerning its association and distinction with personality traits, motivation and abnormal behavior. Establishing the place of TP among other known determinants of alcohol related behavior would be beneficial. It has been generally accepted that drinking motives are the most proximal predictive factor of alcohol use, in which all distal factors converge. Distal factors related to alcohol use include physiological reactivity, personality, and social/environmental factors (Cox & Klinger, 1988). In order to account for this distal level of determinants, we chose to take into account personality traits. In

the following sections, drinking motives, personality traits and time perspectives will be defined

and detailed in their relationship to behaviors, notably alcohol consumption.

3.2. Overview of determinants studied

3.2.1. Drinking motives

Drinking motives have been identified as the most proximal determinant predictive of

drinking behaviors in which all other distal factors converge (Kuntsche, Knibbe, Gmel, & Engels,

2005). In 1988, Cox and Klinger came out with a conceptual framework based on this idea in

which the authors described the processes leading up to the decision to drink. This model quickly

gained popularity and continues to structure recent works. Major strengths of their model include

its underpinnings in cognitive behavioral theory and its exhibition of the interrelationships

between multiple levels of factors leading up to alcohol use. Motives were defined in terms of the

valence of the reinforcement obtained after consuming alcohol. Accordingly, two types of

drinking motives were outlined: positive reinforcement motives and negative reinforcement

motives. The former is defined by drinking alcohol in order to increase positive affect (e.g at a

bar with friends) and the latter is defined by drinking in order to reduce negative affect (e.g. at

home alone).

Cooper is one of the most influential authors among those grounded in Cox and Klinger's

theory. In 1994, she created and validated a 4-factor questionnaire that was designed to assess

drinking motives. The included factors corresponded to a two by two cross table defined by the

source (internal, external) and the valence (positive, negative) of expected reinforcement. The

valence of reinforcement sticks to the definition proposed by Cox and Klinger (1988). The

source of reinforcement can either be psychological (internal) or social (external). When source is

crossed with valence, four reasons to drink are designated: social (positive, external), coping

(negative, internal), enhancement (positive, internal) and conformity (negative, external). Internally sourced motives (coping and enhancement) often lead to heavy alcohol use and negatively reinforced motives (coping and conformity) most often to alcohol related problems(Cooper, 1994; Grant, Stewart, O'Connor, Blackwell, & Conrod, 2007). Each specific motive describes a clinically distinct process that leads to the decision to drink and the circumstances in which one is willing to do so.

When people drink alcohol for a social motive, they are aiming to make a social experience even better by consuming alcohol, thus improving their positive affect in a social context. Accordingly, people who endorse social motives drink in the presence of others at events such as parties and get-togethers with mixed-sex friends, but do not report drinking alone (Cooper, 1994). Social motives were traditionally considered the least risky of drinking motives because drinking behavior would be restricted to "appropriate" social contexts. Social motives have led to heavy alcohol use (e.g. Hauck-Filho, Teixeira, & Cooper, 2012; Kuntsche, Knibbe, Gmel, & Engels, 2006) but not to problems (Cooper, 1994). However, some researchers suggest that the normalization of social drinking habits among college students renders them a risky motive in this specific population (Lyvers, Hasking, Hani, Rhodes, & Trew, 2010). For example college students in Brazil (Hauck-Filho et al., 2012) are at risk for developing problems while drinking for social motives. In sum, social motives seem to be problematic when one's typical social interactions frequently involve consuming alcohol, be it because of a cultural context (e.g. France) or be it due to a social group (e.g. university students).

People who endorse enhancement motives would drink in order to spice things up. This internally driven motive would be associated with a low level of arousal that merits a boost. Here, the person does not feel distressed, but wishes to feel even better. They could drink for example at get-togethers with friends of the same sex (Cooper, 1994). Conceptually, people

could also drink for enhancement motives while watching a good movie or while working in the afternoon. Enhancement motives may be dangerous because they are internally sourced. It has been demonstrated that enhancement motives lead to a heightened frequency and quantity of alcohol use (Cooper, 1994).   Enhancement motives were determinants of alcohol abuse, misuse (Kong & Bergman, 2010), binge drinking, problems while intoxicated that are violent or sexual in nature (Kuntsche et al., 2006), alcohol dependence, and harmful use (Lyvers et al., 2010). Some find that enhancement motives are related directly to problematic alcohol use (Hauck-Filho et al., 2012) or indirectly, through the full mediation of alcohol use (Cooper, 1994).

People who drink in order to fit in with valorized social groups endorse conformity motives. By drinking alcohol, they are able to relieve themselves of the negative affect produced by feeling socially excluded or uncomfortable. Personally, these people do not want to drink, but their yearning to be socially accepted would outweigh their desire for abstinence. Hence, they will only drink in the presence of others and only when they expect that the group will like them better if they do so (Cooper, 1994). Conformity motives were negatively associated with alcohol use (Cooper, 1994; Grant et al., 2007; Mezquita et al., 2011) and theoretically have a positive association with alcohol related problems, but this has only been observed once (Cooper, 1994). Furthermore, some studies found that these motives did not significantly predict alcohol use or problems (Hauck-Filho et al., 2012; Lyvers et al., 2010).

Coping motives were commonly viewed as the riskiest motive to drink (Kuntsche et al., 2005). When people are feeling anxious or depressed, they may consume alcohol in order to relieve themselves of these negative feelings. When people who endorse coping motives are feeling down, they most often drink alone instead of going out or inviting people over (Cooper, 1994). This would be an avoidant coping strategy that does not resolve the initial cause of distress, but rather frequently creates more biopsychosocial problems, associated with both

alcohol misuse and the original cause of distress (Grant et al., 2007; Kuntsche et al., 2006; Lyvers et al., 2010). Studies have shown that coping motives either lead directly to problems independently of alcohol use (Hauck-Filho et al., 2012) or that this association is mediated by the frequency and quantity of alcohol consumed (Cooper, 1994).

Some suggest that it is clinically relevant and valid to specify if the person is feeling anxious or depressed when they use alcohol to cope (Grant et al., 2007; Mezquita et al., 2011). Considering that these two negative phenomenon have different clinical manifestations (e.g. major depressive disorder versus generalized anxiety disorder), it would be logical that their association with alcohol use would also clinically distinct. For example, people with anxiety anticipate future distress, whereas among people with depression, distressful events have already occurred, are occurring and will continue to occur (Beck & Beck, 2012). Recent studies have suggested that using alcohol to cope with depression leads to a different clinical outcome than when coping with anxiety (Grant et al., 2007; Grant, Stewart, O'Connor, Blackwell, & Conrod, 2009; Mezquita et al., 2011). However, the first study indicates that coping anxiety motives lead to decreased use, whereas the second study finds that they lead to increased use. Furthermore, coping depression motives led to increased use in the first study, but do not significantly predict use in the second. Thus, more research would be beneficial in order to elucidate the predictive validity of specific coping motives.

The 4-factor model of drinking motives was initially validated in the United States among undergraduate students (Cooper, 1994). The questionnaire proved to be reliable, valid and better than 1, 2 and 3-factor solutions. Each motive was able to predict unique outcomes related to alcohol use. Subsequently, the questionnaire's external validity was extended to other cultures and populations. Today, the questionnaire has proved to be valid in Switzerland (Kuntsche et al., 2006), Australia (Lyvers et al., 2010) and Brazil (Hauck-Filho et al., 2012). College students are

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the most often studied, but pre-adolescents (Kuntsche & Müller, 2012), adolescents (Kuntsche et al., 2006) and public high school drop outs (Kong & Bergman, 2010) have also been included in samples. The recent 5-factor model which splits coping motives into two distinct dimensions was initially validated in Canada among undergraduates (Grant et al., 2007, 2009) and has since been validated in Spain among both clinical and nonclinical samples (Mezquita et al., 2011). Both of these studies showed that a 5-factor model fit the data better than a 4-factor model and that coping anxiety and coping depression motives predicted distinct alcohol related outcomes. Thus, it seems that a 5-factor model of drinking motives describes problematic drinking behavior more accurately than generic coping motives. In sum, social, coping depression and enhancement motives seem to be positively associated with problematic alcohol use whereas coping anxiety and conformity motives seem to be negatively associated with this outcome.

3.2.2. Personality traits

Personality psychologists aim to study the mechanisms by which traits interact with the external environment and generate unique individuals (Zimbardo & Boyd, 2015). Personality would be one of the most distal factors determinant of alcohol use (Cox & Klinger, 1988). Over the years, various nomothetic and idiographic conceptions of personality have been outlined, one of the first of which dates back to Hippocrate (460-377 B.C.). Gordon Allport found over 50 definitions of personality and defines the term himself as "the dynamic organization within the individual of those psychophysical systems that determine his unique adjustments to the environment" (1937) and "…that determine his characteristic behavior and thought" (1961). Personality traits are relatively stable over time and influence how people behave across situations. Theories on personality differ according to how much weight they grant to environmental factors in proportion to genetic determinants.

Many study personality traits by using the "lexical hypothesis", which states that all pertinent traits are encoded into language (Plaisant, Courtois, Réveillère, Mendelsohn, & John, 2010), i.e. all important traits have words to describe them and these words are written in the dictionary. By extension, researchers can find all of the pertinent traits and their interrelationships by extracting and examining terms used in language to describe people. This process ultimately takes the form of factorial analyzes in which higher and lower order factors are extracted. Historically, Allport, Cattel and Eynsenck elaborated the most popular models using this method. However, in the 1960's and 70's, the lexical hypothesis was heavily criticized and research was put on hold (Cooper & Pervin, 1998). Nevertheless, in 1981, Goldberg and colleagues conducted additional factorial analyzes and came out with a 5-factor model. This work inaugurated the reintroduction of a 5-factor model into psychology (Cooper & Pervin, 1998). Subsequent studies extracted the same five factors and by the 1990's the « Big 5 » became a consensual conception of personality traits (Costa & McCrae, 1992). It seems that these traits are universal but that average scores can significantly differ across cultures(Schmitt, Allik, McCrae, & Benet-Martínez, 2007). Costa and McCrae created widely disseminated questionnaires based on this model, such as the NEO Personality Inventory Revised (NEO-PI-R) and a shortened version, the NEO Five Factor Inventory (NEO-FFI). Participants obtain a score on each dimension and specific facets comprising dimensions. Traits are comprised of facets and defined on a continuum between two polar adjectives. The five higher order traits are openness to experience (closedness), conscientiousness (undirectedness), agreeableness (antagonism), extraversion (introversion), and neuroticism (emotional stability).

Even if there is no "alcoholic personality," some traits render people vulnerable to develop a problematic relationship with alcohol (Ibáñez et al., 2010). Studies suggested that specific personality types and traits were associated with substance use in general, as well as with

peoples' substance of choice. Out of the Big 5 personality traits, high neuroticism, low agreeableness and low conscientiousness are the most often associated with alcohol misuse (Flory et al., 2002) but all of the Big 5 dimensions have been significantly associated with problematic alcohol use in at least one study. Thus, each of the Big 5 personality traits would be pertinent to examine in its relationship to problematic alcohol use. These traits would reflect useful inter-individual differences that protect or render the person vulnerable to developing problematic alcohol use, and by extension, an AUD.

Extraverted people thrive in social interactions and are affectionate, talkative, active, fun loving and passionate. They have a high frequency of positive emotions and seek excitement. Introverted people are timid and avoidant of group interactions. They are reserved, loners, and vulnerable (Costa & McCrae, 1992). A study shows that Canadian college students are significantly more extraverted than their French counterparts (Schmitt et al., 2007). High extraversion has been associated with a positive urge to drink in response to an alcohol related cue (Kambouropoulos & Rock, 2010), alcohol abuse among a community sample (Flory, Lynam, Milich, Leukefeld, & Clayton, 2002) and future alcohol misuse among adolescents (George, 2010). Others have found no significant relationship between extraversion and young adult alcoholism (Loukas, Krull, Chassin, & Carle, 2000) or alcohol misuse among college students (Ibáñez et al., 2010). Thus, extraversion was inconsistently related to alcohol misuse, but in sum, it seems that extraversion is either positively related to problematic alcohol use or unrelated.

People who are open to experiences would enjoy novel ideas and experiences, variety and change. They are described as empathetic, creative, curious and appreciative of beauty in nature and in art. Closed people like routine, convention and conservatism (Costa & McCrae, 1992). On average, French and Canadian college students have the same level of openness (Schmitt et al., 2007). Loukas et al. (2000) found that high openness is positively associated with alcoholism

among young adult children of alcoholics, and Ibáñez et al. (2010) found that openness is positively correlated with the frequency of alcohol use but insignificantly related to the quantity consumed. Likewise, Flory et al. (2002) found that openness was unrelated to alcohol abuse. Overall, it seems that openness is weakly associated with problematic alcohol use or unrelated.

Neuroticism describes peoples' ability to cope with emotional distress. Neurotic people would have more negative emotions than those who are emotionally stable. They were more often anxious, depressive, impulsive, vulnerable, self-conscious and temperamental (Costa & McCrae, 1992). A study showed that French students were more neurotic than Canadians students (Schmitt et al., 2007). In theory, neuroticism is tied to alcohol misuse because some people consume alcohol in order to cope with negative affect (Ibáñez et al., 2010). Neuroticism is positively associated with drinking frequency and quantity among college students (Ruiz, Pincus, & Dickinson, 2003). Furthermore, high neuroticism has been widely linked to various alcohol related problems including young adult alcoholism(Loukas et al., 2000), alcohol abuse in college (Flory et al., 2002), and patient relapse one year following treatment for alcohol dependence (Bottlender & Soyka, 2005). In light of these results, it seems that neuroticism has a positive association with problematic alcohol use.

Agreeable people can be described as friendly, compliant, trusting, altruistic, good-natured, modest and cooperative (Costa & McCrae, 1992). High agreeableness is negatively associated with the frequency and quantity of alcohol use (Ibáñez et al., 2010) and positively related to reasons to limit alcohol use (Loukas et al., 2000). Inversely, antagonism manifests itself in people whodescribed as untrusting, ruthless, suspicious, stingy, critical and irritable (Costa & McCrae, 1992). French college students are more antagonistic than their Canadian counterparts (Schmitt et al., 2007). Antagonism would be associated with young adult alcoholism (Loukas et al. 2000), as well as with alcohol abuse (Flory et al., 2002) and use (Ruiz

et al., 2003) among college students. However, Ruiz et al. (2003) failed to establish a hypothesized relationship between antagonism and alcohol related problems among college students. In sum, it seems that antagonism would be positively associated with problematic alcohol use.

People who are conscientious are described as organized, reliable, ambitious, self-disciplined and focused on achievement, whereas undirected people are described as negligent, lazy and aimless (Costa & McCrae). In college, the French were just as conscientious as Canadians (Schmitt et al., 2007). People that who are highly conscientious would have more reasons to limit alcohol use (Loukas et al., 2000). On the contrary, undirectedness was positively associated with alcohol misuse (Ruiz et al., 2003; Ibáñez et al., 2010) and abuse among college students (Flory et al., 2002; Ruiz et al., 2003). This trait has also been associated with young adult alcoholism (Loukas et al., 2000) and patient relapse one year following treatment for alcohol dependence (Bottlender & Soyka, 2005). Thus, it seems that undirectedness is positively related to problematic alcohol use.

In conclusion, all of the Big 5 personality traits have been significantly associated with alcohol use behavior in at least one study. It is possible that neuroticism, undirectedness, antagonism, openness and extraversion could all be positively associated with problematic alcohol use. However, neuroticism and undirectedness seem to be the most consistently and strongly tied to problematic alcohol use. Nevertheless, because the relationship between traits and alcohol use would be mediated by many intermediary factors, models that exclusively include personality traits as determinants were deemed "passé" even by the 1980's (Cox & Klinger, 1988). Thus, it is important to include traits in addition to more proximal determinants of alcohol use (e.g. drinking motives).

3.2.3. Time perspectives

"Time" is the most frequently used noun in the English language. Keeping with the lexical hypothesis, time must then be a fundamental concept to humans. Time has been studied by a wide range of scholars including anyone from Sigmund Freud to Albert Einstein (Zimbardo & Boyd, 2008). Many domains including philosophy, physics, theology and psychology have studied time from subjective and objective standpoints. Psychological time can be opposed to chronological time and has four main applications in research: time calculation, time orientation, time estimation and time perspective (TP) (Hoornaert, 1973). Among these topics, TP may draw the most attention, but there is no agreed upon definition of the term. Rather, many definitions and conceptions have been proposed for over 50 years (Thiébaut, 1998). First, Lewin defined the term as the totality of one's perspective on past and future at a given moment (Klapproth, 2011). Since, multiple facets of TP have been defined, including temporal orientation or directionality (the amount of cognitive time spent in the present, past and future), temporal density (the "quantity or richness of content from temporal perspectives"), temporal extension (the distance that the individual is able to project himself into the future or past), temporal coherence or realism (in part defined by the clarity or degree of realism of temporal projection) and temporal attitude (the valence of the emotional experience associated with the temporal frame) (Apostolidis & Fieulaine, 2004).

Measures of time perspective include projective tests, questionnaires and behavioral techniques (Klapproth, 2011). In scientific publications, the most widely used measures of TP are the Zimbardo Time Perspective Inventory (ZTPI) (Zimbardo & Boyd, 1999) and the Consideration of Future Consequences Scale (CFCS) (Strathman, Gleicher, Boninger, & Edwards, 1994). These scales were related but not redundant (Crockett, Weinman, Hankins, & Marteau, 2009) and predicted outcome above and beyond Big 5 personality traits (Worrell

&Mello, 2007; Zimbardo & Boyd, 1999). The ZTPI has been validated among a sample of French college student (Thémis Apostolidis & Fieulaine, 2004), but the CFCS has not yet been validated among French people. Interestingly, a group of psychologists in Nantes have recently proposed a measure of time orientation specifically tailored to French youth and substance use.

The CFCS measures to what extent people take into account the future consequences of their actions when behaving in the present. Scores lie on a continuum ranging from future orientated to present orientated. Convergent concepts to future orientation include locus of control and delay of gratification. The scale is valid, reliable and explains an impressive 96.4% of the variance. Some authors argued that future is the most important TP related to health related behavior (Hall et al., 2015). However, Zimbardo and Boyd (1999) criticize the CFCS for over simplifying TP, in part because the CFC constrained time onto a single dimension.

The development of the ZTPI took over 15 years and included aspects such as qualitative interviews, focus groups and introspective reflections, as well as multiple factorial analyzes and criterion validity studies. Initially, the scale included only present and future perspectives (Zimbardo & Gonzalez, 1985) but moving forward, more items were added. In exploratory analyzes, the authors systematically extracted five dimensions, which explained 36% of the variance. Confirmatory analyses were then conducted on the 5-factor model which provided adequate fit (Zimbardo & Boyd, 1999). In its latest version, the model took into account the valence of the temporal attitude in past and present perspectives, as well as a future perspective that does not distinguish between valences. 61 authors collaborated on a study investigating the cultural profiles and validity of ZPTI TPs in 24 countries (France but not Canada included). Generally, equivalence was observed in the factor structure and construct across culture and sex (Sircova et al., 2015).

The ZTPI draws out five dimensions of TP (here, ordered from most to least variance explained): 1) *Past Negative* refers to reflecting negatively on objectively neutral or distressful events that occurred in the past. 2) *Present Hedonistic* refers to people being careless and focused on maximizing current pleasure. This dimension diverges with the CFCS. 3) *Future* refers to striving to attain long-term achievements and rewards. This dimension converges with the CFCS. 4) *Past Positive* refers to pleasant recollections of the past. 5) *Present Fatalistic* is characterized by disengagement in goal-orientated behavior because one believes their efforts are futile. This is accompanied by feelings of helplessness or hopelessness (Zimbardo & Boyd, 1999).

It is worth noting that some researchers suggest that future TP should be divided into two dimensions according to the person's attitude towards the temporal frame (e.g. Worrell & Mello, 2007). Stated simply, positive future TP leads to adaptive behavior, whereas with a negative valence, this TP would be considered maladaptive. Accordingly a Future Negative subscale for the ZTPI was developed and validated by (Carelli, Wiberg, & Åström, 2015). Interestingly, (Matthews & Stolarski, 2015) hypothesized that depression would be characterized by a high past negative TP, whereas anxiety would be associated with a negative or apprehensive view of the future. However, for now the 5-factor structure is more widely used and agreed upon. Each TP dimension was capable of predicting diverse outcomes related to physical and psychological health (Stolarski, Fieulaine, & Beek, 2015). Interestingly, one study found that among included health behaviors, alcohol use was the best predicted by TP (Henson, Carey, Carey, & Maisto, 2006).

As stated earlier, a new measure of temporal orientation, the "test d'orientation temporelle (TOT)" (test of temporal orientation), underwent development in France. It was designed to be specifically pertinent to the development of TP among young people and its association with

abnormal behavior. It was also pointed out that ZTPI did not explain enough variance and that there could be redundancy between the constructs of present hedonism and sensation seeking. In order to respond to these limitations, a group of researchers and clinical psychologists held focus groups and elaborated a preliminary version of a questionnaire on the basis of their clinical experience with young people. The TOT was first validated among French high school and college students. It had a binary response format, included 4 dimensions (30 items) and explained 31% of variance in exploratory analyzes (Acier et al., 2016), but had many limitations.

More focus groups were held. The next version of the questionnaire (TOT-R) used a 5-point response format. The TOT-R was validated among French high school and college students. Here, 59 % of the variance is explained by three dimensions: Anticipation (3 items), Temporal Rupture (4 items) and Future ("avenir") (3 items). Anticipation referred to the process by which people foresee concrete upcoming consequences and act accordingly. Future orientation allowed the subject to be in psychological proximity with uncertain, abstract or imaginary goals. Temporal rupture referred to people taking breaks from the continuity of time or escaping from the passing of time in order to avoid becoming overwhelmed with stress. After exploratory factor analysis, confirmatory analyzes demonstrated that the 3-factor solution had satisfactory fit as well as configural invariance according to level of education (high school, college).

The TOT-R future scale correlated positively with the risky time frames of the ZTPI-SF (past negative, present hedonist and present fatalist perspectives) whereas the TOT-R anticipation scale transcribed protective factors (positive correlations with the future and past positive dimensions of the ZTPI but a negative correlation with present fatalist). The temporal rupture dimension did not significantly correlate with any dimension on the ZTPI-SF (Loose, Acier, Pilet, & Sysaykeo, 2017). Recently, a new version of the questionnaire was developed: the TCT-

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5D. Our research group generated new items for existing dimensions and to added two new dimensions: Past (learning from experience) and Full Present (engaging wholeheartedly in present experience). An article detailing the development and validation of the 5-factor version of the questionnaire is figured in annex 3. Because there are so few studies that use our French conceptualization of temporality, the following paragraphs concerning TP will be structured using the framework provided by the ZTPI.

Authors have been debating whether TP should be conceptualized as a dispositional state, such as a personality trait, or as a situational factor that primordially depends on environmental elements (Klapproth, 2011). Researchers have not come to conclusions about the "nature of TP" even if the situation-personality debate regarding this novel topic is "essential" and ongoing (Kairys & Liniauskaite, 2015). TP has been described as a "cognitive-motivational process", a stable disposition, and a transient attitude. Interestingly Zimbardo supports that TP is both stable and transient. Accordingly, Kairys and Liniauskaite suggested describing TP as "two fold" when referring to TP's stability and malleability. It is generally admitted that TP is a dispositional construct that can be modified by characteristics of the situation (Kairys & Liniauskaite, 2015).

Contextual factors such as trauma, status change or modified states of consciousness (such as hypnosis) can alter TP (Zimbardo & Boyd, 2015), suggesting that TP would not be entirely stable/dispositional. When people are in challenging life situations, TP shifts away from the future and towards the present in order to adapt effectively to present stress. This has been seen to occur with people who are addicted to drugs or alcohol, homeless, institutionalized or imprisoned (Fieulaine & Apostolidis, 2015). Likewise, synchronic emotional states were also known to shift TP, such that positive emotions favor future considerations and negative emotions favor short-term thinking (Klapproth, 2011). Low socio-economic status and other precarious situations also

incline people towards a present perspective because, among other reasons, the future is too unpredictable to plan (Fieulaine & Apostolidis, 2015).

Societal transitions can also modify TP whether they are induced externally (e.g. Arab Spring) or internally (e.g. immigration) (Husman, Brem, Banegas, Duchrow, & Haque, 2015). Culture, operationalized as nationality, also would have an impact on TP. Cluster analysis was conducted on a randomly selected sample from 24 countries in order to investigate cultural (in)variance in TP profiles. The 7th strongest cultural difference was found among the French. People in France belonged more often to the cluster "present orientated" (high present fatalist and hedonist TP) and "negative" (high present fatalistic and past positive but low past positive) in comparison to the total sample, whereas in the USA for example, people belonged more often to the "negative" or "future" clusters (Sircova et al., 2015). Lastly, it has been generally accepted that TP shifts as a function of developmental stages. For example, young adults had a more ambiguous vision of their future than did older adults (Brothers, Chui, & Diehl, 2014).

Specialized intervention and prevention techniques may also target and change TP. Prior to the seminal work of Zimbardo and Boyd, interventions targeting TP mainly focused on enhancing future perspective and positive goal-orientated behaviors. For example, interventions that target personal goals to enhance motivation have been implemented in normal (entrepreneurs, inventors, managers, adventure teams) and clinical groups (drug addicts, weight control)(Zaleski & Przepiórka, 2015). Another TP-based therapy was developed for adolescents, which involved thinking up and intensifying positive future goals. Here, adolescents who attended the time intervention had significantly better high school attendance rates than those who did not (Mello & Worrell, 2015). Even if these therapies focused on the future while generally neglecting the present and past, Zimbardo's work has inspired the development of a variety of TP based interventions. For example, "TP coaching" (Boniwell & Osin, 2015) popped

into existence, as did "TP prevention" (Martinez & Fieulaine, 2015) and "Time Perspective Therapy" designed for people with post-traumatic stress disorder (Sword, Sword, & Brunskill, 2015).

In the future, TPT may extend its application beyond post-traumatic stress disorder to include problems such as addictive disorders. However, in order for this to happen, more research needs to be conducted on the topic of temporality and addictive behaviors. Time perspectives have shown meaningful associations with a variety of health related behaviors and extending findings into addictive behaviors would be a viable option. Across cultures and samples, past negative and present fatalist translate to vulnerability factors whereas past positive and future would protective. Present hedonist TP leads both to risky behaviors and increased psychological well-being (Sircova et al., 2015). Zimbardo advanced that there would be a "balanced" temporal profile, which would be protective against all kinds of negative outcomes ranging from seat belt wearing to happiness. The profile entails high future, high past positive, moderately high present hedonism, low past negative and low present fatalist perspectives. The following paragraphs will examine each of these dimensions separately and detail a selection of established relationships between specific TPs and health-related behaviors.

Unsurprisingly, a tendency towards easily recalling numerous negative past experience would be a vulnerability factor. A study showed that past negative people stole and lied more often than those who scored low on this dimension (Zimbardo & Boyd, 2008).High scorers tended to especially enjoy gambling and disengage from healthy pleasurable activities including sexual intercourse (Zimbardo & Boyd, 1999). Among young Italians, binge drinkers and eaters reported higher past negative scores than those who did not engage in binging behavior (Laghi, Liga, Baumgartner, & Baiocco, 2012). Furthermore, problematic Internet use has also been associated with past negative TP (Chittaro & Vianello, 2013) as well as with problematic alcohol

use among French college students (Apostolidis, Fieulaine, & Soulé, 2006). In sum, it is plausible that past negative perspective is positively related to problematic alcohol consumption.

On the contrary, easily recalling positive and nostalgic memories of the past would be a protective factor. For example, the Italian binge drinkers and eaters reported lower past positive TP than those who do not engage in binging behavior (Laghi et al., 2012). Others demonstrate that people who score high on past positive drink less often than those with other preferential time orientations (Zimbardo & Boyd, 1999). It seems that past positive TP could be a protective factor guarding against alcohol use among college students, but this relationship is relatively infrequently found suggesting that the relationship might be null.

Those who scored high on present hedonism lied and stole more frequently and had a more positive attitude towards gambling than those who scored low on this dimension. They tended to study less and exercise more than others (Zimbardo & Boyd, 2008). Present hedonism is associated with heavier and more frequent alcohol, drug and cigarette use. This TP was associated with a higher number of sexual partners, but also increased use of condoms and other forms of birth control (Henson et al., 2006). Among high school and university students living in the USA, present TP measured by the CFCS is positively associated with alcohol and drug use (Keough, Zimbardo, & Boyd, 1999). In France, researchers have demonstrated that a present hedonist perspective predicts increased substance use (Fieulaine & Martinez, 2010). Present hedonism seems to be relatively strongly and consistently related to problematic alcohol use.

High present fatalistic perspective seems to render people more vulnerable to developing problematic behaviors. Students who scored high on this dimension had lower grade point averages but oddly did not have an increased perception of free time. This TP was associated with having sex with many partners (Zimbardo & Boyd, 1999). Other risk-taking behaviors, such as lack of seat belt wearing, have also been associated with this time frame (Henson et al., 2006).

Interestingly, people who scored high on the present fatalistic dimension actually wanted to live shorter lives than those who did not (Zimbardo & Boyd, 1999). Furthermore, Italian binge drinkers and eaters reported higher present fatalistic time orientation than non-bingers (Laghi et al., 2012). Present fatalist TP has also been associated with problematic Internet (Chittaro & Vianello, 2013) and cigarette use (Henson et al., 2006). Keough et al. (1999) found that present TPs were positively associated with alcohol use among students but did not study the fatalistic dimension independently, whereas Henson et al. (2006) found no significant association between this dimension and alcohol use. Even if results across studies are conflicting, a present fatalistic perspective could be positively related to drinking behavior.

Future orientated people were more concerned with longevity and nutrition than those who scored low on this dimension (Zimbardo & Boyd, 1999). Additionally, future orientated people had more clearly defined goals and higher academic achievement (Zimbardo & Boyd, 1999, 2008) even independently of their intelligence (Thiébaut, 1998). This could be explained by the fact that self-regulated learning is characteristic of both future TP and increased engagement in delayed gratification. In other words, when people decide to engage in behavior directed towards a delayed reward such as academic achievement, they would be obliged to disengage in behavior directed towards short-term gratifications (Bembenutty & Karabenick, 2004)such as drinking in a bar with friends. Among young people, future TP was positively associated with health behaviors, including relaxation, safety precautions and decreased substance use including alcohol (Mahon, Yarcheski, & Yarcheski, 1997). Strathman et al. (1994) found that considering future consequences predicted environmental behavior and health concern independently of conscientiousness, hope, life orientation, and ZTPI scores. Likewise, high future perspective is associated with less alcohol, cigarette, and drug use as well as increased exercise and condom use (Henson et al., 2006). Inversely, a lack of future perspective predicted

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delinquency among adolescents, even more strongly than self-control (Clinkinbeard, 2014). This can be explained by the fact that those with a high future orientation perceive more long-term risks associated with recreational intoxication (Apostolidis et al., 2006). Wills, Sandy, and Yaeger (2001) also found a negative relationship between this perspective and substance use among North American 6th graders. Among young people, it has been found that future perspective predicts less substance use in France (Fieulaine and Martinez, 2010) and in North America (Keough et al., 1999; Zimbardo & Boyd, 2008). Apostolidis et al. (2006) found that exclusively future TP negatively predicted the frequency and quantity of cannabis use among French college students. Furthermore, Italian binge drinkers and eaters have a lower future time orientation than those who do not engage in binging behavior (Laghi et al., 2012) and English students who consider less future consequences are more likely to engage in problematic drinking behavior (Beenstock, Adams, & White, 2010). However, others have found that the CFCS did not significantly explain alcohol use once having accounted for conscientiousness and ZTPI scores (Strathman et al., 1994) which suggests that the ZTPI and the Big 5 are sufficient for tapping future perspective in relationship to alcohol use. It this seems that future TP is a consistent and strong protective factor against problematic alcohol use.

In conclusion, many studies have established associations between TPs and health-related outcomes, notably relating with risk-taking behavior including problematic substance use. When using this conception of TP, it seems that problematic alcohol use is positively associated with high present-hedonistic, past-negative and present-fatalistic time frames, but negatively related to high future and past-positive TPs. Nevertheless, present hedonism and future perspectives would be the most strongly related.

One attractive approach was to simultaneously account for all of the five temporal frames at once using profiling techniques (i.e. cluster analysis), and then identify the profiles that put the

subject the most at risk for problematic alcohol consumption behaviors. Though there have been several studies on the topic, profiles did not replicate well across samples and might not be well related to alcohol consumption behaviors (Loose, Acier, Andretta, et al., 2017). One possible explanation would be that the approach was comparable to looking for an "alcoholic personality type" which is conceptually outdated. Another area of recent debate concerns the pertinence of using exclusively the ZTPI model to explain alcohol consumption behaviors. Across studies it seems that the future and present hedonism would be the only scales that could be considered reliably related to alcohol consumption measures. A recent study showed that it was beneficial to use multiple measures of temporality because only specific scales within these measures were meaningfully related to alcohol consumption (McKay, Perry, Cole, & Worrell, 2017). Accordingly we used two measures of temporality and privileged a regression-based approach over profiling.

4. Interrelationships between determinants

As stated earlier, the design proposed in the context of this study figures distal (traits), intermediary (TP) and proximal (motives) determinants of problematic alcohol use. In other words, drinking motives would be shaped by temporalities and temporalities or motives would be shaped by personality traits. Mediation analyses allow us to test such hypotheses as they describe the processes by which an outcome emerges. In order to systematically address the complexity at hand, the following sections will expose three mediational relationships. First, drinking motives will be examined as mediators between personality traits and problematic alcohol use. This mediational relationship has been well established. Next temporality will be taken into the equation. The second section will examine TP as a mediator between personality traits and problematic alcohol use, whereas in the third section it will be argued that motives mediate the

relationship between TP and problematic alcohol use. These three introductory sections were progressively more exploratory, and relate to the main aims of chapters one to three. When taken collectively, chapter four may be considered.

4.1. Motives as mediators between traits and alcohol use

Cox and Klinger's motivational model for alcohol use (1988) states that personality traits are a distal factor contributing to the genesis of the motivation to drink alcohol or to engage in an alternative activity (i.e. not drink). A wide range of traits including the Big 5 dimensions (Mezquita, Stewart, & Ruipérez, 2010), trait anxiety (Comeau, Stewart, & Loba, 2001), sensitivity to anxiety (DeMartini & Carey, 2011), sensation seeking (Read, Wood, Kahler, Maddock, & Palfai, 2003), novelty seeking (Kuntsche, von Fischer, & Gmel, 2008), impulsivity (Curcio & George, 2011), fun seeking (Willem, Bijttebier, Claes, & Uytterhaegen, 2012), urgency (Adams, 2012), sensitivity to reward (O'Connor, 2007), attachment styles (McNally, Palfai, Levine, & Moore, 2003) and alexithymia (Bruce, Curren, & Williams, 2012) have all been studied as potentially relevant distal factors leading to unique motivational constructs that in turn determine problematic alcohol use. Even if there are a lot of seemingly heterogeneous personality traits examined as distal factors, Big 5 personality traits have drawn the most attention because they bring all these traits together under a single model. Thus, the following review will examine each of the 5 drinking motives as mediators between Big 5 personality traits and problematic alcohol use.

This perspective highlights a dispositional or even a genetically rooted pathway to problematic alcohol use through the proximal mediator of drinking motives, as defined by Cooper (1994). However, internal motives (coping, enhancement) would be more in line with traits than are external motives (social, conformity) because they are less reliant on contextual

factors. For example, among Canadian college students, more variance was explained by adding personality traits to the models explaining internal drinking motives (6-11%) than when explaining external drinking motives (3%) (Theakston, Stewart, Dawson, Knowlden-Loewen, & Lehman, 2004). Furthermore, a qualitative comparison motivational models and college students' drinking frequency, quantity and circumstances suggested that internal motives were more tied to traits than were external motives (O'Hara, Armeli, & Tennen, 2014). Likewise, a study on alcohol use among twins demonstrated that coping motives were more tied to genetics than were other motives (Littlefield et al., 2011). Thus, coping and enhancement motives seem to be more strongly and consistently linked to personality traits than would be social or conformity motives.

Regarding Big 5 personality traits, social motives have shown a bivariate correlation with extraversion, neuroticism, undirectedness (Stewart & Devine, 2000), agreeableness and low imagination/intellect (closedness) (Theakston et al., 2004)among Canadian college students. However, another study carried out among Canadian undergraduates found no significant bivariate relationships between social motives and Big 5 personality traits (Stewart, Zvolensky, & Eifert, 2001). With that said, it still seems possible that social motives play a mediational role between personality traits and alcohol use. For example, a study found that social motives fully mediated the relationship between alexithymia and alcohol use (Bruce et al., 2012). More importantly, a study found that social motives mediated the relationship between extraversion and alcohol use among college students (Hussong, 2003). This divergent finding may be due to the fact that the last study took daily measures of variables and used both self and peer evaluations. Overall, it seems that the association between social motives and traits has been relatively weak and inconsistently found. However, seeing as how Stewart and Devine (2000) also found a positive association between extraversion and social motives, it is possible that Hussong's observation (2003) could be replicated in the present study.

Conformity motives were significantly predicted by a lack of imagination/intellect and high emotional stability over and above alcohol use among Canadian college students (Theakston et al., 2004). They have shown a bivariate correlation with high neuroticism and introversion among Canadian college students (Stewart et al., 2000). However, one study failed to observe any significant correlations between this motive and Big 5 traits among Canadian undergraduates (Stewart et al., 2001). Furthermore, it seems that no study has concluded by establishing a mediating role of conformity motives between Big 5 personality traits and drinking motives. However, it has been shown that the association between alexithymia (Bruce et al., 2012) and anxiety sensitivity (Comeau et al., 2001) was positively mediated by conformity motives, the latter trait being clearly related to neuroticism. In sum, it seems doubtful Big 5 traits would be associated with conformity motives aside from, possibly, neuroticism.

Among Big 5 personality traits, enhancement motives are most often tied to low conscientiousness or extraversion but not to the other three traits. For example, three research groups found that low conscientiousness and extraversion predicted enhancement motives, which in turn predicted heavy alcohol use, but not alcohol related problems (Mezquita et al., 2010; Stewart & Devine, 2000; Theakston et al., 2004). Further studies confirmed that the relationship between extraversion and alcohol use was mediated by enhancement motives among Swiss (Kuntsche, von Fischer, & Gmel, 2008) and American (Hussong, 2003) undergraduates. Regarding further results about undirectedness, one longitudinal study found that undirected participants who drank for enhancement motives did so regardless of daily task completion whereas conscientious participants drank for enhancement motives only after having completed their daily tasks (Arbeau, Kuiken, & Wild, 2011). This could imply that undirected students who drink for enhancement motives encounter more problems than conscientious students tied to failure to complete daily tasks due to alcohol consumption. In respect to this body of results, it

seems that enhancement motives would positively mediate the association between low conscientiousness or extraversion and problematic alcohol use.

Neuroticism and related constructs have been consistently linked to drinking to cope, heavy alcohol use and related problems. Several research groups have demonstrated that coping motives mediate the relationship between a disposition towards negative affect and alcohol use or related problems (Cooper, 1995; Arbeau et al., 2011; Kuntsche et al., 2008; Read et al., 2003). Even on a daily basis, negative emotions predicted coping motives (Arbeau et al., 2011). The association between neuroticism and alcohol misuse would likely be mediated by coping motives among North American college students (Hussong, 2003; Stewart et al., 2001; Stewart et al., 2000). Coping motives could also mediate the relationship between trait anxiety and heavy alcohol use (Comeau et al., 2001). Longitudinally, from adolescence to young adulthood, changes in coping motives mediated the relationship between changes in neuroticism levels and alcohol use (Littlefield, Sher, & Wood, 2010). Coping motives would clearly be related to a difficulty with self-regulating emotions when faced with negative affect. For example, coping motives also fully mediate the relationship between alexithymia and alcohol use (Bruce et al., 2012) and between a negative model of self and alcohol related problems (McNally et al., 2003). One study demonstrates that coping motives partially mediate the relationship between low conscientiousness and alcohol use among Swiss college students (Kuntsche et al., 2008). In sum it seems that coping motives mediate the relationship between neuroticism and problematic alcohol use.

Two analyses have studied coping anxiety and coping depression motives differently as they pertain to personality traits and alcohol use outcomes. Coping depression motives mediated the relationship between negative affectivity (Willem et al., 2012) or high neuroticism (Mezquita et al., 2010) and alcohol related problems. Coping anxiety motives mediated the association

between low conscientiousness and high neuroticism (Mezquita et al., 2010) and alcohol related problems. However, Willem et al., (2012) found that coping anxiety motives were related to negative affectivity but unrelated to alcohol use variables. As concluded in Mezquita et al. (2010), it seems that "slightly different" personality traits explained coping depression and coping anxiety motives.

In sum, several studies found that drinking motives mediated the relationship between personality traits and problematic alcohol use using a 4-factor (Cooper, 1994) or 5-factor model (Grant et al., 2007; 2009).

More specifically, it seems that :

- social motives mediate the relationship between extraversion and problematic alcohol use;

- conformity motives mediate the relationship between neuroticism and problematic alcohol use ;

- enhancement motives mediate the relationship between undirectedness or extraversion and problematic alcohol use ;

- coping anxiety motives mediate the relationship between undirectedness or neuroticism and problematic alcohol use ;

- and coping-depression motives mediate the relationship between neuroticism and problematic alcohol use.

4.2. Time perspectives as mediators between traits and alcohol use

The association and distinction between time perspective and personality traits have drawn attention. Dispositions such as Big 5 personality traits (Dunkel & Weber, 2010), impulsivity (Baumann & Odum, 2012), sensation seeking, anxiety trait, novelty seeking (Keough et al., 1999), identity formation (Laghi, Baiocco, Liga, Guarino, & Baumgartner, 2013), pessimism (Seginer, 2000), optimism (Laghi, Baiocco, D'Alessio, & Gurrieri, 2009), resiliency

(Fortunato & Furey, 2011), hopelessness, attachment styles (Laghi et al., 2009), self-efficacy and self-regulation (Shell & Husman, 2008) have been examined as potential distal factors leading to TP, which leads in turn to outcomes such as problem behaviors (Chen & Vazsonyi, 2011) or life satisfaction (Zhang & Howell, 2011). Among studied variables, Big 5 personality traits (notably conscientiousness) have drawn the most attention. However, it can be noted that there has been a tendency in research to study this subject in order to demonstrate that TP is a construct that is not reducible to personality traits. Thus, a number of studies that employ time and trait measures did so in order to control for the latter in multiple regression analyses (e.g. Keough et al., 1999). Even if this useful in determining that TP does indeed predict criterion above and beyond personality traits, discussions about mediational effects are few and far between. Thus, this section will primarily focus on bivariate relationships between TPs and traits as well as studies that intentionally or unintentionally establish that TP mediates the relationship between traits and health-related outcomes.

People who were highly orientated towards the future were less aggressive, less often liars (Zimbardo & Boyd, 2008), less depressed and less anxious (Fortunato & Furey, 2011; P. Zimbardo & Boyd, 2008). They were more energetic, conscientious, concerned with future consequences, confident, creative (Zimbardo & Boyd, 2008), optimistic and resilient (Fortunato & Furey, 2011). They had a more integrated identity (Laghi et al., 2013) and scored higher on measures of self-efficacy, causal attribution and self-regulation (Shell & Husman, 2008). Regarding Big 5 personality traits, one study demonstrated that future perspective was positively associated with agreeableness, emotional stability, openness and conscientiousness when measured by the CFCS, but only with the latter when measured by the ZTPI. This study found that conscientiousness was the strongest predictor of future TP even if other personality traits were significantly associated (Adams & Nettle, 2009). Furthermore, Dunkel and Weber (2010)

exclusively found positive and significant associations between future TP and neuroticism or conscientiousness. Daugherty and Brase (2010) found bivariate relationships between future perspective and agreeableness or conscientiousness. However, these associations disappeared when regression analyses predicted alcohol use and controlled for Big 5 personality traits. This study indirectly suggested that future TP mediated the relationship between these traits and problematic alcohol use. In sum, future TP has been positively associated with agreeableness and openness, but is the most strongly and consistently associated with conscientiousness. This perspective has been generally unassociated with extraversion and there were conflicting results regarding its relationship to neuroticism. This could be due to the fact that future orientated people experience more stress, have less free time and regret not having more time to spend with their loved ones (Zimbardo & Boyd, 1999). A heavy workload associated with future perspective could generate anxiety. Inter individual differences related to emotional regulation and coping styles could explain in part why some future orientated people would be neurotic while others are not.

People who scored high on past negative were found to be more aggressive, anxious, shy and temperamental than those with low scores. They were less conscientious, considerate, stable, energetic, friendly, happy and confident (Zimbardo & Boyd, 2008). Past negative was negatively associated with optimism and positively with hopelessness (Laghi et al., 2009). This perspective was positively predicted by introversion and neuroticism among college students in the United States (Dunkel & Weber, 2010). Past negative TP was also associated with low attachment to parents and peers in adolescence (Laghi et al., 2009). Also, adolescents who scored high on past negative had a more diffused identity than those who score low (Laghi et al., 2013). Longitudinally, past negative orientation mediated the relationship between past trauma and current psychological distress (Holman & Silver, 1998). With regards to these results, it seems

that high past negative perspective would be positively associated with introversion, neuroticism, undirectedness and antagonism but unrelated to openness.

 People who scored high on the past positive dimension were less aggressive, anxious and depressed than low scorers (Zimbardo & Boyd, 2008). This perspective was associated with increased conscientiousness, creativity, stability, dependence on rewards, energy, friendliness, happiness, confidence and extraversion (Zimbardo & Boyd, 2008) and agreeableness (Dunkel and Weber, 2010). Laghi et al. (2009) found that adolescents with a secure attachment to their parents scored higher on past positive than those with an insecure attachment. This time frame was also associated with an integrated identity formation (Laghi et al., 2013). In regards to these results it seems that positive past would be generally a protective time frame. It is also positively related to conscientiousness, agreeableness, extraversion and emotional stability. This relationship could also exist for openness because past positive has been associated with creativity.

High scores on the present fatalistic scale were associated with increased aggression, depressive symptoms, lethargy, anxiety, temper, (Zimbardo & Boyd, 2008) hopelessness and pessimism (Laghi et al., 2009). In other works, high scorers were more likely to have a diffused identity formation (Laghi et al., 2013) as well as decreased self-esteem, creativity, and happiness (Zimbardo & Boyd, 2008). Oddly, one study found that present fatalism was positively associated with emotional stability (Daugherty & Brase, 2010). Regarding other Big 5 traits, high scores on this dimension are positively associated with undirectedness (Dunkel & Weber, 2010; Zimbardo & Boyd, 2008), antagonism (Daugherty & Brase, 2010 ; Zimbardo & Boyd, 2008), closed mindedness and introversion (Zimbardo & Boyd, 2008).

In comparison to other profiles, present-hedonistic orientated people had vague future goals. Their parents were divorced more often, but they also communicated more often with

family members than those who scored low on this dimension (Zimbardo & Boyd, 1999). They were found to be more aggressive and depressed than low scorers, but also more energetic, creative and happy. In regards to Big 5 personality traits, present hedonism was associated with undirectedness, neuroticism (Daugherty & Brase, 2010; Dunkel & Weber, 2010; Zimbardo & Boyd, 2008), agreeableness, openness (Daugherty & Brase, 2010; Dunkel & Weber, 2010) and extraversion (Zimbardo & Boyd, 2008).

In conclusion, many studies demonstrated that personality traits were associated with TPs. Furthermore, some studies suggested that personality traits were distal factors that lead to TP. In regards to this body of research, it seems quite plausible that TPs mediate the relationship between personality traits and problematic alcohol use even if this hypothesis has not been amply validated. More specifically it seems that:

- Future perspective partially mediates the relationship between openness, conscientiousness, agreeableness or emotional stability and decreased problematic alcohol use;

- Past positive perspective partially mediates the relationship between conscientiousness, extraversion or emotional stability and decreased problematic alcohol use;

- Past negative perspective partially mediates the relationship between introversion, antagonism, or neuroticism and increased problematic alcohol use;

- Present fatalistic perspective partially mediates the relationship between introversion, closedness, undirectedness or antagonism and increased problematic alcohol use;

- Present hedonist perspective partially mediates the relationship between undirectedness, extraversion, agreeableness, or neuroticism and increased problematic alcohol use.

4.3. Motives as mediators between time perspectives and alcohol use

In theory, time perspective would be related to behavior (e.g. drinking) through various mediating variables (e.g. drinking motives). For example, Trommsdorff (1983) stated that "relations between future orientation and behavior are mediated by other variables, or do not emerge at all." As previously exposed, the relationships between TPs and wellbeing have been well researched. Now, research needs to focus on the mechanisms responsible for this association (Cunningham, Zhang, & Howell, 2015). Likewise, Hall, Fong and Sansone, 2015 pointed out that trending studies aimed to define the mediators situated between TP and health behaviors in large samples. Research shows that TP predicts drinking behavior (Laghi et al., 2012) and drinking motives would be the most proximal predictive factor of problematic alcohol use (Kuntsche et al., 2005). Thus, it seems logical that the relationship between TP and alcohol use would at least partially mediated (if not fully mediated) by drinking motives. However, the relationship between TP and drinking motives has not yet been measured *per se*. Rather, their association is mostly grounded in theory and indirectly related experimental results.

A case can be made that supports that specific drinking motives mediate the relationship between TP and substance use by looking at TP through the lens of life goals. Anticipating future events and remembering past consequences more or less distant in time would influence how the subject is motivated to behave in the present. Motivation would be derived by both internal forces such as personality traits and by contextual variables that stand between the individual and the desired outcome (Thiébaut, 1998). The relationship between engagement in behavior orientated towards future goals and drinking motives was supported both by Cox and Klinger's model (1988) and by empirical evidence (Lecci, MacLean, & Croteau, 2002; Palfai, Ralston, & Wright, 2011). All of these research groups supported that the presence of non-alcohol related life goals was a key protective factor motivating a decision to abstain from problematic alcohol

use and that a lack of such goals would be a vulnerability factor. Cox and Klinger's (1988) conceptual framework for alcohol use exhibited a semi-conscious cost-benefit analysis in which the individual weighs the positive and negative consequences of drinking versus not drinking. Reasons for not drinking would thus tied to non-alcohol related motives that can take the form of engagement in positive life goals, meaning motivation aimed at obtaining valued future rewards rather than immediate temptations.

Even if the Cox and Klinger do not explicitly relate life goals to TP, "goals are by their nature related to time" (Zaleski & Przepiórka, 2015, p. 327). Future aspirations of what one hopes to achieve and avoid have obvious motivational consequences (Seginer & Lens, 2015). Notably, the theory of Achievement Motivation has been interested in future TP for over five decades. When navigating through time, people would work towards their subjectively derived goals. This forward movement would motivate people to engage in particular behaviors which takes effort, choice and persistence (Husman et al., 2015). A three component model of future TP advanced that for each specific life domain, motivation shaped a cognitive representation of the future, which in turn led to behavior orientated towards future goals (Seginer & Lens, 2015). Future TP would be a catalyst for motives related to health behavior, goal setting and achievements (Carelli et al., 2015). Manifestly, motives have been most often studied in relationship to future TP and adaptive behavior. However, further studies would necessary in order to explore the relationship between motives and other time frames.

In this way, engagement in behavior directed towards rewarding future life goals seems to be negatively tied to motives to consume alcohol. One study demonstrated that social, enhancement and coping drinking motives mediated the relationship between life goals and problematic alcohol use (Lecci et al., 2002). Palfai and colleagues (2011) demonstrated that a lack of meaningful life goals engendered enhancement-drinking motives, which in turn led to

increased alcohol use. The authors suggested that people would not obtain positive affect by engaging in life goals and thus seek positive affect elsewhere ; they would enhance their experience by consuming alcohol. Furthermore, when people engage less in daily tasks working towards valued life goals, they gain more positive incentive from drinking alcohol than people who strive to meet personal goals.

A couple studies suggested that coping motives could mediate the relationship between TP and problematic alcohol use. Lecci et al. (2002) argued that drinking to cope reduce negative affects, which could stem from a low level of self-efficacy pertaining to the accomplishment of life goals. Path analysis showed that goal self-efficacy was directly related to coping motives, which were directly related to drinking related problems. Here, self-efficacy, meaningfulness and social support in life goals protected against the aversive effects of alcohol, while goal distress was a vulnerability factor. Also, it was found that coping styles in general mediated the relationship between TP and substance use and abuse, such that future orientation led to active behavioral coping strategies which would then protect the individual against alcohol use (Wills et al., 2001). Unfortunately, no studies examined the associations between TP and specific coping motives (anxiety or depression) even if these affects would be associated with distinct temporal frames.

Lastly, a study showed that the perception of negative effects associated with cannabis use ("drug perception") fully mediated the relationship between future orientation and cannabis use among French adolescents (Apostolidis et al., 2006). This was similar to looking at drinking motives as a mediating factor between TP and problematic substance use. Motives are thought to be the most proximally predicted by drinking expectancies, meaning the perceived positive, negative, chemical and indirect effects that one thinks he will attain after having consumed alcohol (Cox & Klinger, 1988). Here, a future TP was only predictive of less cannabis use if

negative expectancies were present. This reinforces the plausibility of the hypothesis that drinking motives, like expectancies, mediate the association between TP and problematic alcohol use.

In conclusion, it seems that drinking motives could mediate the relationship between TP and problematic alcohol use. It is probable that internal motives (coping, enhancement) will be stronger mediators than external motives. More specifically, it seems most likely that enhancement motives could partially mediate the relationship between low future perspective or present fatalist perspective and problematic alcohol use; and that coping depression motives could partially mediate the relationship between low future perspective or present fatalist perspective and problematic alcohol use. Furthermore, it seems conceptually plausible that social motives mediate the relationship between present hedonist orientation and problematic alcohol use.

5. Overview of studies and methods

As previously stated, this thesis primarily aimed to investigate the processes leading up to drinking behaviors by studying three different levels of determinants : personality traits, temporalities and drinking motives. We adopted a purely quantitative methodology and transversal study design. Questionnaires assessing the constructs of interest were administered online to French and Canadian college students and we used the resulting data set throughout chapters one to four. In order to reduce redundancy throughout the chapters, some information, like the description of a questionnaire used in a previous chapter, will not be repeated. The main aim of chapters one, two and three was to examine specific mediational models of alcohol consumption, but we grafted on secondary aims at times. Chapter four was built off of the results obtained from chapters one to three, and examined results collectively by using analyses of serial

mediation. Unless stated otherwise, all regression-based analyses described below controlled for sex, age and place of residency.

In chapter one, we provided an in-depth account of the procedure used and the characteristics of our samples. This was the only chapter where we accentuated cultural differences. We described the sample in detail and sample equivalency was examined across place of residency. Across place of residency, we also examined differences in mean endorsement of personality traits, drinking motives and indicators of problematic alcohol use. Our primary aim in the first chapter was to investigate personality traits as determinants of alcohol consumption through the multiple parallel mediators of drinking motives. We provided analyses of mediation for each residency group and for the total sample while controlling for residency. In this manner we were able to appreciate cultural differences relating to indirect effects. The main finding of the chapter was that specific personality traits were related to alcohol consumption because they led to specific drinking motives.

In chapter 2, instead of studying drinking motives, we studied temporality in relationship to personality. Two different measures of temporality were used : the well-known ZTPI and the brand new TCT-5D. As the only study on the TCT-5D is unpublished and annexed, we used the opportunity to continue our investigation of the validity of the TCT-5D scales and how they compared to the ZTPI constructs in regards to personality traits. It was in part for this reason that we analyzed bivariate relationships between personality traits and the two measures of temporality. Afterwards, we ran a series of regressions wherein TCT-5D or ZTPI scales predicted total Audit scores. In order to check for redundancy between temporality scales that were significantly related to alcohol use, the temporalities that were significant predictors in the first two regressions were used as predictors in a third regression. The resulting non-redundant set of temporalities was conserved for the last series of analyses, which corresponded to the

primary objective of this chapter. We aimed to study indirect relationships between personality traits and alcohol consumption through the most pertinent facets of temporality. Expectedly, our main finding was that temporalities mediated the relationship between personality traits and alcohol consumption. Chapter three was the most exploratory and investigated the last permutation of mediational models. We found significant indirect effects of temporalities on alcohol consumption through specific drinking motives. There were no secondary objectives in this chapter.

All three of these chapters, or studies, stands alone in its own right, but they were designed to be taken together collectively in order to test the hypothesis that traits develop into temporalities that develop into drinking motives that lead in turn to alcohol consumption. The fourth chapter takes on the full sequential hypothesis for specific indirect effects. We compiled positive results from chapters one to three and generated hypotheses about specific indirect serial effects using different forms of logic. Interestingly, we tested and validated the hypothesis that suggested, in some cases, results from chapters one to three could not be dissociated. This was a fascinating finding to discuss and we did so in length. Indeed, chapter four was conceptual and ventured into the heart of mediational analyses : accounting for complexity by studying conditional processes. We took a "meta" stance on the methodology used in chapters one to three and re-examined the meaning behind cause and effect. By looking into the future and into the past, we extended our conceptual findings in our field of interest, and beyond.

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CHAPTER 1

Alcohol consumption, personality traits and drinking motives among college students: France versus Québec

1. Introduction

1.1. Alcohol consumption in France and in Québec

As drinking among university students remains a renowned and risky behavior, numerous public health campaigns have been designed and implemented in an effort to positively impact problematic drinking. Though most students effectively "mature out" of at risk alcohol use, other students unfortunately maintain or develop a problematic relationship with alcohol. Such struggles can lead to devastating consequences, including alcohol dependence, physical illnesses and premature death. Male students tend to consume more alcohol and to develop more alcohol related problems than do females (Ham & Hope, 2003). Even if men are more at risk, environmental characteristics differ between countries and may influence levels of alcohol consumption. For example, French 18-34 year olds consumed alcohol more often and in greater volumes than their Canadian counterparts (Wilsnack, Wilsnack, Kristjanson, Vogeltanz-Holm, & Gmel, 2009). In comparison to French adults, Canadians engaged in less heavy episodic drinking and alcohol use has been responsible for less years of life lost (World Health Organization (WHO), 2014). Interestingly, alcohol consumption has been steadily dropping in France over the last few decades, whereas recently there has been a slight increase in consumption observed among Canadians (Devaux & Sassi, 2015).

Differences in alcohol regulations also distinguish these countries. For example in Québec, Canada there is a specific government monopoly on alcohol sales. Alcoholic beverages

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are also more expensive than in France (MADD Canada Policy Backgrounder, 2014). A standard

6-pack of beers costs approximately 13.75$CAD (9.26€) in Canada and merely 5.78€

(8.58$CAD) in France ("Alcohol prices in various countries," n.d.) which could make a

difference especially for students on a tight budget. Alcohol would be tightly knit into French

culture. For example, France makes more money off of wine exports than any other country and

the French people are the #2 consumer of wine worldwide, after people living in the United

States (International Organisation of Vine and Wine, 2016).

Environmental characteristics, such as social norms, would shape in part drinking

behavior and can operate through peers or family members for example. Social standards tied

into culture would also influence the frequency and context at which it is considered appropriate

to consume alcohol (Ham & Hope, 2003). Furthermore, differences in individual characteristics

(e.g. personality traits) have been known to impact drinking behaviors and levels of traits vary

across cultures (Schmitt, Allik, McCrae, & Benet-Martínez, 2007). Studying the interplay of the

psychosocial factors determinant of drinking behaviors within specific cultural settings could

help advance a comprehensive understanding of the complex etiology of drinking behaviors.

1.2. Personality traits as determinants

Personality psychologists aim to study the mechanisms by which traits interact with the

external environment and generate unique individuals (Zimbardo & Boyd, 1999). A meta-

analysis regrouped studies that investigated bivariate relationships between Big 5 personality

traits and drinking behaviors. Across studies high neuroticism, low conscientiousness and low

agreeableness were associated with increased alcohol consumption, whereas extraversion and

openness were unrelated. However, personality traits explained little variance in alcohol use

levels (2-4%). Furthermore, findings across studies were inconsistent as they exhibited positive,

negative and null relationships between each trait and alcohol consumption (Malouff, Thorsteinsson, Rooke, & Schutte, 2007). Many have suggested that multiple levels of intervening variables mediate the associations between traits and behaviors (e.g. Cox & Klinger, 1988). Another confounding factor may be culture. Indeed "places, like people, have their own personalities" (Levine, 2015) and individual characteristics vary as a function of culture. Schmitt et al., 2007 studied cultural differences in Big 5 personality traits across 56 nations, France and Canada included. In comparison to the French, Canadian college students scored higher on extraversion, agreeableness, and emotional stability. Furthermore, variations in the reasons why people drink alcohol have been observed across cultures (Mackinnon et al., 2017).

1.3. Drinking motives and alcohol consumption

Drinking motives are thought to be the most proximal predictive factor of drinking behaviors, through which all other distal factors would exert their influence (Kuntsche, Knibbe, Gmel, & Engels, 2005). Cox and Klinger (1988) drew up a popular framework modeling the interplay of different levels of determinants of drinking behaviors. They theorized that people would drink either to increase positive affect (approach motives) or to decrease negative affect (avoidance motives). Cooper (1994) subsequently advanced that motives could also differ according to the source of reinforcement, which could either come from an internal (i.e., psychological) or external (i.e., social environment) source. By crossing the source (internal, external) and the valence (positive, negative) of expected reinforcement, four motives were drawn up. Social motives (external, positive) respond to a social cue and consist drinking in order to increase positive affect in social situations. Those who drink for conformity motives (external, negative) react to group situations in which alcohol is present and wish to avoid social rejection by means of alcohol consumption. Enhancement drinkers (internal, positive) wish to

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increase their level of enjoyment and positive affect. Those who endorse coping motives (internal, negative) drink in order to alleviate themselves of negative affect and often do so alone (Cooper, 1994).

Studies have evidenced that each drinking motive leads to a specific pattern of drinking behaviors (Kuntsche et al., 2005). Social motives were associated with increased alcohol consumption, but not to problems, whereas conformity motives were associated with decreased alcohol use and directly with problems. Enhancement motives led to heavy alcohol use, and in turn to related problems. Coping motives were the most risky and were associated with heavy and problematic alcohol use (Cooper, 1994). However, coping with feelings of anxiety and sadness may not have the same relationship with alcohol use. For example, timidity, social anxiety and sub-clinical anxiety may guard against alcohol consumption, whereas anxiety disorders would be related to problematic alcohol use. On the other hand, both clinical and sub-clinical depression would be risk factors (Ham & Hope, 2003). Accordingly, coping motives have been divided into two separate dimensions: coping anxiety and coping depression (Grant, Stewart, O'Connor, Blackwell, & Conrod, 2007). Coping-depression motives were associated the most often with heavy alcohol use and problems, but findings have been contradictory relating coping-anxiety motives to alcohol use (Grant et al., 2007; Loose & Acier, 2017; Mezquita et al., 2011).

Youth from thirteen different countries endorsed drinking motives in the following order: Social > enhancement > coping > conformity (Kuntsche et al., 2014). This ordering was confirmed in another study that included college students from ten different countries. The few studies that used the 5-factor model of drinking motives each found the following ordering: social >enhancement > coping anxiety >coping depression >conformity (Grant et al., 2007; Loose & Acier, 2017; Mezquita et al., 2011). Interestingly, people from individualistic countries (e.g.

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United States) endorsed all drinking motives more strongly than those living in collectivist countries (e.g. Portugal) and this difference was accentuated with approach motives (Mackinnon et al., 2017). As findings suggested that French culture was more collectivist than that of Canada (Hofstede, Hofstede, & Minkov, 2010), we expected that students in Québec would endorse all motives more strongly than those in France, and that this effect would be the strongest for social and enhancement motives.

1.4. Pathways to drinking behaviors

In order to understand the interplay of different levels of determinants, multiple studies have looked into the relationships between personality traits, drinking motives and alcohol consumption. Personality traits would be distal factors leading to drinking motives, which would in turn lead to drinking behaviors (Cox & Klinger, 1988). Coping and enhancement motives would be more closely associated with traits than are social and conformity motives. For example, Stewart, Loughlin and Rhyno (2001) found that internal motives, but not external motives, mediated the relationship between traits and alcohol consumption (n=154). Theakston, Stewart, Dawson, Knowlden-Loewen and Lehman (2004) also measured five traits and four motives (n=581). Several of the significant relationships found in Stewart et al. (2001) were replicated in this study, but Theakston et al. (2004) also found that a trait similar to openness (imagination/intellect) and agreeableness exerted their influence on alcohol consumption through drinking motives. Contrary to hypotheses, external motives were identified as significant mediators, but the effects were weaker than that of internal motives.

Moving forward, Kuntsche, von Fischer, and Gmel (2008), and Mezquita, Stewart, and Ruipérez (2010) only included internal motives as potential mediators and three out of five traits as potential distal factors (conscientiousness, extraversion, neuroticism). Using a large sample of

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Swiss college students, Kuntsche et al. (2008) found that low conscientiousness led to enhancement or coping motives. Neuroticism alone was considered a "protective" factor in this study but when this trait was associated with coping motives the effect was dampened. In a Spanish sample, low conscientiousness but also high extraversion led to enhancement motives (Mezquita et al., 2010). Contrary to Kuntsche et al. (2008), the study in 2010 separated coping depression and coping anxiety motives. Both coping motives were predicted by high neuroticism, but coping anxiety motives were also predicted by low conscientiousness. The authors concluded that this supports the distinction between specific coping motives.

Loose, Acier and El-Baalbaki (2017) (annex 2) also studied the subject and suggested that it may have been premature to neglect the measurement of specific traits or motives. Recent advances in mediational analyses were employed and yielded novel results (e.g. Hayes, 2013; Zhao, Lynch, & Chen, 2010). Among French high school and college students, all five traits and all five motives were measured. Furthermore, indirect only and competitive mediation were figured in as possibilities, which revealed interesting findings. Loose et al.(2017)found that every motive (except coping-anxiety) was a significant mediator, and that every trait (except openness) exerted its influence through specific drinking motives. Neuroticism was elucidated as both a "risk" factor and a "protective" factor because a case of indirect only competitive mediation was observed. Neuroticism led to high coping depression motives which led to increased consumption, but also to conformity motives which was associated with decreased use. Agreeableness and conscientiousness were protective factors and exerted their influence on alcohol consumption through coping depression, social and enhancement motives. Extraversion was a risk factor, as the trait led to social, enhancement and conformity motives. As the current study was nearly identical to the study of Loose et al.(2017), we can get an idea of the reliability

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of our findings within a French sample and to what point they generalize to students living in Québec.

Inconsistent findings observed across studies may be explained in part by methodological or cultural differences. Using complex etiological frameworks that account for interrelationships between personality traits, motivations and alcohol consumption would help advance the extent literature concerning the pathways leading to alcohol related behaviors. As the levels and the interrelationships of these variables may differ between cultures, it would be advantageous to compare results in international samples. In order to reduce possible bias due to language translations in cross cultural research (Vallerand, 1989), it would be interesting to study two comparable francophone samples that differ in geographic location: college students living in France (Europe) versus those living in Québec (North America). There were two major aims of this study: 1) Explore differences in mean endorsement of drinking motives, personality traits and alcohol related behaviors among college students living in France and in Québec. 2) Calculate and culturally compare direct and indirect pathways between personality traits and alcohol consumption through drinking motives while controlling for age and sex.

2. Methods

2.1. Measures

The *Alcohol Use Disorder Identification Test* (AUDIT) is a well-known screening test for problematic alcohol use. This questionnaire is internationally renounced which will allow more direct comparisons with existing studies. 10 items are divided into three dimensions (hazardous alcohol use, dependence symptoms, harmful alcohol use) but may be summed together in order to obtain a total score. Scores over 7 or 8 are indicative of risky or problematic drinking (Babor,

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Higgins-Biddle, Saunders, & Monteiro, 2001). The questionnaire was validated among French people by Gache et al. (2005).

The *Big Five Inventory Français* (BFI-Fr) was selected in order to measure Big 5 personality traits. The questionnaire has 45 items, 17 of which are reverse coded. It takes 10 minutes time to administer and is among the shortest measures of personality traits to have been validated among French speakers. Using a large sample of university students, (Plaisant, Courtois, Réveillère, Mendelsohn, & John, 2010) demonstrated that the translated version maintained factor structure and convergent validity with another measure of Big 5 personality traits (NEO-PI-R). For each scale, responses range from 1 to 5 and traits lie on a polar continuum. High (and low) scores relate to neuroticism (emotional stability), conscientiousness (undirectedness), openness (closedness), extraversion (introversion) and agreeableness (antagonism).

The *Modified Drinking Motives Questionnaire Revised* (MDMQR) measured five different drinking motives. The questionnaire contains 28 items and takes 10 minutes to administer. Responses are coded on a Likert type scale ranging from *never/almost never* to *always/almost always*. The psychometric proprieties of the French version have been studied and revealed that 5-factor model fit the data better than a 4-factor solution that constrained coping motives unto a single latent factor. However, coping anxiety motives were rarely associated with alcohol use measures and model fit for the 5-factor solution was slightly sub-par (Loose & Acier, 2017). In the present study internal coherency for scales was the following: coping depression (9 item, α=0.92), coping anxiety (4 item, α=0.72), social (5 item, α=0.76), enhancement (5 item, α=0.83) and conformity (5 item, α=0.78).

Two *attention traps* were set in hopes decreasing the likelihood of analyzing random responses. This technique was judged especially pertinent in light of the monetary prize

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associated with participation (Kazdin, 2002). For example, towards the end of the BFI-Fr, we added an item in which participants were explicitly asked to answer "not characteristic." Anyone failing to respond "not characteristic" was discarded from the sample.

2.2. Population and procedure

Questionnaires were administered online, using the secure platform LimeSurvey. Two other questionnaires were included, but were not analyzed in the present chapter. French speaking college students living in France or in Québec aged between 18 and 29 who reported having drunk alcohol at least once over the preceding year were included in this study. Only participants who correctly responded to attention traps were conserved. Participation could be interrupted at any time and all responses were collected anonymously. Participants were contacted via email diffusion lists provided by willing universities and through online social media groups. All participants who completed the study were invited to participate in a lottery to win 100 Canadian dollars or 100 euros. The protocol was approved by relevant Canadian and French ethical boards: The comité institutionnel d'éthique de la recherche avec les êtres humains (CIEREH) of the Université du Québec À Montréal (certificate number 2016_e_1175; November 28, 2016) as well as the Comité d'Évaluation Éthique de l'Inserm (IRB00003888) (certificate number 16-296bis; December 12, 2016).

2.3. Overview of analyses

First, characteristics of French and Canadian samples were described. In order to assess group equivalency, proportions were compared. Next, differences in mean for residency groups were calculated for BFI-Fr, MDMQR and Audit scales. Lastly, in order investigate the inter-relationships between traits, motives and alcohol consumption among French and Canadian college students, multiple parallel mediator models that controlled for age and sex in a first step

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were elaborated for each residency sample. These last calculations were also provided for the total sample while controlling for sex, age, and place of residency (France / Québec).

3. Results

Between January and April 2017, 1,372 people interacted with the online questionnaire. Of those, 1,218 indicated that they fit the preliminary inclusion criteria. Two participants were excluded because they indicated that they responded to age related inclusion age, but also that they were born before 1987. 867 participants completed all questionnaires and correctly responded to the two attention traps. Of these, 793 students participated in the lottery to win a prize. Analyzed data included 389 students residing in France (M_{age}=21.49; SD_{age}=2.50) and 478 students residing in Québec (M_{age}=23.94; SD_{age}=2.57). Student's independent sample t-test indicated that the Canadian sample was significantly older than the French (t (865)=-14.153, p<0.001; d=0.10). In the French sample, 74% were female (n=286), 18% held a part time job (n=68), 53% were in a couple rather than single (n=205) and 0.5% had children under their responsibility (n=2). In the Canadian sample 80% were female (n=381), 64% held a part time job (n=305), 59% were in a couple (n=280) and 2% had children (n=10). Chi-squared tests indicated that the Québec sample had a significantly higher proportion of women (χ^2(1)=4.34, p=0.04) and part time job holders (χ^2(1)=184.57, p<0.001) than the French sample, whereas the other proportions described above did not significantly differ.

3.1. Differences in mean across sex and state of residency.

We first recoded reversed items for the BFI-Fr. Average non-weighted scores were then calculated for BFI-Fr and MDMQR scales. The total Audit score was calculated, as well as the three scale scores (items 1-3; items 4-6; items 7-10). MDMQR conformity and coping depression scales had excessively high kurtosis and accordingly a Log 10 transformation was

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conducted on all MDMQR scales. After transformation, all variables had an absolute value of

kurtosis < 7 and an absolute value of skew < 2, which enters into the criteria of a normal

distribution (Weston & Gore, 2006). Means and standard deviations were calculated for

Canadian and French sub-samples for measures of motives, traits and alcohol use. Then,

student's t-tests were conducted wherein place of residency was used as an independent variable.

For each pairwise comparison, Levine's test of variance homogeneity was conducted. When this

test was significant, a Welch-Satterthwaite t-test was used in order to correct for heterogeneous

variance (Field, 2009). Means without transformation, standard deviations, t-tests and effect sizes

(Cohen's *d*) are figured in table 1.1.

Table 1.1. Means (without transformation), standard deviations, t-tests and effect sizes (Cohen's d) among French
(*N*=389) and Canadian (*N*=478) residents

		Extraversion	Agreeableness	Conscientiousness	Neuroticism	Openness
France	M	3.01	3.83	3.34	3.16	3.55
	SD	0.86	0.62	0.69	0.89	0.67
Québec	M	3.23	3.90	3.76	2.94	3.65
	SD	0.91	0.56	0.64	0.88	0.66
Effects	t	-3.60 ***	-1.67 [a]	-9.33***	3.60***	-2.33*
	d	0.25	0.12	0.63	0.25	0.15
		Social	Coping-anxiety	Enhancement	Coping-depression	Conformity
France	M	2.85	1.84	2.45	1.35	1.33
	SD	0.93	0.86	1.06	0.68	0.59
Québec	M	2.70	1.74	2.30	1.25	1.25
	SD	0.94	0.76	0.95	0.48	0.47
Effects [b]	t	2.30*	1.38 [a]	1.63	2.26* [a]	2.42* [a]
	d	0.16	0.12	0.15	0.17	0.15
		AUDIT total	Hazardous use	Dependence	Harmful use	AUDIT total Score > 7 %(*n*)
France	M	6.78	4.40	0.66	1.71	36% (*n*=141)
	SD	4.71	2.17	1.13	2.33	
Québec	M	6.35	4.03	0.64	1.68	31% (*n*=112)
	SD	4.52	1.94	1.11	2.30	
Effects	t	1.35	2.65**	0.30	0.21	$\chi2$=2.413(1)
	d	0.09	0.18	0.02	0.02	

Note. [a] Welch-Satterthwaite t-test ; [b] t-tests performed on Log10 transformed scores;
* *p*<0.05; ** *p*<0.01; ****p*<0.001

Between samples, no difference was observed in mean total Audit scores or in the

proportion of problematic drinkers (total score > 7). Nevertheless, the French scored higher on

the hazardous alcohol use scale (items 1-3) than did the Canadian sample. We decided to investigate each item of this scale in order to better appreciate the observed difference. We found that students in France scored significantly higher on the volume of alcohol consumed per occasion (t (749.869) = 4.928, $p<0.001$; $d = 0.34$) and on the frequency of binge drinking (t (792.415) = 2.360, $p<0.05$; $d = 0.16$), but interestingly students in Québec drank more frequently than those in France (t (865)= -2.263, $p<0.05$; $d = 0.16$). Canadians scored higher on extraversion, conscientiousness and openness, whereas the French scored higher on neuroticism. The French sample endorsed social, coping depression and conformity motives more strongly than did the Canadian sample (table 1). In both samples, motives were endorsed in the following order: Social > enhancement > coping anxiety > coping depression > conformity. A series of t-tests revealed that mean endorsement between all motives differed (e.g. social>enhancement).

3.2. Drinking motives as mediators between Big 5 traits and alcohol consumption

In order to investigate the potential mediational relationships, the macro PROCESS (model 4) run with SPSS was used (Hayes, 2013). One distal factor (X), multiple parallel mediators (M_i), one outcome variable (Y) and co-variables (C_i) can figure into models (figure 1.1). Path a describes a regression in which X predicts M_i, and path b pertains to a regression in which M_i predicts Y while controlling for X. Path c refers to the direct effect of X on Y, whereas path c' relates to the effect of X on Y once having controlled for all other variables.

Figure 1.1. Multiple parallel mediator model: traits, drinking motives and alcohol consumption
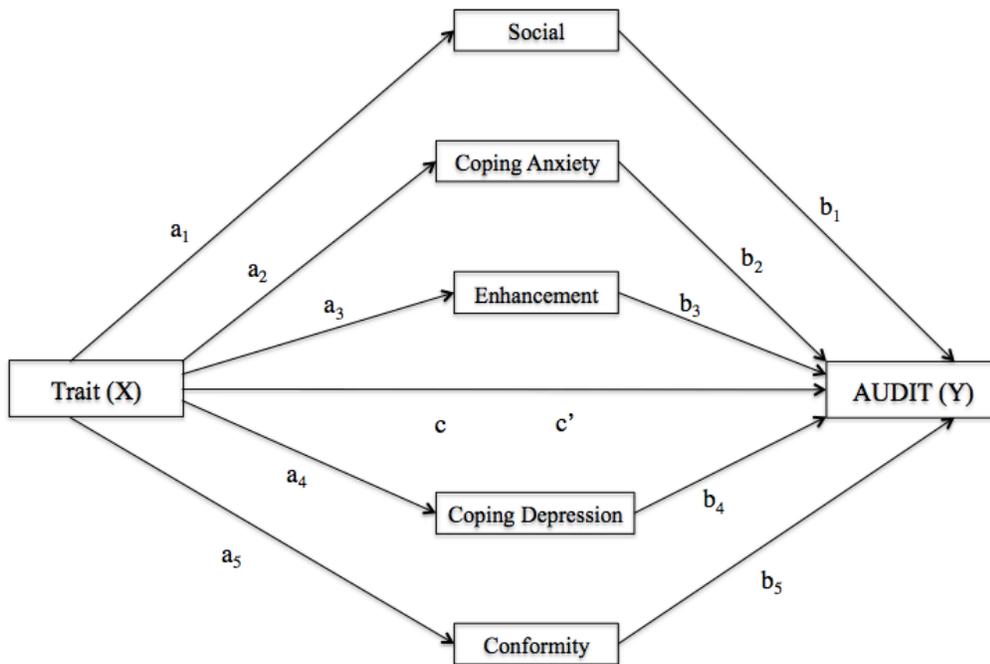
This analytical technique operates on a series of Ordinary Least Squares Regressions and reaches beyond Baron and Kenny's causal steps approach to mediation in many useful ways. First of all, there we could include multiple parallel mediators instead of just one. The significance of indirect effects was calculated using bootstrapping instead of a Sobel z test which has the advantage of not operating on the assumption that path $a \times b$ has a normal distribution. PROCESS also allows for indirect only mediation wherein the direct effect $X => Y$ is not significant. The technique can also provide pair-wise comparisons of indirect effect sizes of the same sign. Competitive mediation is also taken into account and refers to multiple parallel specific indirect effects with a different signs, which can lead to a suppression or attenuation of the direct effect (Hayes, 2013). For the purposes of this study, five multiple parallel mediator models were drawn up for each residency group (ten models in sum) in which one trait (X) predicts total Audit scores (Y) through the multiple parallel mediators of five drinking motives (M_{1-5}) while controlling for age and sex in a first step. This process was repeated five more

times, but using the total sample and additionally controlling for place of residency (France / Québec). The "total effect" (path c or X=>Y), the "direct effect" (path c'), the indirect effect through multiple parallel mediators M_{1-5} (path a_i ×path b_i), and the pairwise contrasts of the effect sizes of indirect effects are figured in table 1.2. These calculations operated on 20,000 bias corrected bootstrapped samples; 95% confidence intervals were used. Table 1.3 figures unstandardized beta coefficients and standard errors calculated for paths a_{1-5} and paths b_{1-5}.

Table 1.2. Total, direct and indirect effects of traits on alcohol use through drinking motives with covariates. Results shown with and without controlling for state of residency.

	Total		Québec		France	
	Effect (BSE)	LLCI; ULCI	Effect (BSE)	LLCI; ULCI	Effect (BSE)	LLCI; ULCI
Extraversion						
Total effect (c)	1.12 (0.17)	0.79; 1.46*	0.74 (0.22)	0.30; 1.18*	1.66 (0.27)	1.14; 2.19*
Direct effect (c')	1.04 (0.14)	0.76; 1.33*	0.81 (0.19)	0.45; 1.18*	1.37 (0.23)	0.92; 1.82*
Social (a_1b_1)	0.05 (0.04)	-0.02 ; 0.12	0.04 (0.05)	-0.05; 0.15	0.06 (0.06)	-0.03; 0.20
Coping Anxiety (a_2b_2)	-0.04 (0.03)	-0.11; 0.00	-0.05 (0.04)	-0.15; 0.01	-0.03 (0.04)	-0.16; 0.01
Enhancement (a_3b_3)	0.13 (0.05)	0.04; 0.24*	0.04 (0.05)	-0.03; 0.16	0.25 (0.09)	0.10; 0.47*
Coping Depression (a_4b_4)	-0.08 (0.04)	-0.18; -0.01*	-0.11 (0.06)	-0.26; -0.02*	-0.05 (0.07)	-0.24; 0.05
Conformity (a_5b_5)	0.02 (0.02)	0.00; 0.08	-0.01 (0.02)	-0.07; 0.03	0.07 (0.05)	0.00; 0.19
Agreeableness						
Total effect (c)	-0.61 (0.27)	-1.13; -0.08*	-0.70 (0.37)	-1.42; 0.03	-0.53 (0.39)	-1.30; 0.24
Direct effect (c')	-0.25 (0.22)	-0.68; 0.19	-0.24 (0.31)	-0.85; 0.36	-0.19 (0.32)	-0.82; 0.45
Social (a_1b_1)	-0.09 (0.06)	-0.22; 0.02	-0.14 (0.10)	-0.35; 0.03	-0.06 (0.08)	-0.25; 0.08
Coping Anxiety (a_2b_2)	-0.01 (0.02)	-0.09; 0.01	-0.02 (0.05)	-0.17; 0.05	0.00 (0.03)	-0.08; 0.05
Enhancement (a_3b_3)	-0.12 (0.08)	-0.30; 0.03	-0.11 (0.09)	-0.31; 0.03	-0.13 (0.15)	-0.44; 0.14
Coping Depression (a_4b_4)	-0.16 (0.08)	-0.35; -0.04*	-0.18 (0.12)	-0.50; -0.02*	-0.14 (0.10)	-0.42; -0.01*
Conformity (a_5b_5)	0.03 (0.03)	-0.01; 0.10	0.00 (0.05)	-0.12; 0.09	0.00 (0.06)	-0.12; 0.11
Conscientiousness						
Total effect (c)	-1.26 (0.24)	-1.72; -0.80*	-1.32 (0.32)	-1.96; -0.68*	-1.18 (0.35)	-1.86; -0.50*
Direct effect (c')	-0.67 (0.20)	-1.06; -0.28*	-0.77 (0.27)	-1.31; -0.23*	-0.49 (0.29)	-1.06; 0.09
Social (a_1b_1)	-0.15 (0.06)	-0.28; -0.06*	-0.16 (0.08)	-0.35; -0.02*	-0.15 (0.09)	-0.36; -0.01*
Coping Anxiety (a_2b_2)	-0.02 (0.04)	-0.12; 0.06	-0.03 (0.06)	-0.17; 0.06	-0.02 (0.07)	-0.18; 0.12
Enhancement (a_3b_3)	-0.25 (0.07)	-0.42; -0.12*	-0.09 (0.07)	-0.26; 0.03	-0.45 (0.14)	-0.77; -0.22*
Coping Depression (a_4b_4)	-0.20 (0.07)	-0.38; -0.09*	-0.27 (0.12)	-0.58; -0.09*	-0.13 (0.09)	-0.39; -0.01*
Conformity (a_5b_5)	0.04 (0.03)	0.00; 0.12	0.00 (0.04)	-0.10; 0.08	0.06 (0.06)	-0.03; 0.21

Social-Coping depression	0.05 (0.08)	-0.11; 0.23	0.11 (0.14)	-0.13; 0.42	-0.01 (0.11)	-0.22; 0.21
Enhancement-Coping depression	-0.05 (0.09)	-0.23; 0.14	-	-	-0.32 (0.15)	-0.63; -0.06*
Social – Enhancement	0.10 (0.08)	-0.04; 0.26	-	-	0.30 (0.14)	0.07; 0.62*
Openness						
Total effect (c)	0.38 (0.24)	-0.08; 0.84	0.58 (0.32)	-0.05; 1.20	0.16 (0.36)	-0.54; 0.86
Direct effect (c')	0.13 (0.20)	-0.25; 0.52	0.29 (0.26)	-0.23; 0.81	-0.08 (0.30)	-0.67; 0.50
Social (a_1b_1)	0.10 (0.06)	0.00; 0.23	0.14 (0.09)	-0.01; 0.34	0.07 (0.08)	-0.07; 0.27
Coping Anxiety (a_2b_2)	0.00 (0.01)	-0.01; 0.05	0.00 (0.02)	-0.02; 0.09	0.00 (0.03)	-0.04; 0.07
Enhancement (a_3b_3)	0.22 (0.07)	0.10; 0.39*	0.18 (0.08)	0.05; 0.38*	0.27 (0.13)	0.05; 0.55*
Coping Depression (a_4b_4)	-0.08 (0.06)	-0.25; 0.01	-0.04 (0.09)	-0.24; 0.12	-0.11 (0.09)	-0.38; 0.01
Conformity (a_5b_5)	0.00 (0.02)	-0.03; 0.05	0.00 (0.02)	-0.03; 0.05	0.02 (0.05)	-0.08; 0.14
Neuroticism						
Total effect (c)	0.30 (0.18)	-0.05; 0.65	0.31 (0.24)	-0.15; 0.78	0.28 (0.28)	-0.26; 0.83
Direct effect (c')	-0.13 (0.16)	-0.13; 0.16	-0.06 (0.20)	-0.46; 0.34	-0.26 (0.24)	-0.74; 0.22
Social (a_1b_1)	0.08 (0.04)	0.01; 0.17*	0.05 (0.06)	-0.05; 0.18	0.11 (0.06)	0.01; 0.27*
Coping Anxiety (a_2b_2)	0.04 (0.06)	-0.06; 0.16	0.03 (0.06)	-0.07; 0.17	0.05 (0.11)	-0.14; 0.29
Enhancement (a_3b_3)	0.09 (0.05)	-0.01; 0.21	0.02 (0.05)	-0.07; 0.14	0.19 (0.10)	0.01; 0.42*
Coping Depression (a_4b_4)	0.29 (0.08)	0.15; 0.47*	0.26 (0.10)	0.10; 0.51 *	0.31 (0.14)	0.09; 0.64*
Conformity (a_5b_5)	-0.06 (0.04)	-0.14; 0.00	0.01 (0.05)	-0.10; 0.11	-0.13 (0.06)	-0.27; -0.04*
Enhancement-Coping depression			-	-	-0.12 (0.16)	-.044; 0.18
Social-Coping Depression			-	-	-0.20 (0.15)	-0.54; 0.06
Social-Enhancement			-	-	-0.08 (0.10)	-0.31; 0.09

Note. Pairwise comparisons in italics. * 95% confidence interval does not contain zero. BSE = Boot standard error. LLCI= lower level confidence interval. ULCI = upper level confidence interval. [a] controlling for state of residency, sex and age. [b] controlling for sex and age.

Extraversion directly predicted alcohol consumption in both samples, but the effect was accentuated among the French. Once having partitioned out the variance of motives and control variables, this trait continued to predict alcohol consumption in the French and Canadian samples. In the French sample, but not in the Canadian sample, the indirect effect of extraversion on alcohol consumption through enhancement motives was positive and significant. In the Canadian sample, but not in the French sample, the indirect effect of extraversion on alcohol use was negative and significant through coping depression motives. Once having partitioned out the

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variance due to place of residency, the indirect effect of extraversion on alcohol consumption was significant through both social and coping depression motives.

Results concerning agreeableness and openness were replicated across the two residency groups. There was no significant direct effect of agreeableness on alcohol consumption, but a negative indirect effect through coping depression motives was found. Openness did not directly predict alcohol consumption, but there was a positive and significant indirect effect through enhancement motives. The confidence interval for this indirect effect became tighter once we partitioned out state of residency.

Conscientiousness directly predicted drinking levels in both samples, such that undirectedness alone led to increased alcohol use. All indirect effects were negative. In the Canadian sample, drinking motives accounted in part for the direct effect, whereas in the French sample, motives entirely accounted for the direct effect (path c' non significant). Coping depression motives were significant mediators exclusively in the French sample. The indirect effect of conscientiousness through social motives was significant in both samples and of comparable size. Enhancement motives were also significant mediators in both samples, but the effect was accentuated among the French. When comparing the size of indirect effects within samples, no difference was observed between effects among students in Québec. However, in the French sample, enhancement motives explained significantly more of the indirect effect than did coping depression or social motives. Furthermore, when residency was partitioned out, the indirect effect through enhancement motives was significant in the total sample.

Alone with sex and age, neuroticism did not significantly predict alcohol consumption, but indirect effects revealed interesting differences between samples. In the Canadian and French sample, the indirect effect of neuroticism through coping depression motives was positive and significant. However, only in French sample, the indirect effects through social and enhancement

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motives were also positive and significant. Also, the indirect effect through conformity motives was significant, but negative (high neuroticism, high conformity motives, low alcohol use). In the French sample pairwise comparisons showed that there was no difference between the sizes of these indirect effects. Note that this was a case of competitive mediation in which there were significant parallel indirect effects of different signs. Consequently, no pairwise comparison was performed with the conformity scale. In the total sample controlling for residency, age and sex, effects remained significant through coping depression and social motives, but not through enhancement or conformity motives.

Table 1.3. Paths *a* and Paths *b* for 15 multiple parallel mediator models: personality traits and drinking motives

	Path a_1	Path a_2	Path a_3	Path a_4	Path a_5	Path b_1	Path b_2	Path b_3	Path b_4	Path b_5
Total [a]										
E	0.01 (0.01)	-0.02 (0.01)*	0.02 (0.01)*	-0.01 (0.01)*	-0.01 (0.01)*	5.74 (1.10)*	1.92 (1.09)	5.84 (0.94)*	7.00 (1.21)*	-1.90 (1.09)
A	-0.02 (0.01)	0.01 (0.01)	-0.02 (0.01)	-0.02 (0.01)*	-0.01 (0.01)	6.07 (1.13)*	0.75 (1.11)	6.83 (0.95)*	6.78 (1.25)*	-2.42 (1.12)*
C	-0.03 (0.01)*	-0.04 (0.01)*	-0.04 (0.01)*	-0.03 (0.01)*	-0.02 (0.01)*	6.09 (1.12)*	0.60 (1.10)	6.70 (0.95)*	6.70 (0.95)*	-2.53 (1.11)*
O	0.02 (0.01)*	0.00 (0.01)	0.03 (0.01)*	-0.01 (0.01)	0.00 (0.01)	6.09 (1.13)*	6.09 (1.13)	6.77 (0.96)*	6.98 (1.25)*	-2.41 (1.12)*
N	0.01 (0.01)*	0.05 (0.01)*	0.01 (0.01)	0.04 (0.01)*	0.03 (0.01)*	6.05 (1.13)*	0.82 (1.12)	6.79 (0.96)*	7.04 (1.26)*	-2.30 (1.13)*
Québec [b]										
E	0.01 (0.01)	-0.02 (0.01)*	0.01 (0.01)	-0.01 (0.01)*	-0.01 (0.01)	6.29 (1.43)*	1.91 (1.55)	4.55 (1.31)*	8.59 (1.93)*	0.65 (1.58)
A	-0.02 (0.01)	-0.03 (0.18)*	-0.02 (0.02)	-0.02 (0.01)*	-0.02 (0.01)*	6.61 (1.45)*	0.86 (1.56)	5.14 (1.33)*	8.49 (1.97)*	0.19 (1.61)
C	-0.02 (0.01)*	-0.03 (0.01)*	-0.02 (0.01)	-0.03 (0.01)*	-0.02 (0.01)*	6.41 (1.45)*	0.84 (1.55)	5.34 (1.32)*	7.90 (1.96)*	0.15 (1.59)
O	0.02 (0.01)	0.00 (0.01)	0.04 (0.01)*	0.00 (0.01)	0.00 (0.01)	6.60 (1.45)*	0.91 (1.56)	4.97 (1.33)*	8.68 (1.97)*	0.26 (1.61)
N	0.01 (0.01)	0.03 (0.01)*	0.00 (0.01)	0.03 (0.01)*	0.03 (0.01)	6.61 (1.46)*	0.93 (1.57)	5.10 (1.33)*	8.60 (1.98)*	0.35 (1.62)
France [b]										
E	0.01 (0.01)	-0.02 (0.01)	0.04 (0.01)*	-0.01 (0.01)	-0.02 (0.01)	5.61 (1.70)*	2.08 (1.55)	6.56 (1.34)*	5.58 (1.57)*	-4.13 (1.53)*
A	-0.01 (0.01)	0.00 (0.02)	-0.02 (0.02)	-0.03 (0.01)*	0.00 (0.01)	5.95 (1.78)*	0.69 (1.61)	8.22 (1.38)*	5.25 (1.65)*	-4.77 (1.60)*
C	-0.02 (0.01)*	-0.04 (0.01)*	-0.06 (0.01)*	-0.03 (0.01)*	-0.01 (0.01)	6.12 (1.78)*	0.49 (1.60)	7.92 (1.38)*	5.36 (1.63)*	-4.88 (1.59)*
O	0.01 (0.01)	0.00 (0.01)	0.03 (0.02)*	-0.02 (0.01)	0.00 (0.01)	5.98 (1.78)*	0.61 (1.60)	8.29 (1.39)*	5.31 (1.65)*	-4.79 (1.60)*
N	0.02 (0.01)*	0.06 (0.01)*	0.02 (0.01)*	0.05 (0.01)*	0.03 (0.01)*	5.89 (1.78)*	0.88 (1.62)	8.14 (1.38)*	5.67 (1.66)*	-4.65 (1.60)*

Note. [a] Controlling for age sex and place of residency. [b] Controlling for age and sex. Path 1 = Social. Path 2 = Coping anxiety. Path 3 = Enhancement. Path 4 = Coping depression. Path 5=Conformity. E = Extraversion. A= Agreeableness. C = Conscientiousness. O = openness. N = Neuroticism. * *p*< 0.05. Unstandardized beta coefficients. Standard Error in parentheses.

4. Discussion

Drinking behaviors among college students living in France or in Québec are all too often problematic and our study extended our understanding of the determinants of drinking behaviors. Contrary to hypotheses, levels of alcohol consumption observed among students in Québec were similar to that of students living in France, with one small difference: students in France had a higher level of hazardous alcohol use. Students in France drank more alcohol per occasion and engaged in more episodes of binge drinking, but students in Québec drank more frequently. Prevention campaigns in France may benefit from focusing on the quantity of alcohol consumed per occasion (e.g. "trop d'alcool tue l'ivresse"), whereas in Québec it may be more beneficial to target the dangers associated with drinking too frequently. Despite the observed difference in hazardous use, Quebecers might be just about as likely as the French to develop problems related to alcohol consumption, such as dependence symptoms and alcohol related harm, though the pathways to alcohol related problems might differ.

Mean endorsement of personality traits differed between the two groups of students, but observed differences did not entirely converge with the findings of the meta-analysis conducted by Schmitt et al. (2007). In their study and in the present study, people in Québec were more extraverted and emotionally stable than those in France. Schmitt et al. (2007) additionally found that Canadians were more agreeable, whereas we additionally found that students in Québec were more open and conscientious than those in France. Furthermore, the effect size of the difference in conscientiousness observed in our study was the largest and might be attributable to differences in the specificities of being a college student in France or in Québec. Consciousness describes people who are hardworking, well organized, ambitious and persevering (Costa & McCrae, 1992). In comparison to the French, students in Québec had more part time jobs in

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addition to their studies. Students living in Québec might be motivated or obliged to spend more time working, which could only be done effectively if one has a high level of conscientiousness. This finding might also be explained by the fact that the Québec sample was older than the French sample. A meta-analysis revealed that conscientiousness increased with age and that the change began to take place when people were in their 20s (Roberts, Walton, & Viechtbauer, 2006). However, the difference in age in our samples was small (d=0.10).

The ordering of the mean endorsement of drinking motives was equivalent to that observed in previous works (e.g. Grant et al., 2007; Loose & Acier, 2017). The French sample endorsed social, coping-depression and conformity motives more strongly than did the Canadian sample. This finding went in the opposite direction of our hypothesis inspired by Mackinnon et al. (2017) that pertained to drinking motives in individualistic versus collectivist countries. In our study, differences may be attributable to specific cultural aspects, rather than the global characteristic of individualism. This explanation seems especially plausible because the difference in individualism between France and Canada was negligible in comparison to the stark difference in groups analyzed in Mackinnon et al. (2017). Our findings might be better explained by factors such as the integration of alcohol into French culture and social customs (social motives), the normalization of drinking behaviors and social pressure to drink even when one does not desire to consume (conformity motives) and the baseline rate of emotionally stable individuals in France (high neuroticism and high coping depression motives).

A series of multiple parallel mediator models demonstrated that all personality traits led to alcohol consumption through drinking motives independently of sex and age. Some traits were associated with alcohol use without taking into account motives (extraversion and conscientiousness), whereas the other three traits only had an indirect relationship with alcohol use through drinking motives. When studying personality and behavior, it would be important to

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take into account proximal determinants. Overall, coping depression and enhancement motives were the most frequently revealed as mediators. This converges with findings suggesting that internal motives were more related to traits than were external motives (e.g. Stewart & Devine, 2000), even if we did also find significant indirect relationships through external motives (social and conformity). More specifically, social motives were a significant mediator of conscientiousness in both samples, and of neuroticism among the French. Conformity motives also only appeared as a significant mediator among people in France. Collectively these findings suggest that even if external motives may be less related to traits, they could still be related, and this may be especially true in specific environments in which drinking behavior is highly normalized (e.g. college in France).

In both samples, extraversion was an overall risk factor in that high scores on extraversion were directly associated with higher levels of problematic alcohol consumption (path c), whereas Malouff et al. (2007) found that this effect was null across studies. Among students in France the effect was accentuated, suggesting that French students who are sociable would be especially at risk for hazardous alcohol consumption. Furthermore, the pathways to alcohol use stemming from this trait differed between countries. In France, but not in Québec, extraverted students would want to make situations more fun or exciting by means of alcohol consumption (enhancement motives), and thus be at risk for problematic alcohol use. Extraversion also led to enhancement motives elsewhere (Mezquita et al., 2010; Theakston et al., 2004). In Québec, but not in France, introverted students would be more likely to develop coping depression motives. As extraversion indirectly led to lower alcohol use, extraversion may be considered in part a protective factor in regards to drinking behaviors among college students in Québec. Interestingly, other studies have found similar results using Canadian and European samples: extraversion and coping motives were related among a sample of Canadians (Theakston

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et al., 2004), but extraversion was not related to coping motives among a sample of Spaniards (Mezquita et al., 2010). This contirbues to the reliability of this culturally distinct finding.

Agreeableness and openness had no direct effect on alcohol consumption, and findings did not differ between French and Canadian students. As findings were fully replicated across samples, culture may have little impact on these relationships. Antagonism led to coping depression motives, which in turn to led inflated alcohol consumption. In other words our study suggested that agreeableness would only be a protective factor because it would guard against consuming alcohol as a means to decrease negative affect. In contrast, Theakston et al. (2004) found that only enhancement motives were related to this trait. Openness had no direct association with alcohol consumption in both samples, but the trait led to heightened enhancement motives, which in turn led to inflated alcohol use. This has been confirmed elsewhere (Theakston, 2004). Unfortunately the vast majority of studies examined did not measure agreeableness or openness (e.g. Kuntsche et al., 2008; Mezquita et al., 2010). Prospective studies may be advised to include these traits in order to assess the reliability of findings and the influence of cultural variables on potential interrelationships.

As expected, conscientiousness was clearly a protective factor among students in France and Québec. Our study may suggest that students who have trouble working incrementally towards long-term goals would consume more alcohol for a variety of reasons. Students who lack direction would drink more frequently while socializing or to dampen feelings of sadness. The findings relating to coping motives has been found elsewhere (Kuntsche et al., 2008), whereas the results pertaining to social motives seem to be novel. Our study also suggested that French students, but not Canadian students, who scored low on conscientiousness would also be inclined to use alcohol to for enhancement motives. Furthermore, this pathway would be responsible for the majority of the indirect effect among college students in France. As this

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finding has been replicated multiple times elsewhere (Kuntsche et al., 2008; Mezquita et al., 2010; Stewart & Devine, 2000; Theakston et al., 2004), it is somewhat surprising that the indirect effect did not emerge in the Canadian sample.

Neuroticism alone did not predict alcohol consumption in either sample, and the indirect pathways differed considerably across countries. Among students in Canada and France, those who lacked in emotional stability tended to drink to relieve themselves of feelings of sadness. This indirect pathway has also been found multiple times elsewhere (Kuntsche et al., 2008; Mezquita et al., 2010; Stewart & Devine, 2000; Theakston et al., 2004). However, among students in France, neuroticism also led to heighted social and enhancement motives, which both led to inflated alcohol use. Furthermore, among students in France, neuroticism led to conformity motives, which in turn led to decreased alcohol consumption. Theakston et al. (2004) also revealed this finding. As neuroticism describes people who tend to worry and be self-conscious (Costa & McCrae, 1992), the trait may negatively impact people's capacity to turn down alcohol under social pressure because they would be worried about receiving a negative social appraisal. Furthermore, as the French notoriously have many social customs involving alcohol, people in France may have learned that they will receive negative social appraisal if they do not consume alcohol, whereas in Québec, social rejection based on abstaining from alcohol might be a less common event. Endorsement of conformity motives was also significantly higher among the French sample, which also highlights their pertinence within specific cultural contexts. Lastly, the case of competitive mediation observed among the French was also observed in Loose et al. (2017) which alludes to the reliability of this finding. Again, these indirect relationships may help explain the absence of a direct link between neuroticism and alcohol consumption, as well as inconsistent findings found in other works (e.g. Malouff et al., 2007).

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Despite the interest of the present study, our findings had several limitations. All measures were self-report and we only used one measure for every construct. This could be notably limiting in regards to our analysis of the specificities of alcohol consumption among participants. Even if we provided comparisons of means for Audit scales, subsequent analyses used exclusively the total score which may over-simplify relationships between determinants of drinking quantity and frequency versus alcohol related problems for example. Analyses were further limited by our negligence of the co-variance between personality traits because they were entered each into their own model. Even if we controlled for sex in most analyses, women were disproportionally represented. There were differences across our residency samples for which we did not control (e.g. part time job holders) and which could act as cofounding variables. The study design was cross sectional but conceptualized as a causal chain. Lastly, we used place of residency, sex and age as control variables, but could had gone a step further looked into moderated mediation. Especially in light of the cultural differences observed herein, future works could investigate the moderating role of culture on the mediational relationships observed in this study.

In conclusion, cultural differences in personality traits, drinking motives and alcohol consumption were observed among French and Canadian college students. In research and in practice, we would observe specific differences in baseline levels of these determinants as a function of place of residency. Targeting culturally prevalent determinants could be advised. Furthermore, these determinants did not all interact equally across cultures. In some cases, personality traits would develop into specific drinking motives as a function of place of residency, i.e. as a function of the external or social environment. Taking into account cultural factors when conceptualizing the processes leading up to drinking motives may be beneficial. For example, neuroticism among French students did not generate the same motivational pattern

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as it did among Canadians. This underscores the importance of accounting for cultural

differences within etiological frameworks conceptualizing alcohol consumption behaviors.

Nevertheless, across cultures, all personality traits impacted drinking behaviors through the

multiple parallel mediators of drinking motives.

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CHAPTER 2

Personality, temporality and alcohol consumption among French and Canadian college students

1. Introduction

Recreational alcohol consumption among college students may not only lead to fun and games. When young people chronically consume alcohol, problems associated with use may develop and young adults at a particularly high risk for developing disorders. For example, over a 12 month period in the United States, 4.6% of 12-17 years olds and 8.5% of adults had been diagnosed with an Alcohol Use Disorder, but prevalence is highest among 18-29-year-olds: 16.2% of this age group were diagnosed. Heightened alcohol related problems were also consistently associated with the male gender (American Psychiatric Association, 2013). Looking beyond the United States, variations in alcohol consumption levels can be observed internationally as a function of culture. For example, on average people would consume more alcohol in France (13.66 liters of pure alcohol per year) than in Canada (9.77 liters) (World Health Organization, 2014). Over the decades, researchers have been discovering partial determinants of alcohol consumption behaviors such as genetic predispositions, environmental determinants, or psychosocial factors (International Center For Alcohol Policies, 2009). Etiological frameworks often figure in multiple levels of interacting determinants of drinking behaviors (Cox & Klinger, 1988). Such etiological models inspired the conceptual framework of our study.

We aimed in part to insert promising determinant, temporality, between the well-known distal determinant of personality traits and alcohol consumption behavior. One of the most

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reputed conceptions of temporality is that of Time Perspective (TP). Time perspective refers to organizing experience into temporal zones (past, present, future), which would allow people to construct a coherent perception of reality (Zimbardo & Boyd, 1999). When emotional valence was added into the model, five time perspectives were drawn up : *past positive* (happy memories of the past), *past negative* (memories of bad experiences)*, present hedonist* (engaging in pleasurable hedonist activities), *present fatalist* (perceiving that action in the present will not influence future outcomes) and *future* (working towards future objectives and delaying gratification). TP has since been studied in relationship to a wide variety of behaviors including alcohol consumption. Across cultures, past negative and present fatalist perspectives were vulnerability factors, whereas past positive and future perspectives were protective. Present hedonist TP would lead both to risky behaviors (e.g. substance use) and to enhanced psychological well-being (Sircova et al., 2015).

Even if all TPs have demonstrated associations with behaviors, research suggested that not all TPs were associated with addictive behaviors specifically (McKay, Perry, Cole, & Worrell, 2017). Across studies, high present hedonism, and to a lesser extent low future, would be the most consistently associated with alcohol consumption behaviors (Henson, Carey, Carey, & Maisto, 2006; Keough, Zimbardo, & Boyd, 1999; Loose, Robiou-du-pont, Acier, & El-Baalbaki, annex 3). Occasionally, the other "risky" temporal patterns have been associated with drinking behaviors such as high past negative (Loose, Acier, Pilet, & Sysaykeo, 2017), high present fatalism (Laghi, Liga, Baumgartner, & Baiocco, 2012) or low past positive (Loose, Acier, Andretta, et al., 2017).

One hypothesis could be that temporalities neglected by the ZTPI would be better determinants of addictive behaviors. Temporality does refer to a plurality of concepts including but not limited to TP (e.g. Kazakina, 2015) and viable temporal determinants of addictive

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behaviors may be neglected by the ZTPI model. For example, all three dimensions of a recently developed measure of temporality were significantly associated with alcohol consumption: *anticipation* (foreseeing short-term goals and adapting behavior accordingly), *temporal rupture* (psychologically unhooking from the linearity of passing time), and *uncertain future* (conceiving abstract and unforeseeable future events that would be impossible to act on) (Loose, Acier, Pilet, et al., 2017). The latest version of the questionnaire, called the Temporal Competency Test 5D (TCT 5D), added in two more dimensions : *full present* (engaging wholeheartedly in present moments) and *past* (learning from past mistakes or experience in order to mature) (Loose, Acier, Deledalle, & El-Baalbaki, annex 3).

In both the ZTPI and TCT-5D conceptions, the psychological integration of time would be a semi-conscious disposition, somewhat like a personality trait but more reliant on situational factors (Kairys & Liniauskaite, 2015). Keough et al. (1999) found that the ZTPI dimensions were related to personality traits but that they could not be reduced to such, whereas the work of Loose et al. (annex 3) was admittedly limited because the study did not explore relationships between TCT-5D dimensions and personality traits. This study aimed in part to provide the neglected data analyses of relationships between personality traits and TCT-5D dimensions. Even if studying associations between personality traits and ZTPI or TCT-5D scores could still be interesting in its own right, studies could reach further by investigating indirect relationships in which personality traits lead to aspects of temporality which lead in turn to drinking behaviors. One promising hypothesis could be that personality traits impact drinking behaviors through the proximal mediator of temporality.

Like time perspectives, personality traits have been recognized as significant determinants of alcohol consumption. Traits are thought to be among the most distal determinants and related to behaviors through more proximal mediators (e.g. Cox & Klinger, 1988). A meta-analysis

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found that low conscientiousness, high neuroticism and low agreeableness were significantly related to alcohol consumption across 24 studies (Malouff, Thorsteinsson, Rooke, & Schutte, 2007). When examining the individual studies, it becomes apparent that findings were inconsistent and in some cases even contradictory, e.g. neuroticism can be looked at as both a "protective" and "risk" factor. Loose et al. (annex 3) argued that observed inconsistencies could be explained by the intervention of more proximal variables, such as time perspectives. For example, past positive, future or present hedonist time perspectives mediated the relationship between Big 5 personality traits and alcohol consumption. As the TCT-5D model is conceptually similar to that of the ZTPI, and as aspects of temporality not included in the ZTPI may be associated with drinking behaviors, TCT-5D dimensions could also mediate the relationship between traits and alcohol consumption behavior. Nevertheless, no studies to date have investigated relationships between the TCT-5D and personality traits or alcohol consumption, let alone extending findings to multilevel etiological frameworks.

In order to develop the extent literature associating traits, temporalities, and alcohol consumption, this study aimed to investigate 1) bivariate relationships between personality traits and two measures of temporality, 2) which temporalities significantly predicted alcohol consumption by using two different conceptualizations of time, 3) redundancy between meaningful temporal predictors across instruments in order to select the best temporal predictors, 4) indirect relationships between personality traits and alcohol consumption through the most pertinent facets of temporality. As culture, age, and sex may impact these determinants as well as drinking behaviors, variance due to age, sex and country of residency (Canada / France) was partitioned out in a first step throughout regression analyses.

2. Methods

2.1. Mesures

The *Alcohol Use Disorder Identification Test* was used in order to tap problematic alcohol consumption, as described in chapter 1.

The Big Five Inventory – French was used to measure big 5 personality traits. The questionnaire was described in chapter 1.

The *Temporal Competency Test 5-D* has three items for the five aforementioned dimensions. The questionnaire was developed and validated among a sample of French young people. Participants are asked to position themselves on Likert type scales ranging from *disagree* (1) to *agree* (5). Scales had sufficient reliability and model fit in confirmatory factor was good to excellent in three independent samples. As the French and Canadian samples used in the present study were among those independent samples, measurement error in the present study would be minimal. The development and validation of the TCT-5D was written up as a three-part article (annex 3).

The *Zimbardo Time Perspective Inventory* in French was used to measure the five aforementioned scales. Originally validated in English by Zimbardo and Boyd (1999), the ZTPI has since been translated into French and validated by Apostolidis and Fieulaine (2004). In the French sample, internal coherency ranged between $\alpha=0.70$ and $\alpha=0.79$. Test retest intra-class correlations were all significant and ranged from $r=0.68$ to $r=0.78$. The ZTPI has 54 items and took approximately 15 minutes to administer. An elevated score on a dimension indicates frequent use of the corresponding time frame.

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2.2. Procedure and population

A detailed description of the procedure used for questionnaire administration was provided in chapter 1. Descriptive specificities of the sample used in the present study were also provided beforehand.

2.3. Overview of analyses

First we aimed to investigate relationships between TCT-5D scales and personality traits and compare patterns with the ZTPI. A correlation matrix of bivariate relationships between traits and temporality scales was drawn up. We added in correlations with AUDIT scores in order to allow the reader to appreciate differences in analytical techniques. Afterwards, we ran a series of three regressions in which temporal scales predicted total Audit scores. The first regression used the ZTPI scales as predictors while the second used TCT-5D scales. The third regression only used predictors that were significant in the latter two regressions. Only the temporalities that were still predictors when accounting for common variance were carried over into the last series of analyses. Lastly, we investigated indirect effects of personality traits on alcohol consumption through the multiple parallel mediators of retained temporalities by using another series of regressions. All regression analyses controlled for sex, age, and state of residency in a first step. All analyses were done with SPSS and the macro PROCESS.

3. Results

3.1. Correlations between traits and temporalities

Two-tailed Pearson correlations were calculated between ZTPI scales or TCT-5D scales and Big 5 personality traits (table 2.1). Correlations between total Audit scores and temporality scales are also put at the reader's disposal. TCT-5D full present and past exhibited an equivalent

correlation pattern with personality traits: high extraversion, high agreeableness, high

conscientiousness, low neuroticism and high openness. Both of these dimensions were unrelated

to total Audit scores. Temporal rupture related most strongly to low conscientiousness and high

neuroticism as well as inflated Audit scores. Anticipation correlated with high conscientiousness

and high neuroticism, but also to low extraversion, low openness and low Audit scores.

Uncertain future was correlated with low conscientiousness, high neuroticism, low extraversion

and low agreeableness, as well as inflated Audit scores. The ZTPI scales correlated with

personality in a distinct manner in comparison to TCT-5D scales, with one exception : the present

fatalist scale of the ZTPI showed a similar pattern to the uncertain future scale of the TCT-5D.

The strongest association observed between ZTPI measures and personality traits was between

conscientiousness and future, followed by past negative and neuroticism. Among ZTPI scales,

total Audit scores correlated the most strongly with present hedonist perspective, whereas among

the TCT-5D scales, temporal rupture was the most strongly related to alcohol consumption.

Table 2.1. Pearson correlations between TCT-5D, ZTPI, BFI-Fr, and AUDIT scales (*N*=867)

	E	A	C	N	O	AUDIT
TCT-5D						
Full Present	0.357**	0.189**	0.179**	-0.336**	0.073*	0.049
Past	0.312**	0.219**	0.256**	-0.222**	0.127**	0.013
Rupture	0.013	-0.080*	-0.205**	0.131**	0.018	0.345**
Anticipation	-0.090**	-0.010	0.368**	0.206**	-0.086*	-0.166**
Uncertain Future	-0.145**	-0.104**	-0.327**	0.212**	-0.041	0.107**
ZTPI						
Present hedonist	0.237**	-0.014	-0.267**	-0.009	0.146**	0.299**
Past Positive	0.204**	0.202**	0.196**	-0.225**	0.057	-0.081*
Present Fatalist	-0.104**	-0.219**	-0.342**	0.280**	-0.087*	0.107**
Past Negative	-0.220**	-0.258**	-0.339**	0.491**	-0.053	0.158**
Future	0.057	0.100**	0.642**	0.030	0.005	-0.183**
AUDIT	0.200**	-0.085*	-0.191**	0.042	0.063	

Note. E = Extraversion. A= Agreeableness. C = Conscientiousness. O = openness. N = Neuroticism.
* *p*<0.05; ** *p*<0.01; ***p<0.001.

3.2. Temporalities as predictors of alcohol consumption

Next, in order to account for common variance between temporality scales and to partition out the variance of control variables, two multiple hierarchical regression analyses were calculated. In the first step, age, sex, and country of residency predicted total Audit scores. Dimensions of temporality were entered into a second step. Table 2.2 exhibits the first regression, in which ZTPI dimensions were entered in as mediators with control variables, whereas table 2.3 exhibits the second regression wherein TCT-5D scores take the place of ZTPI scores. Alone, the only control variable to be significantly related to total Audit scores was sex: being male was associated with inflated Audit scores, but only accounted for 1% of variance. When ZTPI scores were added into the model, present hedonist, future and past negative perspectives significantly predicted Audit scores, whereas the other two dimensions were no longer related; 12% of variance was explained (table 2.2). With the TCT-5D scales entered in as predictors instead of ZTPI scores, only temporal rupture and anticipation were significant predictors of total Audit scores. The model explained 14% of variance. In sum, these first two regressions showed that five scales of temporality were significantly related to total Audit scores once having partitioned out common variance: past negative, present hedonist, future, anticipation, and temporal rupture. Lastly, a third regression was run in which this combination of five scales was entered in the place of temporality variables ;18% of variance was explained. However, ZTPI future no longer significantly accounted for AUDIT scores. As path *b* (described below) must be significant in order for mediation to have occurred, only four scales were conserved as potential mediators for the next stage of analyses.

Table 2.2. Hierarchical regression analysis in which ZTPI scales predict alcohol consumption while controlling for sex, age and state of residency.

Step		B	SE B	β	t	p	Adjusted R^2	Δ R^2
1	Constant	138.075	122.810		1.124	0.261	0.009	0.013
	Sex	1.034	0.371	0.095	2.788	0.005		
	Age	-0.066	0.061	-0.040	-1.077	0.282		
	Residency	-0.524	0.349	-0.057	-1.503	0.133		
2	Constant	275.326	118.311		2.327	0.020	0.114	0.110
	Sex	0.901	0.355	0.082	2.535	0.011		
	Age	-0.138	0.059	-0.084	-2.324	0.020		
	Residency	0.009	0.342	0.001	0.026	0.979		
	Present hedonist	2.404	0.308	0.293	7.796	<0.001		
	Past positive	-0.258	0.257	-0.036	-1.006	0.315		
	Present fatalist	-0.513	0.274	-0.075	-1.868	0.062		
	Past negative	0.578	0.233	0.103	2.484	0.013		
	Future	-0.614	0.297	-0.073	-2.069	0.039		

Note. SE = Standard Error

Table 2.3. Two hierarchical regressions in which temporality scales predict alcohol consumption while controlling for sex, age and state of residency (*N*=867). Step 2 is shown (controlling for sex, age and residency).

Step		B	SE B	β	t	p	Adjusted R^2	Δ R^2
2	Constant	13.451	115.454		0.117	0.907	0.144	0.140
	Sex	1.086	0.350	0.099	3.105	0.002		
	Age	-0.006	0.058	-0.004	-0.099	0.921		
	Residency	0.280	0.338	0.030	0.829	0.407		
	Anticipation	-0.691	0.185	-0.120	-3.734	<0.001		
	Temporal Rupture	1.585	0.154	0.336	10.313	<0.001		
	Full Present	0.447	0.266	0.076	1.679	0.093		
	Past	-0.065	0.386	-0.008	-0.168	0.867		
	Uncertain Future	0.188	0.155	0.040	1.211	0.226		
2	Constant	142.523	114.216		1.248	0.212	0.183	0.178
	Sex	1.009	0.341	0.092	2.962	0.003		
	Age	-0.073	0.057	-0.045	-1.274	0.203		
	Residency	0.356	0.328	0.038	1.084	0.279		
	Present Hedonist	1.679	0.290	0.205	5.786	<0.001		
	Past Negative	0.387	0.190	0.069	2.033	0.042		
	Future	0.043	0.330	0.005	0.131	0.896		
	Temporal Rupture	1.318	0.154	0.279	8.538	<0.001		
	Anticipation	-0.517	0.220	-0.090	-2.349	0.019		

Note. SE = Standard Error

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3.3. Temporalities as mediators between traits and alcohol use

Five multiple parallel mediator models were drawn up; one for each distal personality trait (X). Total Audit scores were figured as the outcome (Y) and the four chosen temporalities as multiple parallel mediators (M_{1-4}). Control variables (sex, age, place of residency) were first partitioned out. Path c was calculated by a regression in which X predicts Y, whereas path c' refers to the residual effect of X on Y once having added the mediators into the model. Path a refers to a regression in which X predicts M_i, whereas path b refers to the effect of M on Y once having controlled for X. In order for mediation to have occurred, path $a \times$ path b must be significant (Hayes, 2013). Indirect only mediation (when path c is non-significant) and competitive mediation (parallel mediators with different signs) can be revealed using this analytical technique as it reaches beyond the causal steps approach proposed by Baron and Kenny (1986). Table 2.4 exhibits coefficients for paths $a_i \times b_i$, c, and c' that were calculated using 20,000 bootstrapped samples and 95% confidence intervals. When indirect effects were significant through multiple parallel mediators, pair-wise contrasts of effect sizes were figured. Table 2.5 contains the unstandardized regression coefficients and standard errors for paths a and b.

Extraversion was directly related to inflated Audit scores (path c), and continued to predict total scores once having taken temporalities into the model but to a lesser extent (path c'). There were significant indirect effects of extraversion on alcohol consumption through present hedonist, past negative and anticipation, though the effect through present hedonism was significantly greater than that of anticipation. Competitive mediation was observed. Extraversion was associated with high present hedonism (path a), which was associated with high AUDIT

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scores (path *b*). The trait was also associated with low anticipation, a temporality that was itself associated with low AUDIT scores. Nevertheless, extraversion led to depleted scores on past negative (path *a*), a time perspective that was associated with high AUDIT scores (path *b*). In sum, extraversion led to heightened AUDIT scores through anticipation and present hedonism, but to depleted scores through past negative time perspective.

Agreeableness was directly related with depleted Audit scores (path *c*), but the effect was stamped out once temporalities were taken account (path *c'*). There was a significant and negative indirect effect of agreeableness on alcohol consumption through temporal rupture, such that agreeableness was related to depleted scores on temporal rupture (path *a* negative) which were themselves positively related to alcohol consumption (path *b* positive).

Depleted scores on the Audit were directly predicted by consciousness, but when temporalities were added into the model, the effect vanished. This trait had significant and negative indirect effects through temporal rupture and present hedonism. There was not a significant difference in the size of these two effects. Note that consciousness led to decreased temporal rupture and present hedonism (negative sign path *a*), which were themselves related to heightened Audit scores (positive sign path *b*) which rendered the indirect effect negative.

Openness had no association with AUDIT scores when temporalities were not taken into account (path *c*). Nevertheless the indirect effect of openness on alcohol consumption was positive and significant through present hedonist perspective, and to a lesser extent, through anticipation.

Neuroticism also had no direct effect on AUDIT scores but indirect only competitive mediation was observed. Neuroticism was associated with high scores on anticipation (path *a* positive), a temporality that was associated with decreased alcohol use (path *b* negative).

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However, neuroticism also led to increased temporal rupture, which was in turn related to
heightened scores on the Audit.

Table 2.4. Indirect effects of personality traits on alcohol consumption through parallel mediators while controlling
for age, sex and state of residency (*N*=867).

	Coefficient (BSE)	LLCI; ULCI
2.1. Extraversion		
Path c *	1.125 (0.171)	0.789; 1.461
Path c' *	0.959 (0.168)	0.629; 1.290
Present Hedonist (a_1b_1) *	0.186 (0.057)	0.089; 0.317
Past Negative (a_2b_2) *	-0.119 (0.040)	-0.212; -0.052
Anticipation (a3b3) *	0.049 (0.024)	0.012; 0.111
Temporal rupture (a_4b_4)	0.050 (0.048)	-0.040; 0.151
Present hedonist-anticipation *	0.137 (0.066)	0.017; 0.277
2.2. Agreeableness		
Path c *	-0.606 (0.267)	-1.130; -0.082
Path c'	-0.342 (0.251)	-0.835; 0.151
Present Hedonist (a_1b_1)	-0.010 (0.059)	-0.129; 0.109
Past Negative (a_2b_2)	-0.108 (0.072)	-0.265; 0.022
Anticipation (a_3b_3)	0.011 (0.027)	-0.036; 0.074
Temporal rupture (a_4b_4)*	-0.157 (0.080)	-0.327; -0.010
2.3. Conscientiousness		
Path c *	-1.259 (0.236)	-1.721; -0.796
Path c'	-0.304 (0.251)	-0.797; 0.189
Present Hedonist (a_1b_1)*	-0.325 (0.074)	-0.490; -0.198
Past Negative (a_2b_2)	-0.103 (0.070)	-0.247; 0.029
Anticipation (a_3b_3)	-0.186 (0.099)	-0.387; 0.000
Temporal rupture (a_4b_4)*	-0.340 (0.077)	-0.511; -0.207
Present hedonist-temporal rupture	0.015 (0.102)	-0.180 ; 0.222
2.4. Openness		
Path c	0.380 (0.236)	-0.084; 0.843
Path c'	0.054 (0.219)	-0.375; 0.484
Present Hedonist (a_1b_1)*	0.243 (0.066)	0.133; 0.397
Past Negative (a_2b_2)	-0.017 (0.020)	-0.075; 0.009
Anticipation (a_3b_3)*	0.047 (0.028)	0.008; 0.122
Temporal rupture (a_4b_4)	0.052 (0.067)	-0.078; 0.188
Present hedonist-anticipation *	0.196 (0.072)	0.071; 0.357
2.5. Neuroticism		
Path c	0.299 (0.180)	-0.054; 0.653
Path c'	0.120 (0.196)	-0.265; 0.505
Present Hedonist (a_1b_1)	-0.029 (0.037)	-0.106; 0.042
Past Negative (a_2b_2)	0.149 (0.104)	-0.051; 0.350

	Anticipation (a_3b_3)*	-0.096 (0.040)	-0.189; -0.029
	Temporal rupture (a_4b_4)*	0.156 (0.055)	0.060; 0.276

Note. Pairwise comparisons in italics. * 95% confidence interval does not contain zero. BSE = Boot standard error. LLCI= lower level confidence interval. ULCI = upper level confidence interval.

Table 2.5. Paths *a* and Paths *b* for four multiple parallel mediator models controlling for sex, age, and place of residency (*N*=867): personality traits and temporalities

	Path a_1	Path a_2	Path a_3	Path a_4	Path b_1	Path b_2	Path b_3	Path b_4
E	0.159	-0.175	-0.093	0.038	1.165	0.682	-0.524	1.313
	(0.020) *	(0.030) *	(0.030) *	(0.037)	(0.293) *	(0.193) *	(0.185) *	(0.151) *
A	-0.006	-0.338	-0.023	-0.120	1.699	0.318	-0.494	1.307
	(0.032)	(0.045) *	(0.047)	(0.056) *	(0.285) *	(0.195)	(0.188) *	(0.154) *
C	-0.196	-0.332	0.460	-0.262	1.660	0.310	-0.404	1.298
	(0.028) *	(0.040) *	(0.039) *	(0.049) *	(0.284) *	(0.199)	(0.205) *	(0.154) *
O	0.147	-0.044	-0.094	0.039	1.659	0.388	-0.502	1.316
	(0.028)	(0.041)	(0.041) *	(0.049)	(0.289) *	(0.190) *	(0.189) *	(0.154) *
N	-0.017	0.472	0.187	0.119	1.697	0.316	-0.516	1.310
	(0.022)	(0.027) *	(0.031) *	(0.038) *	(0.287) *	(0.220)	(0.190) *	(0.154) *

Note. Path 1 = Present Hedonist. Path 2 = Past Negative. Path 3 = Anticipation. Path 4 = Temporal Rupture. E = Extraversion. A= Agreeableness. C = Conscientiousness. O = Openness. N = Neuroticism. Unstandardized beta coefficients. Standard Error in parentheses. * *p*< 0.05.

4. Discussion

Over three sets of analyses, we investigated relationships between personality traits, temporalities, and alcohol consumption behaviors among college students living in France or in Québec. First, bivariate associations between personality traits and temporalities were studied using correlational analyses. Correlations between these determinants and alcohol consumption were also provided in order to retrospectively appreciate differences between the conclusions drawn from different analytical techniques (correlation, regression with controls, and parallel mediation with controls). Secondly, three regressions were run which each controlled for age, sex and place of residency in a first step. Out of these control variables, only sex significantly predicted AUDIT scores and unsurprisingly, being male was associated with heightened alcohol

consumption. The first regression entered the five ZTPI dimensions as predictors, whereas in the second, TCT-5D scores took the place of ZTPI dimensions. The first regression showed that only past negative, future and present hedonist time perspectives were associated with alcohol consumption, whereas the second showed that only anticipation and temporal rupture were significantly associated with this outcome. These five temporalities were used as predictors in a third regression.   All scales, except ZTPI future, continued to significantly predict alcohol consumption while accounting for common variance and control variables. ZTPI future was excluded from subsequent analyses. Lastly a series of five multiple parallel mediator models were elaborated in which one personality trait predicted alcohol consumption through the four parallel temporal mediators, while controlling for age, sex and state of residency. Every personality trait was indirectly associated with alcohol consumption, and each temporality was a significant mediator of at least one these indirect relationships.

4.1. Temporality and personality: Comparing the ZTPI and TCT-5D dimensions

In order to further contribute to the validity of the TCT-5D, we studied to what point TCT-5D dimensions were related to personality traits and also provided parallel analyses with the ZTPI for the purpose of comparison. Interestingly, the past and full present dimensions of the TCT-5D had the same correlation pattern with traits. People who are extraverted, agreeable, open, conscientious and emotionally stability would also have high past competency and live fully in the present. Even if these two temporalities were not significantly associated with alcohol consumption in any analyses, they may be clinically pertinent in regards to other behaviors. For example, this personality "profile" has been associated with outcomes in meta-analyses, including heightened overall well-being, satisfaction with life and happiness (DeNeve & Cooper, 1998), as well as less post-traumatic stress disorder and major depressive disorder

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(Kotov, Gamez, Schmidt, & Watson, 2010). Further studies could take into account a wider range of outcomes in order extend the validity of the TCT-5D full present and past scales.

Taking breaks from the linearity of passing time was mainly associated with undirectedness and neuroticism, whereas the opposite was true for anticipation. Interestingly, anticipation was also related with introversion and closedness, though the associations were weak. Also, anticipation and ZTPI future both expectedly converged with conscientiousness. Concerns regarding the discriminate validity between conscientiousness and future perspective (Mello, Worrell, & Buhl, 2016) were somewhat apparent in our study because future correlated much more strongly with this trait than any others. With the anticipation dimension however, the correlation with conscientiousness was weaker and anticipation was correlated with other traits, suggesting that it may be transcribing more than merely consciousness under a different label. We found one possible redundancy between temporality scales in relationship to traits: TCT-5D uncertain future and ZTPI present fatalist scales showed a nearly identical correlation pattern. Nevertheless, contrary to the present fatalism construct, the uncertain future items did not explicitly state that one disinvests in present experience because of future uncertainty. Uncertain future merely states that the person views the distant future as unpredictable and unknown, rather than foreseeable (Loose et al., annex 3). As these two temporalities were associated with nearly the same trait pattern, the uncertainty aspect may be sufficient in tapping fatalist disengagement in the present as described by Zimbardo and Boyd (1999).

4.2. Temporalities as determinants of alcohol consumption

All ZTPI dimensions were associated with alcohol consumption in correlation analyses. However, once having accounted for common variance, the direction of the association and control variables, only present hedonism, future and past negative time perspectives were

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significantly associated with alcohol consumption. The findings concerning present hedonism

and future were expected and have been found in multiple previous works (Keough et al., 1999;

Loose, Acier, Pilet, et al., 2017). Tending towards immediate pleasures with little regards for the

consequences would be associated with alcohol consumption, whereas working towards future

objectives would be a protective factor. Past negative TP was also associated with alcohol

consumption independently of sex, age and residency. This has been observed beforehand

among French young people (Loose, Acier, Pilet, et al., 2017) and may relate to cultural

differences as negative temporal profile was more prevalent among the French (Sircova et al.,

2015). Another explanation could be that the negative affectivity tied onto past negative TP

(Zimbardo & Boyd, 1999) may lead people to drink alcohol in order to cope with negative affect

(Cooper, 1994). Other works will investigate if past negative time perspective leads to coping

drinking motives which in turn lead to problematic alcohol use.

When the TCT-5D dimensions took the place of ZTPI scores, additional variance alcohol

consumption was explained (12% versus 14%), which could suggest that TCT-5D temporalities

explain addictive behaviors slightly better than the ZTPI. As discussed earlier, TCT-5D full

present and past were unrelated to alcohol consumption.   There was a correlation between

uncertain future and alcohol consumption, but the relationship disappeared in regression.

However, anticipation was related to alcohol consumption and also tapped a temporal construct

that entailed a future projection, but with exclusively concrete (not abstract) goals and with a

shorter temporal extension (1 year). Incrementally working towards valued goals has been

highlighted as a key protective factor, especially when alternative activities replace or conflict

with alcohol consumption (e.g. Cox & Klinger, 1988).

Among TCT-5D scales, temporal rupture was the best predictor of alcohol consumption.

This is unsurprising in that this scale related to taking breaks by from the linearity of passing time

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specifically by means of consumption behaviors. Temporal ruptures may serve as a coping mechanism destined to psychologically unhook with negative affect or feelings of boredom provoked by routine daily life (Loose et al., annex 3). As suggested with the past negative dimension, it would be interesting to investigate if coping drinking motives mediate the relationship between temporal rupture and alcohol consumption. Additionally, boredom could also provoke a desire to unhook from daily life, which might provoke enhancement drinking motives. Nevertheless, further study would be necessary in order to investigate these hypotheses.

ZTPI future surprisingly became a non-significant predictor of alcohol consumption in the third regression analysis that entered in this temporality alongside anticipation, present hedonist, temporal rupture, and past negative. The variance explained in Audit scores by the future scale was likely stamped out by shared variance with other factors. As the anticipation scale was conceptually similar to the future scale and as their convergent validity has been demonstrated (Loose et al., annex 3), this scale would be the most likely culprit. Nevertheless, this last regression explained more variance (18%) than the previous two, suggesting that a combination of temporalities from different instruments better explained substance use than necessarily taking into account all of the scales from any individual model. Our findings could advance the extent literature exploring the evasive relationship between temporalities and addictive behaviors.

4.3. Indirect effects of traits on alcohol consumption through temporalities

The last set of analyses pertained to indirect effects of traits on alcohol consumption through the multiple parallel mediators of temporalities. The analytical technique we employed (Hayes, 2013; Zhao, Lynch, & Chen, 2010) yielded different results than would the causal steps approach (Baron & Kenny, 1986) in many useful ways. First, our analyses used regression analyses with controls, rather than bivariate correlations. Secondly, because we accounted for

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indirect only mediation, we did not discard openness and neuroticism as viable distal factors, and indirect only mediation was observed. Thirdly, cases of competitive mediation were identified which would stamp out direct effects. We also used bootstrapping of indirect effects instead of the Sobell test and were able to compare the effect sizes of indirect effects. The following paragraphs detail direct associations between traits and alcohol consumption, as well as indirect relationships through four parallel mediators (present hedonist, past negative, temporal rupture and anticipation) once having controlled for age, place of residency and age in a first step.

Overall extraversion led to heightened alcohol consumption, but when examining indirect effects, it appeared that the trait could either be considered a risk factor or a protective factor as a function of the temporality that emerged. More specifically, extraversion led to high present hedonism and low anticipation, which were vulnerability factors in regards to alcohol consumption. However, extraversion was also associated with depleted scores on past negative, which was a protective factor in regards to consumption behavior. Those who are introverted may tend to have many negative past memories spring to mind, which might motivate them to cope with negative affect by means of alcohol use. With clients who score high on extraversion, clinicians may be advised to help them foresee the short-term consequences of their behaviors, and to find ways of deriving pleasure other than by means of substance use (e.g. sports).

As found across 24 studies (Malouff et al., 2007), agreeableness alone was a protective factor guarding against alcohol consumption. This direct effect was partially accounted for by temporal rupture such that people who are disagreeable would be more inclined to take breaks from temporal linearity by alcohol use. When clients are particularly antagonist, irritable, critical or unfriendly (Costa & McCrae, 1992), coping with daily annoyances by provoking temporal ruptures may be a particularly attractive solution. Clinicians could be attentive to how these clients break up the linearity of time by means of consumption behaviors.

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Conscientiousness was a purely protective factor in relationship to alcohol consumption and led directly to lessened alcohol consumption. However, the direct effect completely disappeared once temporalities were taken into the equation, suggesting that the relationship was fully mediated by temporalities. Those who are described as negligent, lazy, disorganized, late, aimless or quitting (Costa & McCrae, 1992) would be more likely to consume alcohol because they would be attracted to immediate pleasures with little regards for the consequences or would engage in consumption behaviors in order to unhook from the burden of time's linearity.

Openness and neuroticism were only related to alcohol consumption through temporalities i.e. indirect only mediation was observed (Hayes, 2013). Those who are open to experience would tend to engage in more present hedonist activity and less in short term goal orientated behavior, and this would render openness a vulnerability factor in regards to alcohol consumption. Neuroticism on the other hand could be both a protective and vulnerability factor as a function of its association with temporalities (rupture, anticipation). Endorsing items such as "I'm the kind of person who tries to anticipate everything" could stem from trait anxiety or a tendency to worry and would protect individuals against alcohol consumption. Anxiety related constructs can be considered either a risk factor or a protective factor in regards to alcohol consumption (Loose & Acier, 2017). However, emotional instability also includes aspects like negative emotionality and a derogatory image of self (Costa & McCrae, 1992), which may lead individuals to unhook from identity and time by means of consumption behaviors.

4.4. Limitations

This study was limited by its use of self-report measures and by the opportunistic sampling procedure used. Social desirability could have impacted results but was not measured. We made the choice to include only the most pertinent temporalities, but other temporalities

included in this study may still be viable determinants of addictive behaviors (e.g. ZTPI future). Similarly, temporalities excluded from our study might be better than those that we chose to include. Further works would be necessary in order to determine how well other dimensions of temporalities are associated with alcohol consumption. Lastly, our findings may not be generalized outside of francophone college students aged 18-29 years old living in France or in Québec, Canada.

4.5. Implications

Temporalities could be a useful conceptualization inter-individual differences that are more malleable because they are grounded in both aspects of personality and of the situation. Each TCT-5D dimension exhibited a unique correlation pattern with personality traits, except past and full present. This was fascinating in that the two dimensions were conceptually distinct (past versus present). These two dimensions were not related to alcohol consumption, but the trait pattern has been associated with other well-being outcomes in other works. Fully engaging in the present and using the past as a source of learning would go hand in hand, and could lead to an upward spiral between the past and present as time moves forward. As these dimensions were not associated with alcohol consumption, further works could investigate relationships with other outcomes not included in this study such as wellbeing or resiliency for example. Again, this finding supported the hypothesis that specific temporalities would be associated with specific behaviors.

Temporalities and personality traits were determinants of alcohol consumption among francophone college students independently of sex, place of residency and age. However, this blanket statement merits nuance and it was beneficial to take into account specificities of direct and indirect relationships using different analytical techniques. For example, when looking at

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bivariate relationships between temporalities and alcohol consumption, all ZTPI scales appeared to be meaningful determinants. Once we accounted common variance between ZTPI scales, two significant associations vanished, and once we added in TCT-5D dimension, another effect became non-significant. Researchers could be attentive to such analytical differences interpreting literature on temporalities. Furthermore, combining multiple measures of temporality was useful and further research could extend findings by including supplementary measures.

Using analyses of mediation, we revealed that some traits would be associated with alcohol consumption, in whole or in part, because they develop into specific temporalities. Among minors for example personality traits can be viewed as important vulnerability factors that would influence drinking behavior over time when they give way to more proximal factors (i.e. temporality). Psychologists could observe baseline levels of personality traits among their young clients and monitor how these traits develop into temporalities. As temporalities were a more proximal determinant of alcohol consumption and as they are more malleable than personality traits, clinicians may be advised to act on the level of temporality instead of on that of traits. If subsequent research on the topic of temporalities and alcohol use is promising, we could eventually develop intervention techniques that target temporalities specifically in order to positively impact alcohol consumption behaviors among young people.

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CHAPTER 3

Interrelationships between temporalities, motivations and alcohol consumption among francophone college students

1. Introduction

College students notoriously engage in alcohol consumption behaviors. In fact, some prospective students reported being motivated to enroll in under-graduate programs because they wanted to attend college parties (Sher & Rutledge, 2007). Through young adulthood, some students unfortunately develop problems stemming from frequent or heavy alcohol consumption, while others naturally grow-out of problematic alcohol use as adulthood responsibilities accumulate (Ham & Hope, 2003). Understanding the determinants of problematic alcohol use and their interactions would allow public health services and practitioners to better foresee among which students problems will be likely to develop or aggravate. This knowledge could help healthcare professionals act before serious problems develop or afterwards, using effective techniques adapted to individual trajectories and needs.

Determinants however are not all created equal: They interact in multilevel frameworks and some determinants explain alcohol consumption better than others. Those that explain the most variance in alcohol consumption are among the "proximal" determinants, while "distal" determinants explain little variance and exert their influence through more proximal factors (Cox & Klinger, 1988). Among distal determinants we find factors related to stable inter-individual characteristics (e.g. personality traits) whereas determinants that are less stable and more reliant on current or situational factors are figured among proximal determinants (e.g. drinking motives). As frameworks like that of Cox and Klinger figure determinants on multiple levels, determinants

can be thought of as ranging on a continuum, wherein diachronic historic factors shape and give way to synchronic situational factors. More specifically, distal factors would all converge in drinking motives, which are thought to be the most proximal predictive factor of alcohol consumption (Kuntsche, Knibbe, Gmel, & Engels, 2005).

Drinking motives have been defined by the source (internal / external) and the valence (positive / negative) of the reinforcement obtained subsequent to alcohol consumption. By crossing the source and valance of reinforcement, a 2 by 2 cross table renders four drinking motives which all have specific relationships with alcohol consumption variables. *Social motives* (positive, external) are the most often endorsed, and consist of drinking on social occasions. They were associated with increased drinking but not with alcohol related problems. *Enhancement motives* (positive, internal) respond to an internal cue and aim to make an experience better by means of alcohol consumption. Cooper (1994) found that they were associated with heavy alcohol consumption. *Conformity motives* (negative, external)refer to drinking in order to avoid social rejection and were associated with infrequent alcohol consumption. *Coping motives* (negative, internal) refer to drinking in order to reduce negative affect and have led directly to problems and heavy use (Cooper, 1994). More recently it was suggested to split coping motives according to the specific affect they were destined to reduce (anxiety / depression)(Grant, Stewart, O'Connor, Blackwell, & Conrod, 2007). However, coping anxiety motives have been positively, negatively and unrelated to alcohol, and the validity of coping anxiety motives has been called into question (Grant et al., 2007; Loose & Acier, 2017; Mezquita et al., 2011). Many studies have supported that drinking motives mediate the relationship between distal factors and drinking behaviors, such as big 5 personality traits (e.g. Mezquita, Stewart, & Ruipérez, 2010), sensation seeking (e.g. Read, Wood, Kahler, Maddock,

&Palfai, 2003), attachment styles (McNally, Palfai, Levine, & Moore, 2003) or alexithymia (Bruce, Curren, & Williams, 2012). However, this list of examples is far from exhaustive.

Recent research has investigated relationships between "time perspective" and alcohol consumption. Time perspective (TP) refers to the categorization of experience into temporal frames: past, present and future, as well as certain associated cognitions or emotions. *Past negative* refers to recalling negative experiences from the past whereas *Past Positive* refers to positive ones. *Present Fatalism* refers to disengaging from action in the present because one thinks efforts would be futile. *Present hedonism* refers to engaging in pleasurable experiences with little regards for the consequences. *Future* refers to working towards delayed rewards or future goals (Zimbardo & Boyd, 1999). Among TPs, Present hedonism followed by future would be the most in line with addictive behaviors (Keough, Zimbardo, & Boyd, 1999). TP is described as a situational-motivational and dispositional-personality construct, which has led some authors to describe its status as "two-fold." In 2015, the very "nature" of TP was still undergoing debate (Kairys & Liniauskaite, 2015). TP has been described by some as a cognitive motivational construct (Mello & Worrell, 2015), somewhere between a stable disposition and a malleable characteristic. One hypothesis could be that the action of time perspectives, like personality traits, would operate through more proximal mediators (Loose, Robiou-du-pont, Acier, & El-Baalbaki, annex 2). If motives are indeed the most proximal determinant of drinking behaviors, and if time perspective indirectly impacts alcohol consumption, the action of TP would necessarily be through drinking motives.

However even if these dimensions of TP have performed well in predicting a wide variety of outcomes (Zimbardo & Boyd, 2008), findings have been particularly weak or inconsistent regarding addictive behaviors (Loose et al., 2017; McKay, Perry, Cole, & Worrell, 2017). This in part led researchers to create a questionnaire that tapped different aspects of temporality that

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would supposedly be better associated with addictive behaviors among young people (Loose, Acier, Deledalle, & El-Baalbaki, annex 3). The TCT-5D outlined the five following dimensions: *Anticipation*: foreseeing short-term events and adapting accordingly. *Temporal rupture*: disconnecting from the linearity of passing time by means of addictive behaviors in order to avoid a psychological overload. *Full present*: being fully engaged in present experience. *Past:* learning from experience when moving forward. *Uncertain future:* believing that it is impossible to know what the future holds. Relationships between these temporalities and alcohol consumption were presented in chapter 2. Among TCT-5D dimensions, low anticipation and high temporal rupture were the most related to high alcohol consumption.

As clinical observations suggest that a specific set of temporalities would be pertinent for a specific client (Kazakina, 2015), it could follow that specific temporalities are pertinent to specific clinical issues. As not all TPs seem to be related to addictive behaviors (McKay et al., 2017), a combination of temporalities incorporated into different conceptions may explain alcohol consumption better than anyone conception. Concerning temporalities that are conceptually similar (e.g. future, anticipation), it would be useful to limit redundancy by only including the most pertinent temporalities in regards to addictive behaviors. As seen in chapter 2, four temporalities issued from different measures were the best related to addictive behaviors: temporal rupture, anticipation, present hedonist, and past negative. Furthermore, as the relationship between temporalities and alcohol consumption would be mediated by drinking motives, it would be advisable see if that is actually the case, and if so, in what way these variables operate together. We aimed to use the four selected temporal indicators from chapter 2 as distal factors predicting to alcohol consumption through the multiple parallel mediators of drinking motives. As no studies have explicitly investigated if drinking motives mediate the

relationship between temporalities and alcohol consumption, this study remained largely exploratory.

Nevertheless, relationships between substance use, drinking motives and forward projections in time have previously studied. Indeed, "goals are by their nature are related to time" (Zaleski & Przepiórka, 2015, p. 327). This is conceptually similar to the ZTPI future dimension or TCT-5D anticipation. A study found that social, enhancement or coping drinking motives mediated the relationship between life goals and problematic alcohol use (Lecci, MacLean, & Croteau, 2002). Others found that enhancement motives mediated the relationship between lack of meaningful life goals and alcohol use (Palfai, Ralston, & Wright, 2011). Unfortunately, none of these studies explicitly studied temporality, and when this association was implicitly present, no time zones other than the future, opposed to the present, were (conceptually) included. We aimed to extend findings in order to incorporate other temporalities such as those figured in the ZTPI and the TCT-5D. More specifically, we aimed to 1) identify and use the most pertinent temporal and motivational determinants of alcohol consumption while avoiding redundancy, and 2) explore indirect effects of temporalities on alcohol consumption through drinking motives. Throughout these analyses, we partitioned out variance due to participant age, sex and place of residency (France, Québec).

2. Methods

2.1. Population and procedure

This study re-analyzed the data of 867 participants from France and Québec. The procedure for questionnaire administration and characteristics of our sample were described in length in chapter 1.

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2.2. Measures

The *Alcohol Use Disorders Identification Test* was used to measure alcohol consumption, as described in chapter 1.

The *Modified Drinking Motives Questionnaire Revised* was used to measure drinking motives, as described in chapter 1.

The *Temporal Competency Test 5D* was used to measure temporal competency, as described in chapter 2.

The *Zimbardo Time Perspective Inventory* was used to measure Time Perspective, as described in chapter 2.

2.3. Overview of statistical analyses

We first conducted analyses in order to choose the best temporal and motivational constructs to include in mediational analyses, and then we carried out multiple parallel mediator models including the selected factors. First, by drawing on results from chapter 2, we determined that four temporalities were the most well related alcohol consumption among studied dimensions: Anticipation, past negative, temporal rupture and present hedonism. Next, we investigated if any drinking motives did not significantly predict alcohol use, notably because the clinical pertinence of coping anxiety motives has been called into question (Loose & Acier, 2017). Furthermore, if a proximal factor does not predict an outcome, the indirect effect would not be significant. Lastly, we carried out four different multiple parallel mediator models to explore indirect effects of temporality on alcohol consumption through drinking motives while controlling for sex, age and place of residency.

3. Results

We aimed to elaborate four multiple parallel mediator models using PROCESS (model 4) in which one temporal dimension (X) predicted alcohol consumption (Y) through the multiple parallel mediators of drinking motives (M_i) while controlling for age, sex and state of residency (C). Once having partitioned out variance due to control variables in a first step : 1) Path a refers to a regression in which X predicts M_i. 2) Path b refers to the effect of M_i on Y while holding X constant. 3) Path c refers to a regression in which X predicts Y. 4) Path c' refers to the residual effect of X on Y once having added all the mediators into the model (Hayes, 2013). Full mediation occurs when path c is significant but path c' is not. Partial mediation is observed when path c' is less significant or strong in comparison to path c (Baron & Kenny, 1986). Indirect only mediation refers to cases where indirect effects are significant, but path c is not. Competitive mediation refers to cases where at least two significant parallel indirect effects have a different sign and thus stamp out the direct effect, whereas complementary mediation entails parallel mediators with the same sign (Zhao, Lynch, & Chen, 2010).

In order for mediation to have occurred, one of the conditions is that path b must be significant, meaning that the motive (M) must predict alcohol use (Y) while holding the temporality (X) and control variables constant. If M_i does not predict Y, it would be unlikely or odd that M_i would predict Y when controlling for X. Furthermore, any such M_i would dilute our mediational model without providing much useful information. Thus, we decided to weed out any M_i that fell under these conditions before moving along with analyses of mediation. In order to do so, we carried out a hierarchical regression in which drinking motives predicted alcohol consumption while controlling for age, sex and state of residency. This configuration explained 33% of variance in Audit scores (table 3.1). As suspected, coping anxiety did not predict

drinking behaviors and for the reasons cited above, we consequently decided to discard the variable from the subsequent analyses.

Table 3.1. Regression with drinking motives as predictors of alcohol consumption while controlling for sex, age and residency in a first step. Only step 2 is shown.

	B	*SE B*	*β*	*t*	*p*	Adjusted R^2	ΔR^2
Constant	77.881	102.088		0.763	0.446	0.329	0.323
Sex	0.673	0.306	0.062	2.197	0.028		
Age	-0.039	0.051	-0.024	-0.760	0.448		
Residency	-0.069	0.288	-0.007	-0.239	0.811		
Social	6.097	1.126	0.215	5.414	<0.001		
Coping anxiety	0.705	1.109	0.027	0.636	0.525		
Enhancement	6.843	0.954	0.287	7.177	<0.001		
Coping depression	6.899	1.248	0.206	5.526	<0.001		
Conformity	-2.404	1.120	-0.069	-2.148	0.032		

Note. SE = Standard Error.

As seen in chapter two, three regressions were carried out in which different aspects of temporality predicted alcohol consumption independently of age, sex and residency : 1) Among ZTPI scales, future, past negative and present hedonist dimensions were significant predictors. 2) Among TCT-5D scales, anticipation, uncertain future and temporal rupture were significant predictors. 3) When these five temporalities were entered in side by side as predictors of alcohol consumption, they all continued to independently predict alcohol use, with one exception: the ZTPI future perspective. As in chapter 2, we decided to discard future perspective from subsequent analyses of mediation in order avoid redundancy.

This concluded our selection of determinants. We retained present hedonist, temporal rupture, anticipation, past negative (*X*), and all motives except coping anxiety (M_{1-4}). Four multiple parallel mediator analyses were carried out using the configuration described above (one for each *X*). The indirect effect, path *a*× path *b,* was calculated using 20,000 bootstrapped

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samples and 95% confidence intervals corrected for bias because parametric techniques assume

that the product $a{\times}b$ is normally distributed. We also provided bootstrapped effects for path c

and c' in order to enhance comparability and statistical precision. Path c, path c' and the indirect

effects of X on Y through M_{1-5} ($a_i \times b_i$) are figured in table 3.2. Regression coefficients for paths a

and paths b are figured in table 3.3.

Table 3.2. Indirect effects of temporality on alcohol use through drinking motives controlling for sex, age and place of residency

	Coefficient (BSE)	LLCI; ULCI	Coefficient (BSE)	LLCI; ULCI
3.2.1. Present hedonism			**3.2.2. Rupture**	
Total effect (c)	2.57 (0.27)	2.04; 3.10 *	1.64 (0.15)	1.34 ;1.94 *
Direct effect (c')	1.40 (0.24)	0.94; 1.87 *	0.53 (0.15)	0.24; 0.82 *
Social (a_1b_1)	0.34 (0.08)	0.21; 0.51 *	0.32 (0.06)	0.20; 0.44 *
Enhancement (a_2b_2)	0.53 (0.10)	0.34; 0.75 *	0.52 (0.09)	0.36; 0.71*
Coping Depression (a_3b_3)	0.32 (0.10)	0.16; 0.56 *	0.30 (0.08)	0.16; 0.49*
Conformity (a_4b_4)	-0.02 (0.02)	-0.08; 0.01	-0.02 (0.02)	-0.07; 0.00
Social-enhancement	-0.19 (0.13)	-0.46; 0.06	-0.20 (0.12)	-0.46; 0.03
Social-coping depression	0.02 (0.12)	-0.24; 0.25	0.01 (0.10)	-0.21; 0.20
Enhancement-coping depression	0.21 (0.14)	-0.06; 0.48	0.21 (0.12)	-0.03; 0.46
3.2.3. Past Negative			**3.2.4. Anticipation**	
Total effect (c)	0.87 (0.19)	0.49 1.25 *	-0.90 (0.19)	-1.28; -.52 *
Direct effect (c')	0.29 (0.18)	-0.06; 0.63	-0.58 (0.16)	-0.90; -0.26 *
Social (a_1b_1)	0.15 (0.05)	0.06; 0.26 *	-0.06 (0.04)	-0.15; 0.02
Enhancement (a_2b_2)	0.10 (0.06)	-0.01; 0.23	-0.23 (0.06)	-0.37; -0.13 *
Coping Depression (a_3b_3)	0.42 (0.11)	0.22; 0.65 *	-0.01 (0.04)	-0.10; 0.07
Conformity (a_4b_4)	-0.08 (0.04)	-0.18; -0.01 *	-0.02 (0.02)	-0.07; 0.00
Social-coping depression	-0.27 (0.12)	-0.51; -0.05 *		

Note. Pairwise contrasts in italics**.** BSE = Boot standard error. Pairwise contrasts in italics. LLCI= lower level confidence interval. ULCI = upper level confidence interval. * 95% bias corrected confidence interval does not contain zero.

Table 3.3. Paths *a* and Paths *b* for four multiple parallel mediator models controlling for sex, age, and place of residency (N=867) : temporalities and drinking motives

	Path a_1	Path a_2	Path a_3	Path a_4	Path b_1	Path b_2	Path b_3	Path b_4
Present Hedonist Temporal Rupture	0.06 (0.01)*	0.08 (0.01)*	0.05 (0.01)*	0.01 (0.01)	5.56 (1.10)*	6.61 (0.90)*	6.59 (1.06)*	-1.89 (1.10)
	0.05 (0.01)*	0.08 (0.01)*	0.05 (0.00)*	0.01 (0.00)*	5.77 (1.11)*	6.37 (0.93)*	6.58 (1.08)*	-2.04 (1.11)
Past Negative	0.02 (0.01)*	0.01 (0.01)	0.06 (0.01)*	0.03 (0.01)*	6.13 (1.11)*	7.20 (0.92)*	6.68 (1.14)*	-2.50 (1.12)*
Anticipation	-0.01 (0.01)	-0.04 (0.01)*	0.00 (0.01)	0.01 (0.01)	6.31 (1.11)*	6.54 (0.92)*	7.47 (1.06)*	-2.13 (1.11)

Note. Path 1 = Social. Path 2 = Enhancement. Path 3 = Coping Depression. Path 4 = Conformity. PH = Present Hedonism. TR= Temporal Rupture. PN = Past Negative. ANT = Anticipation. Unstandardized beta coefficients. Standard Error in parentheses. * $p < 0.05$.

The models involving present hedonism and temporal rupture exhibited similar indirect effects. Both of these perspectives directly (path *c*) and indirectly predicted alcohol consumption independently of control variables. Indirect effects were significant through social, enhancement and coping depression motives, but not through conformity motives. Pairwise contrasts revealed that the size of these indirect effects did not differ in either model (table 3.2.1., table 3.2.2.). Past negative perspective directly led to alcohol consumption (path *c*) but the effect was vanished once all variables were added into the model (path *c'*). The indirect effect of past negative perspective on alcohol consumption was fully mediated by social, coping depression and conformity motives. Coping depression motives explained more of the indirect effect than did social motives. No pairwise comparison could be meaningfully calculated with the conformity scale because the sign of the effect was negative, whereas the others were positive (Hayes, 2013). The high social and coping depression motives associated with past negative perspective both led to inflated alcohol consumption. Past negative also led however to high conformity motives, which in turn led to depleted alcohol consumption. This was case of competitive mediation in that past negative perspective led to either high or low alcohol consumption as a function of the

emergent motivation (table 3.2.3). Anticipation had both a direct and indirect relationship with alcohol consumption. The indirect effect of anticipation through enhancement motives was positive and significant, and led to heightened alcohol consumption. This can be classified as a case of partial complementary mediation (table 3.2.4.).

4. Discussion

Drinking motives mediated the relationship between temporalities, a motivational-dispositional construct, and drinking behaviors independently of sex, age and place of residency. When progressing though life, temporalities would be shaped throughout the classic developmental stages. As age advances and alcohol consumption becomes a possibility, these temporalities would influence in part the reasons that one would be motivated to engage in alcohol consumption behaviors. This exploratory study furthered our understanding of the place of temporality in etiological frameworks of drinking behaviors. Every temporality and every motive explained drinking behaviors in at least one of our mediational analyses. Interestingly, across the four mediational models, we observed full mediation once (past negative) and partial mediation three times (anticipation, temporal rupture, and present hedonist). This dominance of partial mediation suggested that other factors neglected by this study also explained the relationship between temporality and drinking behaviors (Hayes, 2013).

We observed competitive mediation once (past negative), complementary mediation three times, and no cases of indirect only mediation. The case of competitive mediation was the most interesting in that it suggested that past negative perspective would both positively and negatively impact drinking behaviors (positive indirect effect through social and coping depression motives versus negative indirect effect through conformity motives). Those who score high on past negative had higher rates of aggression, depression and anxiety (Zimbardo & Boyd, 1999) which

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could have led people to cope with negative feelings by means of alcohol use. Even if social motives explained less of the indirect effect than did coping depression motives, the pairing of these two parallel mediators was surprising because social motives (positive, external) are conceptually opposite of coping depression motives (negative, internal). Nevertheless, as conformity motives (negative, external) were also associated, the source of reinforcement being external for social motives may be more important than its "approach motive" quality. Those who have high negative perspective may be particularly swayed by social cues (contextual factors) when deciding to consume alcohol. These social triggers would lead people to drink either because they want to enjoy social experiences (social motives) or in order to fit in with the group (conformity motives). The first case would lead to higher rates of alcohol consumption behaviors, whereas the second would lead to lower rates. Both of these temporal-motivational configurations may allude to a vulnerability of the individual when faced with external demands. In other works past negative has been associated with low self-esteem and low emotional stability (Zimbardo & Boyd, 1999).

Anticipation was the only temporal dimension included in mediational analyses that referred to a forward projection into the future. As stated in the introduction, this forward projection was similar to working towards personal goals. Previous works found that coping, social or enhancement motives mediated the relationship between future time related constructs and alcohol consumption (Lecci et al., 2002), whereas we only found one significant indirect effect (through enhancement). We found that those who lack anticipation drank alcohol in part because they wished to spice up their current experience by means of alcohol use. When people do not obtain positive affect from engaging in life goals, they would seek positive affect elsewhere (Palfai et al., 2011). Alternatively, those who score high on anticipation might not engage in enhancement motives because they are able to foresee and avoid short term negative

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consequences of alcohol consumption (e.g. recovering from heavy use) or because they are busy preparing for other upcoming events that are incompatible with alcohol use. Prevention campaigns could benefit from matching the temporal extension of messages with the temporal frame of the target audience (Martinez & Fieulaine, 2015). For example, for those lacking in anticipation that would drink for enhancement motives, a message such as "*trop d'alcool tue l'ivresse*" (too much alcohol kills the high) might be more effective than focusing on how long-term alcohol consumption can lead to illnesses. It would only be useful to talk about long-term consequences of behaviors with people that are able to perceive the long-term consequences in general. Alternatively we could intervene in order to positively impact people's capacity to foresee future consequences and adapt accordingly.

Present hedonism and temporal rupture, the two orientations that did not include temporal projection, had nearly identical relationships with drinking motives. In both cases, the direct effect was positive and significant and path c' remained significant but the effect was weaker. Nevertheless, in comparison to temporal rupture, the effect of present hedonism on alcohol consumption was greater in both path c and c'. Present hedonism also explained more variance than temporal rupture in the regression that entered the four studied temporal determinants (chapter 2). Even if these two dimensions could be seen as redundant because they exhibited nearly identical patterns, the results from this regression also suggested that these temporalities still predicted alcohol use when accounting for their common variance. The indirect effect of these temporalities was positive and significant through coping depression, social and enhancement motives. These are heterogeneous motivational constructs and may suggest a generalization of drinking motives. Studies have found that endorsing a large quantity of motives to drink, whatever they may be, was associated with increased alcohol consumption (Kuntsche et

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al., 2005). Present hedonism and temporal rupture might be better distinguished by other associated factors, more distal in nature, than by drinking motives.

Those who are inclined towards temporal ruptures could drink alcohol in part because they want to take a break from negative feelings (coping motives), use parties as a means to break up weekly routines (social motives) or drink alcohol in order to get drunk and thus fully cut off the linearity of passing time (enhancement motives). As for those who are inclined towards present hedonism, they could drink alcohol because they want to fully enjoy a social occasion (social motives) or hedonistically seek out positive affect in the present (enhancement motives). The association with coping depression motives was more surprising because coping depression deals with alleviating people of negative emotions (Cooper, 1994), whereas present hedonism refers to partaking in "enjoyment and pleasure". However, present hedonism has also been associated with higher rates of impulsivity, depression and aggression (Zimbardo & Boyd, 1999). One hypothesis could be that when present hedonists are feeling down, they are particularly intolerant of negative emotions and impulsively consume alcohol instead of engaging in more adaptive ways of dealing with their problems. They would not take the time to put into place more effective coping strategies that do not render immediate gratification and that would not resolve the initial cause of distress. For example, if a present hedonist was feeling down about getting a bad grade, they may be more inclined to drink alcohol (short term solution) than to study (long term solution).

Though we extended our measure of temporality beyond the ZTPI model, other important temporalities may have been neglected by the present study. It would have been interesting to include some other measures of temporality (e.g. CFC) or all measures of temporality for that matter. Future works could aim to include a wider variety of measures of temporality and use a series of regressions like in the present study in order to determine how specific temporalities

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relate to specific behaviors, including but not limited to addictive behaviors. This would need to be subsequently repeated in independent samples. If ever we wanted to have one integrated model of temporality, we could conduct factorial analyses on all known temporal constructs in order to study dimensionality and hierarchy, as was done when creating the Big 5 model of personality for example. This might be another viable avenue to render more valid and reliable associations between temporalities and (addictive) behaviors. However, note that selecting temporalities as we did provoked a limitation in that there could have been relationships of indirect only mediation that were unjustly discarded prior to investigation.

Several other limitations should be considered when interpreting the results from this study. Our exclusive reliance on self-report measures may have provoked different forms of bias such as socially desirable responses. As this study was largely exploratory, using a purely quantitative data could be another limitation. The mediation analyses were limited by the cross sectional design of the study. Furthermore, even if we controlled for the confounders of age, sex and place of residency, other pertinent factors, such as personality traits, were neglected by our study. As stated earlier, there could have also been temporalities that we did not measure that would have yielded positive results. All omitted but pertinent variables would have acted as "confounders" and may have biased the effects observed. Further works would benefit from taking into account all levels of determinants in order to better respect this assumption of in mediational analyses.

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CHAPTER 4

Food for thought: From parallel to serial mediation in psychosocial research

- When one thing turns into another -

1. Conceptualizing mediation

As children have understood, the question "but why?" can be demanded after any statement. "Look, there's a rainbow!" "Why is there a rainbow dad?" "Because it was raining and then the sun came out." "Why?" "It's a process called refraction…. why don't you go ask your mom?" Researchers who aim to study how an event came into existence can use mediational analyses as they help to quantify the processes by which an event emerges. Any event could be studied, be it the occurrence of the rainbow itself (physics) or predicting when dad will refer the kid to mom (social sciences). Mediation helps us answer questions about why, how, by what processes or by what mechanisms specific events occur. Another example: we know that Tabaco use is associated with cancer. Why? Because Tabaco has chemicals that deform DNA that makes it more likely that these cells will turn cancerous. If Tabaco did not affect DNA in this manner, which then affects cells, cigarettes would not be associated with cancer (Kazdin, 2002). There would be an infinite number of examples of such relationships, especially in psychosocial sciences, because every behavior could hypothetically be explained by the behaviors leading up to it.

In other words, we can apply this logic to relatively straightforward questions such as "Why did the ball drop?" but we can extend the reasoning to abstract or psychosocial questions such as "How did he recover from depression?" or "Why did he develop problematic alcohol use, but she did not? How exactly did that happen?" Some argue that explaining such abstract and

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personal questions could only be done effectively by using an idiographic approach, as we could see in psychoanalysis for example. There is one unique way to explain the behavior of one unique individual. Such explanations are grounded in constructivism, heuristics and complicated theories put into tension with clinical observations. Ultimately, we would need a qualitative theory for every subject, but even if we worked on our theory forever, we would only asymptotically approach a single truth without ever reaching it because of the fundamental alterity between Self and Other. Applying statistics could be seen as useless because they are a gross oversimplification of the human phenomenon.

Alternatively, a nomothetic approach can be applied, wherein we can study the trajectories of a group of people and their relationship with an outcome. Though this may be less precise when considering a specific person, we are able to better generalize findings to others with similar characteristics and prospectively infer their behavior. When certain sequences of determinants are present, we can say that specific events (behaviors) are more or less likely to occur. We can approximate reality by applying advanced statistics to pertinent variables ideally using large representative samples and then attempt to generalize our findings to a group or person. Throughout the last three chapters, we adopted a quantitative approach to mediation. We specifically focused on the outcome of alcohol consumption behaviors and loosely used a framework originally drawn up by Cox and Klinger (1988) that theoretically explained drinking behaviors. We will elaborate and draw on this example throughout this paper, but also refer to other examples for heuristic purposes. In this manner, we hoped that readers would leave with a solid comprehension of our logic enabling them to gain insight into their own fields or interests.

In this chapter, we first looked into how determinants were figured into etiological frameworks by drawing on the example of the processes leading up to alcohol consumption. Next, we defined sequential "intermediary" factors, ranging from proximal to distal, and study

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parallel mediators operating within the same level. Then, recent advances statistical mediational analyses were explained and applied to the topic at hand. In part four, we compiled the results from the three previous chapters of this thesis in order to create a pattern matrix of positive results. In part five, we proposed a categorization of serial mediational relationships by applying four logical assumptions to the result matrix in order to generate hypotheses grounded in forms of sufficient or insufficient logic. From this, we drew up a hypothesis matrix and tested serial mediational effects. We proposed two forms of serial indirect only mediation wherein we must include all factors in the serial chain in order for a part of the chain to yield positive results. As this was novel, rendered numerous positive results and could seem odd to readers, we took the time to review pertinent results from previous chapters in order to understand significant effects. We then reflected on the assumptions of mediational analyses in regards the results of this study and more generally, in the context of psychosocial studies that attempt to infer mediation.   This fueled our 9th part, wherein we considered the complexity of mediational analyses in science more broadly. Lastly, we looked into the future and into the past, and proposed some higher order abstractions and extensions of our findings. As this study was conceptual and exploratory, we aimed to provide the reader with interesting avenues for reflection, rather than drawing any definitive conclusions. This chapter also served as a quantification of some of the limitations of chapters one to three.

2. Determinants in etiological frameworks

If we want to figure out why people drink (or whatever outcome/event/behavior), we should start by choosing pertinent determinants. However, an enormous number of determinants have been cited in the literature, as is the case with most every outcome. This is arguably due to the inherent complexity of measuring and predicting psychosocial events (e.g. as opposed to

physics). For example, among determinants of alcohol consumption, we find genetic

predispositions, sex, age, culture, family history, alcohol regulations, personality traits, alcohol

availability, but the list could go on and on (potentially indefinitely). To say the least, it is

complicated.

Because we cannot feasibly take everything into account, whatever determinants we do

choose will only tell part of the story ; not all of the variance in the outcome will be explained.

Choosing determinants that were related in previous studies, or that have been theorized as such,

renders positive results more probable and allows comparison with previous studies. In order to

apply the methodology that will be proposed in this paper, researchers must review and select

several levels of determinants that can be sequentially ordered within an etiological framework.

Within each level of determinants, several dimensions should be figured.

In chapter 1, we started out in a confirmatory manner by studying a relatively well-known

indirect relationship wherein personality traits led to alcohol use through drinking motives. Based

on previous findings and chapter 1, we obtained part of the processes leading up to drinking

behaviors wherein traits=>motives=>alcohol use. Again, multiple studies have already supported

that this theory-based sequencing (trait, motive, alcohol) yields positive results to the point that

we could consider this ordering reliable, consensual and assume that the sequencing is correct.

Historical "distal" factors such as personality traits give way to current "proximal" factors such

as drinking motives, the later theorized to be *the* most proximal predictive factor of alcohol

consumption (figure 4.1). Researchers should not haphazardly include determinants as

"mediators" when there is no theoretical basis to do so (Hayes, 2013).

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Figure 4.1. Schema of processes leading up to alcohol use by Kuntsche et al. (2005)
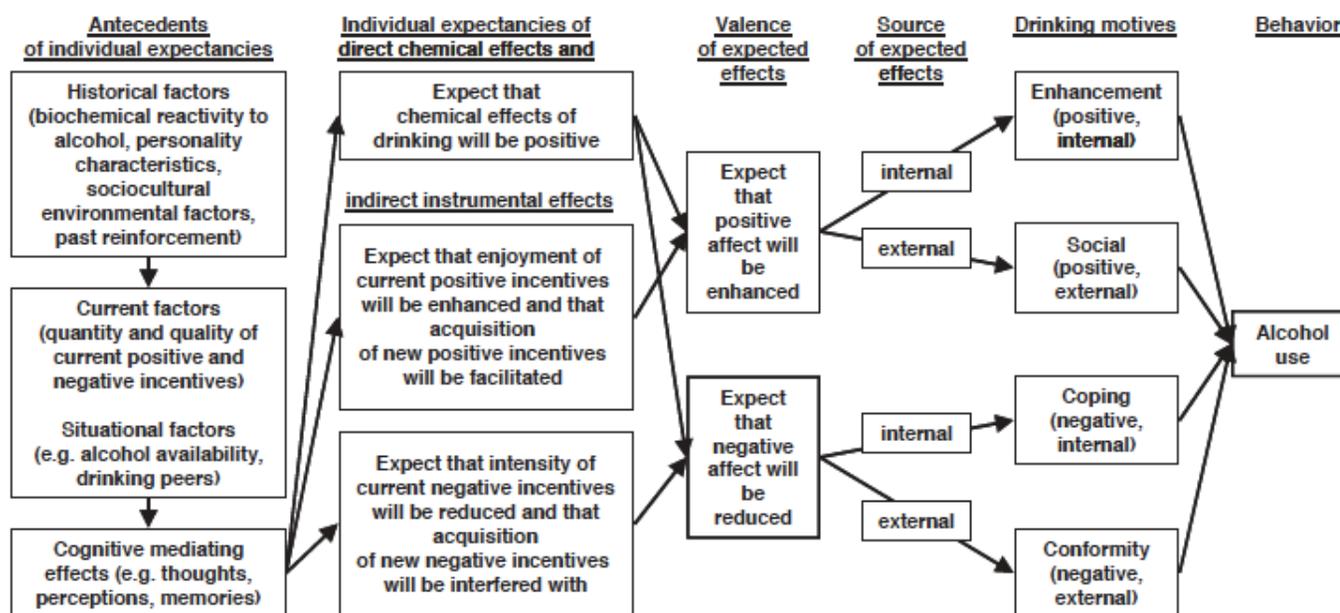
Fig. 1. Antecedents, alcohol expectancies, drinking motives, and alcohol use according to assumptions of the motivational model (Cooper, 1994; Cox & Klinger, 1988, 1990).

Theoretical frameworks, such as Cox and Klinger's, can also help us conceptualize the sequential place of determinants between two poles (distal, proximal). Alone, distal factors explain little variance as their action on the outcome is exerted through "more proximal" mediators, not just *the most* proximal. There are indeed other factors figured between these two extreme poles, such as the current incentives, alcohol availability or beliefs about the effects of alcohol, which could be all be classified as "intermediary" or "more proximal" determinants. Nevertheless, as these intermediary factors are figured on different levels ranging from proximal to distal, they could be thought of as lying on a continuum leading up to the outcome, rather than simply "intermediary". For example, it can be helpful to refer to levels *A, B, C, D, E...k* rather than simply calling factors "intermediary". Within every level, there would be multiple parallel levels of determinants. In other words, we have several vertical (parallel) and horizontal (sequential) levels leading up to an outcome.

As research must move forward, instead of only focusing on the most well-known levels, one can also take interest in understudied determinants that have not yet been placed into etiological models. With this goal in mind, we included a determinant that was not figured into our reference framework. Others could also use existing frameworks in order to situate a little-known determinant among other more often studied determinants. In clinical research on alcohol use, one such variable is temporality. Studies suggest that temporality would be associated to drinking behaviors, but the mechanism by which the relationship operates remains questionable. Temporality has been described as a situational-dispositional construct, or "two fold". Some researchers have theorized about how personality traits would form temporalities (Kairys & Liniauskaite, 2015), whereas others theorized that temporality would give rise to motivation (Mello & Worrell, 2015). When we take these standpoints collectively, we can ground the

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hypothesis that traits form temporalities that form (drinking) motives that form (drinking) behaviors, in that order. This hypothesis could even be considered overly grounded because if motives are *the most* proximal, and personality traits are among the most distal, almost any other related mediator would have to be situated somewhere in-between.

3. Advances in mediation

Since 1986, when Baron and Kenny's causal steps approach was introduced, mediation analyses have undergone major developments. The causal steps approach provides a triangle shaped framework for testing the hypothesis that X (distal factor) leads to Y (outcome) because of M (mediator) (figure 4.2.). The sides of the triangle relate to path *a, b, c* and *c'*. Path *a* refers to the direct effect of X on M. Path *b* refers to the effect of M on Y while holding X constant. Path *c* refers to the effect of X on Y, and path *c'* refers to the residual effect of X on Y when M is held constant. Mediation is said to occur when path *a, b,* and *c* are significant, and when path *c'* is weaker or less significant than path *c*. Unfortunately, many researchers are still hanging onto these old conditions for mediation despite the fact that others have shown that they have important limitations. As we will only be able to address some of these issues, readers can refer to Zhao, Lynch and Chen (2010) or Hayes (2013) for a more complete discussion of limitations and rectifications. Incorporating these advancements, Hayes also developed an ergonomic macro called PROCESS, which is allows researchers to carry out mediational analyses within a myriad of new frameworks. The statistics described in this paper can all be done using the PROCESS macro v2 run on SPSS, SAS or MPlus.

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Figure 4.2. Causal Steps approach to mediation
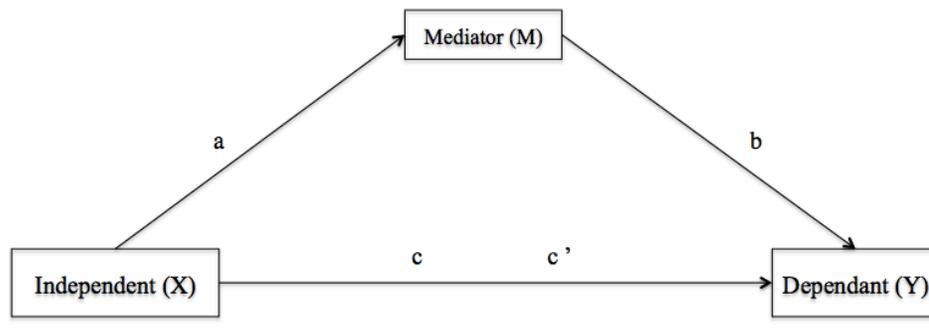
A first limitation was that Baron and Kenny incorrectly theorized that there must be an "effect to be mediated" in order for mediation to have occurred, meaning that X must predict Y alone, i.e. path c must be significant. More recently, researchers figured out that even if X does not predict Y, X could predict M and M could predict Y when holding X constant. This relationship was dubbed "indirect only" mediation. Another important set of limitations stemmed from the fact that there was only one X, M, and Y in the causal steps framework. In reality, there could also be several dimensions of X (e.g. Big 5 personality traits) and many M variables operating together in parallel or in serial. For example, there are four drinking motives (M_{1-4}), meaning multiple dimensions of the same construct operating in parallel as mediators on the same level, situated between personality (X) and behavior (Y) (Figure 4.3.). When mediators are sequenced, we could have personality leading to temporality leading to motivation leading to drinking motives, and finally to drinking behaviors. For example extraversion (X), which leads to present hedonist temporality (M_1), which leads to social drinking motives (M_2), which leads to alcohol consumption (Y).

4. Deriving serial mediation : Combining results of three studies

As stated earlier, this study was built off of the results of chapters one to three. The variables used were as follows: *Big 5 traits* (openness, neuroticism, extraversion, conscientiousness, agreeableness), *temporality* (present hedonist, temporal rupture, anticipation, past negative), *drinking motives* (coping depression, social, enhancement, conformity), *alcohol consumption* (total Audit score coded as a continuous variable), *sex* (female / male), *age* (continuous), and *place of residency* (France / Québec). Through three chapters, we drew up mediational models using PROCESS that incorporated parallel mediators, one distal factor, one outcome and three control variables.

Over the three chapters, 13 parallel mediator models including three control variables were drawn up: In chapter 1, one personality trait (X) led to motives (M_i) which in turn led to drinking behaviors (Y). In chapter two, we used the same methodology, but instead of drinking motives, temporalities (M_i) mediated the relationship between traits (X) and behaviors (Y). Chapter three applied again the same methodology, but this time, drinking motives (M_i) mediated the relationship between temporalities (X) and drinking behaviors (Y). All of these models included parallel (not sequential) mediators (figure 4.3.) and three control variables: age, sex and place of residency. The statistical design used for chapters 1-3 is figured bellow. For example, in one model, it was specified that extraversion (X) led to the parallel mediators of drinking motives (M_{1-4}) that in turn led to alcohol consumption while controlling for age, sex and place of residency. When taken collectively, analyses in chapters one to three tapped serial relationships between levels of determinants (personality, temporality, motive) (figure 4.4.).

Figure 4.3. Multiple parallel mediator model
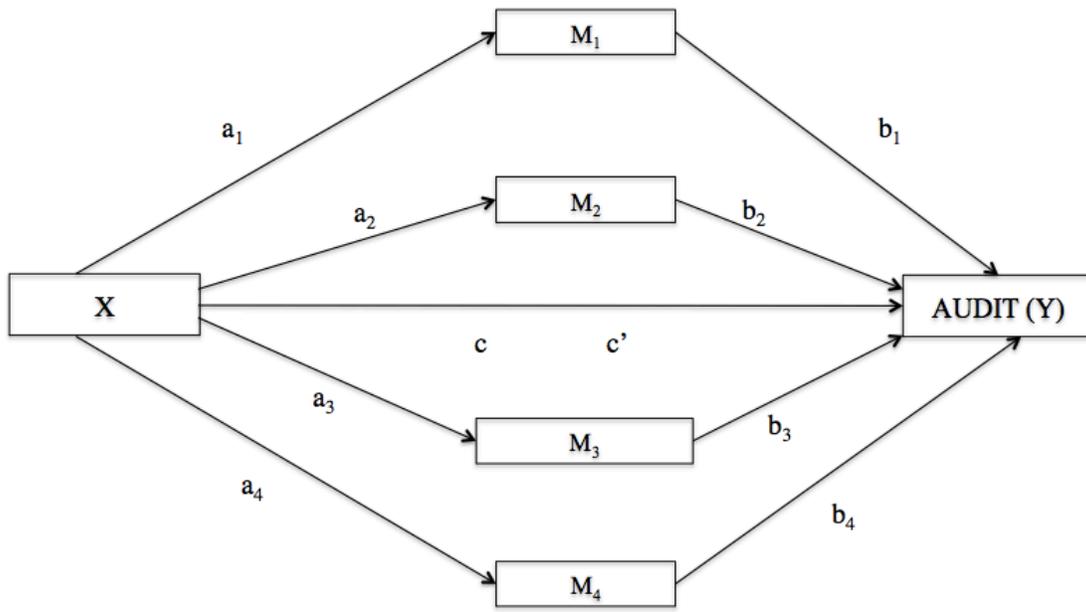
Figure 4.4. Multiple sequential mediators : conceptual model
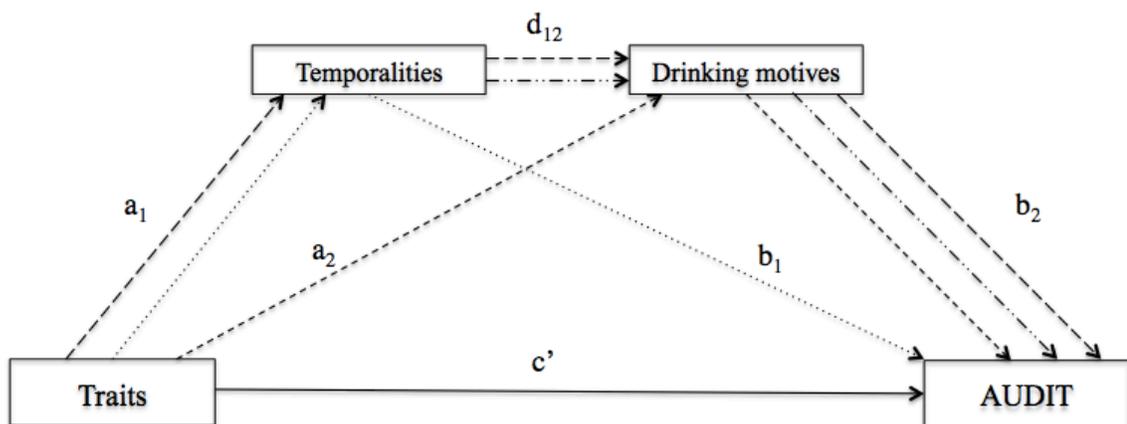
Significant results from each of the three studies were aggregated in table 4.1. For example, case one to three in table 4.1 reports that in study 1, extraversion led to alcohol use through three parallel mediators: coping depression, social and enhancement. This was a case of competitive mediation in that extraversion led to increased social and enhancement motives, which rendered them a vulnerability factor, but also to decreased coping depression motives which rendered them a protective factor in regards to alcohol consumption.

Table 4.1. Result matrix of significant indirect effects on alcohol consumption while controlling for age, residency and sex: Results observed across three studies

	Trait (A)	Temporality (B)	Motive (C)	Factor type
	Study 1			
1	Extraversion		High Social	Vulnerability
2	Extraversion		High Enhancement	Vulnerability
3	Extraversion		Low Coping Depression	Protective
4	Agreeableness		Low Coping Depression	Protective
5	Conscientiousness		Low Social	Protective
6	Conscientiousness		Low Enhancement	Protective
7	Conscientiousness		Low Coping Depression	Protective
8	Openness		High Enhancement	Vulnerability
9	Neuroticism		High Social	Vulnerability
10	Neuroticism		High Coping Depression	Vulnerability
	Study 2			
11	Extraversion	High Present Hedonist		Vulnerability
12	Extraversion	Low Past Negative		Protective
13	Extraversion	Low Anticipation		Vulnerability
14	Agreeableness	Low Rupture		Protective
15	Conscientiousness	Low Present Hedonist		Protective
16	Conscientiousness	Low Rupture		Protective
17	Openness	High Present Hedonist		Vulnerability
18	Openness	Low Anticipation		Vulnerability
19	Neuroticism	High Anticipation		Protective
20	Neuroticism	High Rupture		Vulnerability
	Study 3			
21		Present Hedonist	High Social	Vulnerability
22		Present Hedonist	High Enhancement	Vulnerability
23		Present Hedonist	Low Coping Depression	Protective
24		Rupture	High Social	Vulnerability
25		Rupture	High Enhancement	Vulnerability
26		Rupture	High Coping Depression	Vulnerability
27		Past Negative	High Social	Vulnerability
28		Past Negative	High Coping Depression	Vulnerability
29		Past Negative	High Conformity	Vulnerability
30		Anticipation	Low Enhancement	Protective

Using PROCESS v2, it is only possible to have multiple parallel mediators *or* multiple sequential mediators, but not both at the same time, e.g. we cannot have several traits and several temporalities figured into the same model. There were a few direct consequences of this limitation that should be noted: 1) in serial mediation we cannot account for parallel mediator variance, 2) we cannot take into account common variance between distal factors in a given set of parallel mediation model analyses (e.g. personality traits), 3) when pivoting from parallel to serial mediation, common variance between parallel mediators was taken into account in the former, but not in the latter, which could provoke bias in the serial context. It has been announced that PROCESS v3 will allow researchers to simultaneously include multiple parallel and sequential mediators, but unfortunately v3 is in beta form and has not been released to the public as of date ("What's Coming in PROCESS v3.0," 2017).

The processes leading up to drinking behaviors could be classified along a continuum, ranging from proximal to distal factors. Ultimately, when considered together, these three studies supported that personality traits led to temporality, in turn to drinking motives, and then to drinking behaviors. Each study found significant mediational relationships ($X=>M_i=>Y$), but findings were restrained to two levels in a given study: Study 1) trait, motive; Study 2) trait, time; or Study 3) time, motive (figure 4.4). This article (study 4) thus aimed to bring together these different levels by using the results from chapters one to three (table 4.1) and by applying different forms of logic in order to generate hypotheses that pivot from parallel to serial mediation. This was meant to push the limits of mediational analyses, explore different possibilities and provide a thoughtful framework that could potentially be applied to other subjects.

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5. Categorization of sequential relationships: A proposition

Based on chapters one to three, our assumption was that, sequentially, personality traits led to temporalities that led drinking motives that led to behavior. This was indeed an assumption as opposed to a hypothesis that was tested. In order to facilitate conceptualization, let traits=A, temporalities=B, drinking motives=C, and total Audit scores=D. Therefore we have made the assumption that $A=>B=>C=>D$. In chapter 1, we saw $A=>C=>D$, in chapter 2, $A=>B=>D$, and in chapter 3, $B=>C=>D$ (figure 4.5.). In order to consider the next level of complexity, each of these letters actually has several modalities or dimensions. We took into account five personality traits, four temporalities and four drinking motives that led to total Audit scores. Therefore, we have the framework of $A_{1-5}=>B_{1-4}=>C_{1-4}=>D$. However, chapters one to three showed that only specific relationships exist between these modalities, whereas others would be null. Over the course of these studies, we eliminated options and accepted others within the $A=>B=>C=>D$ framework.

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Figure 4.5. Mediational relationships examined across four studies
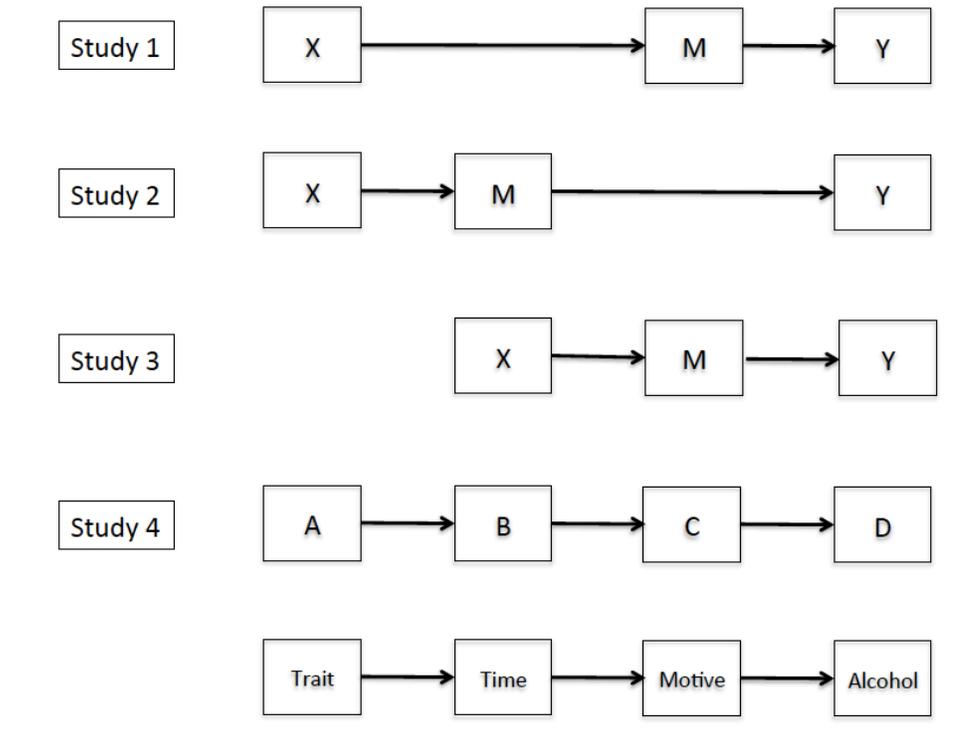
For example, in Chapter 1, we observed that the indirect effect of extraversion (A_i) on alcohol use was explained by social motives (C_i) (table 4.1, case 1). In chapter 2, we observed that extraversion (A_i) led to present hedonist perspective (B_i) and in turn to alcohol use (D) (table 4.1, case 11). In chapter 3, we saw that present hedonist perspective (B_i) led to social motives (C_i), which led to alcohol use (D) (table 4.1, case 21). In other words, taken together: $A_i \Rightarrow B_i \Rightarrow D$, $A_i \Rightarrow C_i \Rightarrow D$, $B_i \Rightarrow C_i \Rightarrow D$. From this knowledge we can clearly deduct that $A_i \Rightarrow B_i \Rightarrow C_i \Rightarrow D$. Table 4.2, series 1, figures all the associations for which this is true when taking into account results figured in table 4.1. This specific example involving extraversion, present hedonist and social motives refers to case number 1 in table 4.2.

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Table 4.2. Hypothesized indirect effects according to categorization and results from tests of serial mediation controlling for age, sex and place of residency

#	Trait	Temporality	Drinking motive	Effect (BSE)	LLCI; ULCI
Series 1. Complete serial					
1	Extraversion	Present Hedonist	Social	0.11 (0.03)	0.07 ; 0.17*
2	Extraversion	Present Hedonist	Enhancement	0.13 (0.03)	0.08 ; 0.20*
3	Extraversion	Present Hedonist	Coping Depression	0.11 (0.03)	0.07 ; 0.18*
4	Extraversion	Past Negative	Social	-0.06 (0.02)	-0.10 ; -0.03*
5	Extraversion	Past Negative	Coping Depression	-0.14 (0.03)	-0.22 ; -0.09*
6	Extraversion	Anticipation	Enhancement	0.04 (0.02)	0.01 ; 0.07*
7	Agreeableness	Rupture	Coping Depression	-0.06 (0.03)	-0.13 ; 0.00
8	Conscientiousness	Present Hedonist	Enhancement	-0.16 (0.04)	-0.24 ; -0.10*
9	Conscientiousness	Present Hedonist	Social	-0.13 (0.03)	-0.20 ; -0.07*
10	Conscientiousness	Present Hedonist	Coping Depression	-0.09 (0.03)	-0.16 ; -0.05*
11	Conscientiousness	Rupture	Social	-0.15 (0.03)	-0.22 ; -0.09*
12	Conscientiousness	Rupture	Enhancement	-0.22 (0.05)	-0.32 ; -0.13*
13	Conscientiousness	Rupture	Coping Depression	-0.12 (0.03)	-0.20 ; -0.07*
14	Openness	Present Hedonist	Enhancement	0.12 (0.03)	0.07 ; 0.20*
15	Openness	Anticipation	Enhancement	0.04 (0.02)	0.01 ; 0.08*
16	Neuroticism	Rupture	Social	0.07 (0.02)	0.03 ; 0.12*
17	Neuroticism	Rupture	Coping Depression	0.06 (0.02)	0.02 ; 0.11*
Series 2. Sufficient serial ($A_i \neq > C_i => D$)					
18	Openness	Present Hedonist	Social	0.10 (0.03)	0.05 ; 0.17 *
19	Openness	Present Hedonist	Coping depression	0.09 (0.03)	0.05 ; 0.16 *
20	Neuroticism	Rupture	Enhancement	0.10 (0.03)	0.04 ; 0.18 *
21	Agreeableness	Rupture	Enhancement	-0.10 (0.05)	-0.21 ; -0.01 *
22	Agreeableness	Rupture	Social	-0.07 (0.03)	-0.14 ; 0.00
23	Extraversion	Past Negative	Conformity	-0.02 (0.01)	-0.05 ; -0.01 *
Series 3. Distal only serial ($B_i \neq > C_i => D$)					
24	Extraversion	Past Negative	Enhancement	-0.04 (0.02)	-0.08 ; -0.01*
25	Extraversion	Anticipation	Social	0.01 (0.01)	0.00 ; 0.03
26	Extraversion	Anticipation	Coping depression	0.00 (0.01)	0.01 ; 0.02*
27	Neuroticism	Anticipation	Social	-0.03 (0.02)	-0.07 ; 0.00
28	Neuroticism	Anticipation	Coping depression	-0.03 (0.02)	-0.06 ; 0.00
Series 4. Proximal only serial ($A_i \neq > B_i => D$)					
29	Neuroticism	Present Hedonist	Social	-0.01 (0.02)	-0.04 ; 0.02
30	Neuroticism	Present Hedonist	Enhancement	-0.02 (0.02)	-0.06 ; 0.02
31	Extraversion	Rupture	Social	0.02 (0.02)	-0.02 ; 0.06
32	Extraversion	Rupture	Enhancement	0.03 (0.03)	-0.03 ; 0.09
33	Extraversion	Rupture	Coping Depression	0.02 (0.02)	-0.02 ; 0.06
34	Openness	Rupture	Enhancement	0.03 (0.04)	-0.05 ; 0.12

35	Agreeableness	Past Negative	Social	-0.09 (0.03)	-0.17 ; -0.04*
36	Agreeableness	Past Negative	Coping Depression	-0.27 (0.06)	-0.41 ; -0.18*
37	Neuroticism	Past Negative	Social	0.13 (0.05)	0.04 ; 0.24*
38	Neuroticism	Past Negative	Coping Depression	0.33 (0.07)	0.22 ; 0.48*
39	Conscientiousness	Anticipation	Enhancement	-0.03 (0.01)	-0.06 ; -0.01*

Note. BSE = Boot standard error. Pairwise contrasts in italics. LLCI= lower level confidence interval. ULCI = upper level confidence interval. * 95% bias corrected confidence interval does not contain zero.

However, this logical supposition was overly grounded in the sense that more conditions were met than would be needed. It would be sufficient to assume that if $A_i=>B_i=>D$ and $B_i=>C_i=>D$, then $A_i=>B_i=>C_i=>D$, because when these assumptions are broken down, all necessary permutations are shown: $A_i=>B_i=>D$ can be broken down into $A_i=>B_i$ and $B_i=>D$. Likewise $B_i=>C_i=>D$ can be broken down into $B_i=>C_i$ and $C_i=>D$. Taken together we now have $A_i=>B_i$, $B_i=>C_i$, and $C_i=>D$. All the hypotheses that can be generated using this logic were shown in series 2, table 4.2. Note that in series 1, $A_i=>C_i=>D$ was true whereas in series 2, $A_i=>C_i=>D$ was false. For example, case 18 (table 4.2) was generated because openness was associated with alcohol consumption through present hedonist perspective (table 4.1, case 17), and present hedonism led to alcohol consumption through social motives (table 4.1, case 21). However, openness did not lead to alcohol consumption through present hedonist perspective (table 4.1, study 1).

We thought that all hypotheses grounded in series 1 or series 2 logic would yield positive results. However, we also decided to explore two other sets of assumptions when generating hypotheses. Series 3 logic is as follows: $A_i=>B_i$ and $A_i=>C_i$, but $B_i\neq>C_i$. Therefore, if any of these serial effects were significant, that would mean that we must take into account the entire chain *ABCD* in for *BC* to hold true; if not, *B* did not lead to *C*. This would imply that we must take into account a specific personality trait (A_i) in order for the indirect effect of a specific

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temporality (B_i) on alcohol consumption through a specific drinking motive (C_i) to be true. For example, the hypothesis generated in case 24 (table 4.2) had the following reasoning: extraversion led to alcohol use through past negative perspective (table 4.1, case 12); extraversion led to alcohol consumption through enhancement motives (table 4.1, case 2); but past negative perspective did not lead to alcohol consumption through enhancement motives (table 4.1, study 3).

Series 4 related to a similar insufficient logic wherein $A_i=>C_i=>D$ and $B_i=>C_i=>D$, but $A_i\neq>B_i=>D$. Following the same interpretation, if any of these hypotheses were true it meant that the full sequence must be taken into account in order for $A_i=>B_i$ to hold true. If we don't take into account the relationship between personality and temporality, there is no association between the temporality, the motivation and alcohol use. For example, hypothesis number 29 was generated using the following logic: neuroticism leads to alcohol consumption through social motives (table 4.1, case 9) ; present hedonist is associated with alcohol consumption through social motives (table 4.1, case 21); neuroticism does not lead to alcohol use through present hedonist perspective (table 4.1, study 2).

In brief, we used results from three previous studies and generated hypotheses about serial mediation based on four different logical conditions:

1) *Complete serial*: $A_i=>B_i=>D$ and $A_i=>C_i=>D$ and $B_i=>C_i=>D$

2) *Sufficient serial*: $A_i=>B_i=>D$ and $B_i=>C_i=>D$, but $A_i\neq>C_i=>D$

3) *Distal only serial:* $A_i=>B_i=>D$ and $A_i=>C_i=>D$, but $B_i\neq>C_i=>D$

4) *Proximal only serial:* $A_i=>C_i=>D$ and $B_i=>C_i=>D$, but $A_i\neq>B_i=>D$

For proximal only or distal only serial, we advanced the hypothesis that in some cases we must take into account the full causal chain in order to obtain positive results. In order to better conceptualize this type of relationship with multiple sequential mediators, take the rainbow example stated in the introduction in reference to figure 4.1: The rainbow would have to appear (X or A) in order for the kid to ask dad (M_1 or B), dad to give a partial answer (M_2 or C) and refer the kid to mom (Y or D). Having only a piece of this chain would not be sufficient, i.e. if the rainbow did not appear (X or A), or if the kid did not ask dad in response to the rainbow (M_1 or B) or if dad did not answer in response to the kid (M_2 or C) then there could be no reference to mom (Y or D). In other words, when explaining the processes leading up to dad pawning off the kid to mom, it would be insufficient neglect the initial appearance of the rainbow or to just study the indirect effects of rainbows on mom referencing through either the kid asking questions or dad giving partial responses; we would have to take into account the full sequence in order for the relationship $X=>M_1=>M_2=>Y$ or $A=>B=>C=>D$ to hold true.

6. Testing serial relationships

As described above, we generated the hypothesis table 4.2. for series 1-4 using the result matrix provided in table 4.1. Then we tested the hypotheses using the sequential mediation option in PROCESS (model 6), wherein one trait (A or X), one temporality (B or M_1), one motive (C or M_2), and one outcome (D or Y) were entered sequentially while partitioning out the variance due to control variables (age, sex and place of residency). The conceptual model can be seen in figure 4.4. There are three different indirect pathways yielded by the PROCESS macro in this configuration, but for the purposes of this study, we were only interested in the significance of the full serial effect ($a_1 d_{21} b_2$). Sequential indirect effects were calculated for 39 models using 20,000 biased corrected bootstrapped samples and 95% confidence intervals (table 4.2).

The sample was composed of 867 college students living in Québec, Canada (n=478) or France (n=389). There were 23% of men in the total sample (n=200), and age ranged from 18-29 years old (M=22.8, SD=2.81). We conducted post-hoc analyses of sensitivity using G*Power. For the regressions elaborated in chapters one to three, as well as the 39 serial models figured in the present study, we could detect an effect size (f^2) of 0.02 with alpha set at 0.05 and power at 0.80. Our study design allowed us to maximize power because we tested models incrementally, rather than specifying a huge model in structural equation modeling for example that included all the variables (parameters) at once. Because of the numerous comparisons that were made, experiment wide error could be a problem but we deemed this an acceptable trade-off.

As seen in table 4.2, 16/17 (94%) hypotheses from series 1 and 5/6 (83%) hypotheses from series 2 were confirmed. Case 7 (series 1) and case 22 (series 2) yielded null results. However, in both of these cases the confidence interval appeared to be equal to zero. As 0.00 was rounded automatically by PROCCESS and as bootstrapping was used (i.e. random resampling), this null finding might be a type 2 error. In series 3, 2/5 (40%) of hypotheses were confirmed. However, the size of effects in this series did not surpass 0.04, which alludes to the minimal importance of the effect. All null findings in series 3 had 0.00 as a lower or upper level confidence interval, and again our null findings might be type 2 errors. However, case 26 on the other hand might be a type 1 error because the boot standard error was superior to the effect observed which only differed slightly from zero. In brief, series 3 results had questionable reliability.

In series 4, 5/11 (45%) hypotheses were confirmed. Effect sizes of significant effects in series 4 were higher than that of series 3 (max= 0.33) and all null findings clearly included zero in the confidence interval, suggesting that findings were more reliable. If results were not due to error, series 3 or 4 results suggested that in some cases we had to take into account the full serial

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effect in order for a piece of the sequential chain to hold true, and that this phenomena would not be a particularly rare occurrence.

7. Proximal and distal only mediation: Investigating positive results

As series 3 and 4 were based in "insufficient" logical assumptions, we took a closer look into relationships between variables by drawing on results of path a and b found previous chapters. Results from study 3 ($B=>C=>D$) help us understand positive results from series 3 ($B_i\neq>C_i=>D$), whereas results from study 2 ($A=>B=>D$) were pertinent to series 4 ($A_i\neq>B_i=>D$). We noticed that indirect effects did not take place because both paths a and b must be significant, whereas in some cases only path a or b was significant. Alternatively, some of our results could arguably be explained by statistical error.

7.1. Distal only serial mediation

Take case 24 in table 4.2. as an example (extraversion=>past negative=>enhancement=>use; $B_i\neq>C_i=>D$) (figure 4.6). The indirect effect of past negative on alcohol consumption through enhancement motives only appeared when extraversion was taken into the mix. In other words, introversion would necessarily precede the development of past negative perspective in order for this time perspective to cause enhancement motives, and consequently alcohol use. When introversion was not taken into account, there was no relationship between past negative perspective and enhancement motives. Mathematically that would imply that holding extraversion constant allowed an effect to appear, and that when excluded, extraversion was acting as a confounder. Alternatively, results cited from chapter three could have been a type 2 error i.e. path a_2 for past negative was actually significant (table 4.3.). In that case, the hypothesis in Case 24 would be miscategorized, and actually be part of series 1 logic. Case 26 most likely had the same meaning as case 24. For case 26, we would have to take

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into account extraversion in order for an indirect effect of anticipation on coping depression motives to appear, or results were due to error in study 3 that led to a misclassification of the hypothesis in study 4.

Figure 4.6. Example of distal only sequential mediation

Table 4.3. Motives as mediators between temporalities and alcohol consumption: Results from chapter three

	Path a_1	Path a_2	Path a_3	Path a_4	Path b_1	Path b_2	Path b_3	Path b_4
PH	0.06	0.08	0.05	0.01	5.56	6.61	6.59	-1.89
	(0.01)*	(0.01)*	(0.01)*	(0.01)	(1.10)*	(0.90)*	(1.06)*	(1.10)
TR	0.05	0.08	0.05	0.01	5.77	6.37	6.58	-2.04
	(0.01)*	(0.01)*	(0.00)*	(0.00)*	(1.11)*	(0.93)*	(1.08)*	(1.11)
PN	0.02	0.01	0.06	0.03	6.13	7.20	6.68	-2.50
	(0.01)*	(0.01)	(0.01)*	(0.01)*	(1.11)*	(0.92)*	(1.14)*	(1.12)*
ANT	-0.01	-0.04	0.00	0.01	6.31	6.54	7.47	-2.13
	(0.01)	(0.01)*	(0.01)	(0.01)	(1.11)*	(0.92)*	(1.06)*	(1.11)

Note. Path 1 = Social. Path 2 = Enhancement. Path 3 = Coping Depression. Path 4 = Conformity. PH = Present Hedonism. TR= Temporal Rupture. PN = Past Negative. ANT = Anticipation.
Unstandardized beta coefficients. Standard Error in parentheses. * $p < 0.05$.

7.2. Proximal only serial mediation

Cast 36 showed that even if there was not a significant indirect effect of agreeableness on alcohol consumption through past negative perspective, agreeableness led to past negative perspective (significant path a) (figure 4.7.). Study 3 showed that past negative perspective led to alcohol consumption through coping depression motives (significant path $a \times b$). Though there was a significant direct effect of past negative on alcohol consumption, study 3 showed that this relationship was fully mediated by drinking motives. We had to take into account coping depression motives in order for the relationship between agreeableness, past negative perspective and alcohol consumption to appear. Case 36 was the same as case 35 but social motives took the place of coping depression motives.

Figure 4.7. Example of proximal only sequential mediation

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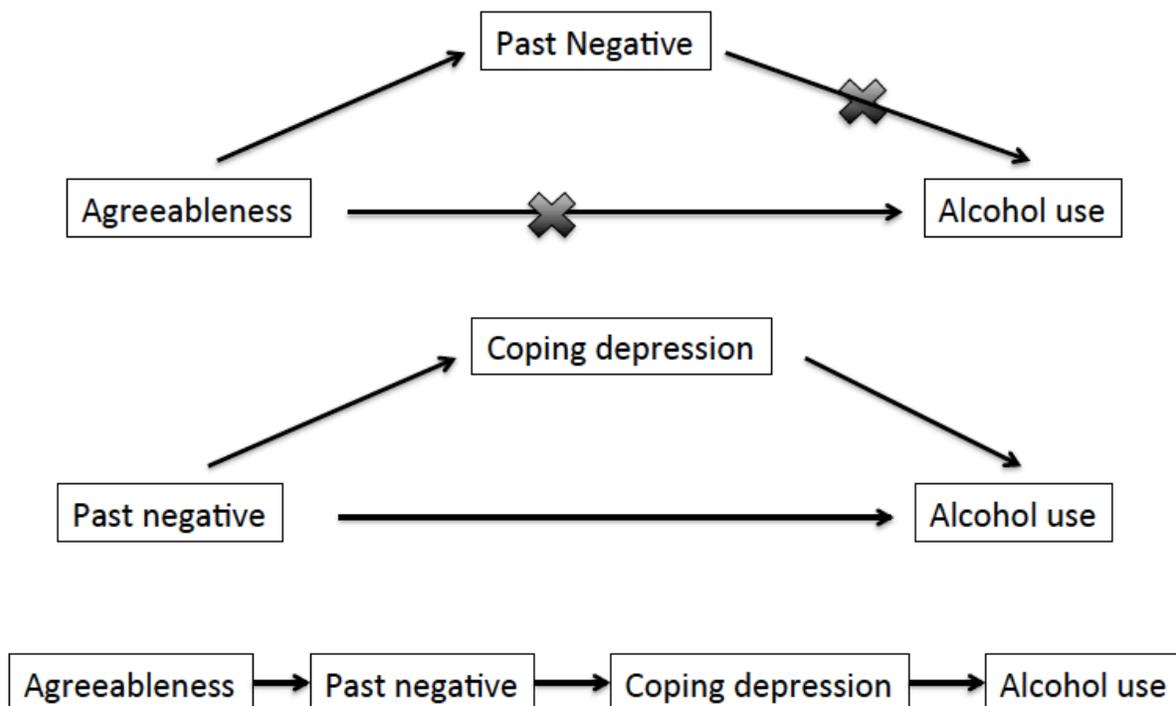
Table 4.4. Motives as mediators between personality traits and alcohol consumption: Results from chapter two

	Path a_1	Path a_2	Path a_3	Path a_4	Path b_1	Path b_2	Path b_3	Path b_4
E	0.159	-0.175	-0.093	0.038	1.165	0.682	-0.524	1.313
	(0.020) *	(0.030) *	(0.030) *	(0.037)	(0.293) *	(0.193) *	(0.185) *	(0.151) *
A	-0.006	-0.338	-0.023	-0.120	1.699	0.318	-0.494	1.307
	(0.032)	(0.045) *	(0.047)	(0.056) *	(0.285) *	(0.195)	(0.188) *	(0.154) *
C	-0.196	-0.332	0.460	-0.262	1.660	0.310	-0.404	1.298
	(0.028) *	(0.040) *	(0.039) *	(0.049) *	(0.284) *	(0.199)	(0.205) *	(0.154) *
O	0.147	-0.044	-0.094	0.039	1.659	0.388	-0.502	1.316
	(0.028)	(0.041)	(0.041) *	(0.049)	(0.289) *	(0.190) *	(0.189) *	(0.154) *
N	-0.017	0.472	0.187	0.119	1.697	0.316	-0.516	1.310
	(0.022)	(0.027) *	(0.031) *	(0.038) *	(0.287) *	(0.220)	(0.190) *	(0.154) *

Note. Path 1 = Present Hedonist. Path 2 = Past Negative. Path 3 = Anticipation. Path 4 = Temporal Rupture. E = Extraversion. A= Agreeableness. C = Conscientiousness. O = Openness. N = Neuroticism.
Unstandardized beta coefficients. Standard Error in parentheses. * $p < 0.05$.

Case 37 and case 38 had an analogous interpretation. In study 2, neuroticism led to past negative perspective (path *a*), but past negative perspective did not lead to alcohol consumption while controlling for neuroticism (path *b*). Past negative perspective did however lead to social and coping depression motives which in turn led to alcohol consumption (study 3). The full serial effect $a_1 d_{21} b_2$ was consequently significant. Lastly, case 39 was probably best explained by error. Results from study 2 showed that path a_3 was significant, as was path b_3, but the indirect path $a_3 b_3$ was non significant. However, as the confidence interval of path $a_3 b_3$ included 0.00, we may have made a type 2 error and should have categorized the hypothesis in series 1.

8. Violating assumptions in mediation

Mediation analysis has several assumptions about the inclusion of pertinent variables leading up to Y. There should be no confounders in the relationship 1) X to Y, 2) X to M and 3) M to Y. Also, X should not be meaningfully associated with a confounder that effects the

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relationship *X* to *Y* (O'Rourke & MacKinnon, 2015). Because we were only able to take into account two levels of determinants per chapter, we technically violated specific assumptions of mediational analyses throughout the chapters. If *X* is a personality trait, and we leave out temporalities, then the assumption of no confounders between *X* and *M* is violated (chapter 1). If *X* is a personality trait and we leave out drinking motives, then we violate the assumption that there are no confounders in the relationship *M* to *Y* (chapter 2). If *X* is a temporality and we leave out a distal factor preceding *X* (i.e. trait) that effects the relationship *X* (e.g. temporality) to *Y*, the neglected *X* could act as a confounder. In other words, variables that were distal to *X* could meaningfully effect the relationship *X=>Y* (chapter 3).

The generation of our serial hypotheses in series 2, 3 and 4 tested the effects of violating specific assumptions. We either left out a proximal variable (motives), an intermediary variable (temporalities) or a distal factor (personality traits). When "ungrounded" hypotheses were accepted, this indicated that we must take into account the full serial effect in order to obtain positive results. Though this could seem odd, this is simply violating known assumptions of mediational analyses and could be somewhat analogous to the conceptualization of indirect only mediation, wherein we there was no need for *A=>C* if *A=>B, B=>C*. Nevertheless respecting these stringent assumptions to mediation would be considered an ideal, but practically impossible. Consequently, rethinking the meaning behind cause and effect has been set aside as a topic of philosophical debate (Hayes & Rockwood, 2016). In order to better respect reality, we decided to venture back into the limitations provoked by this debate and reconsider mediation as a whole.

9. Rethinking sequencing in mediational analyses

As mentioned earlier, in our reference framework, the "intermediary" factors leading up to alcohol consumption would have more levels than simply *ABC,* but mediation assumes that we include all causally chained variables between X and Y. For example, alcohol expectancies would precede drinking motives the most closely and were not measured in this study. Leaving out such variables violated the assumption of taking into account all factors that are part of the causal process of X leading to Y. Furthermore, alcohol expectancies are far from the only "intermediary" determinants left out of the present study. However, it would be very costly, if not impossible, to take into account all the "intermediary" factors between X and Y because they could arguably be infinite in number, though we technically *must* in order to not violate an assumption of mediational analyses. The number of determinants could be thought of as a countable infinite set of sequentially ordered factors situated between X and Y akin to other infinite countable sets of ordinal numbers. For example, when the infinite set $1/2 + 1/4 + 1/8 + 1/16 + \ldots$ is pushed to the limit of infinity, we reach 1. Consequently, researchers take into account a selection of pertinent determinants, rather than including all pertinent variables. Even if it would not be feasible to take into account all playing factors, hypothetically we would need to do so in order to avoid interpreting in error.

In the real world, neglecting the assumption of accounting for all mediators can generate false statements that could appear to be true when taken at face value. For example, take the claim "Nobody dies because they don't have access to health care" (Raul Labrador, House of Representatives, USA, May 5, 2017). Dying (Y) because of health care access (X) would indeed be related, but we must account for causally related intermediary factors. For example, the absence of health care access would lead people not be able to seek out medical aid (M_1) which

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would lead to the non treatment (M_2) and aggravation (M_3) of a health conditions which could lead to death (Y). Furthermore, it may be helpful or necessary to take into account more distal factors, such as pre-existing medical conditions (X_{-1}) or familial wealth (X_{-2}), in order to properly specify the relationship between health care access and death.

As effect sizes observed in series 4 (proximal only) were greater than that of series 3 (distal only), positive results from series 4 may have shown the importance of taking into account the more proximal predictive factors of consumption behaviors. In our study, leaving out a distal factor appeared to be less important than leaving out a proximal factor. The importance of distal factors could nevertheless be brought up, because it is unsure if the small effect sizes observed in our study were a consequence of "distal only" mediation being less important, or if it was due to the specific research example that we analyzed. Indeed, distal only mediation does seem to be a phenomenon. For example, "she had trouble finding a job because she had never had good concentration and so she ended up drinking daily," or "it was only because she was so extraverted to begin with that she fell into the wrong crowd and started drinking," or "had he not been so hardworking, he would not have been able to make it out of the situation he did and would be back with his old friends drinking beers." The phenomenon could also be related to hindsight. For example, "Had the damn been built properly, the water would not have flooded the town and killed all those people." Alternatively, researchers could benefit from adding a heuristic extension to an assumption of mediational analyses: All distal factors that causally influence X should be measured. If not, distal factors could act as confounders and analyses could yield null or biased results. As this would simply be another way of framing a known assumption for mediation(O'Rourke & MacKinnon, 2015), our extension was heuristic, not novel.

However, having such an assumption in the serial context would have important implications. First and foremost, there were other distal factors that were not measured in the

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present study (e.g. temperament) that would give way to the most distal factor included in our study (personality traits). If we added temperament for example, we would have the chain *ABCDE* to taken into account (*A*=temperament; *B* = personality traits… *E*= alcohol consumption). In other words, there could have been other existent relationships wherein adding in a distal factor would render the effect *BCDE* significant or change the interrelationships between sequentially ordered variables.

The *X* included in a given study would be determined by non-measured variables at X_{-1} (e.g. temperaments in the present study) and this causal relationship ($X_{-1} =>X=>M=>Y$) would change the relationship between *X, M* and *Y*. Furthermore, X_{-1} would be determined by X_{-2}; X_{-2} would be determined by X_{-3} and so on. We would have to identify and measure the origin of *X*, meaning the most distal variable leading to *Y* that could not be explained by a more distal *X*. Nevertheless, it is conceptually arguable that such an origin would exist and even if we did identify such variables, measuring all mediating variables leading to *Y* could be difficult or practically impossible. Also, there would be many *X* variables operating in parallel, as would be the case for *M* and *Y* variables.

Another issue relates to the conceptualization of *Y*. Even if it could seem evident that *Y* would necessarily be alcohol use in the present study (i.e. target outcome), *Y* could be placed as *X* or *M* when attempting to define the parameters of a sequence (figure 4.8.). Technically, in order to have fully tapped interrelationships, we would have had to draw up models wherein traits (*X*) lead to drinking motives (*Y*) because of temporalities (*M*). This could have been a good way to generate hypotheses and may have offered up a more solid foundation for effects observed in our serial only series. Furthermore, the fact that the location of *X* is relative to time, reinforces the hypothesis that "distal only" mediation could be pertinent to other research topics. As shown in Figure 4.8, at T_{x+2} for example, we could define level *C* as either *X, M,* or *Y*. Furthermore at level

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C, X, M and *Y* could be seen as distal factors operating in parallel leading up to *E*. In sum, the position of *X, M* or *Y* is only relative to time.

Figure 4.8. *X, M* and *Y* leap frogging forward in time
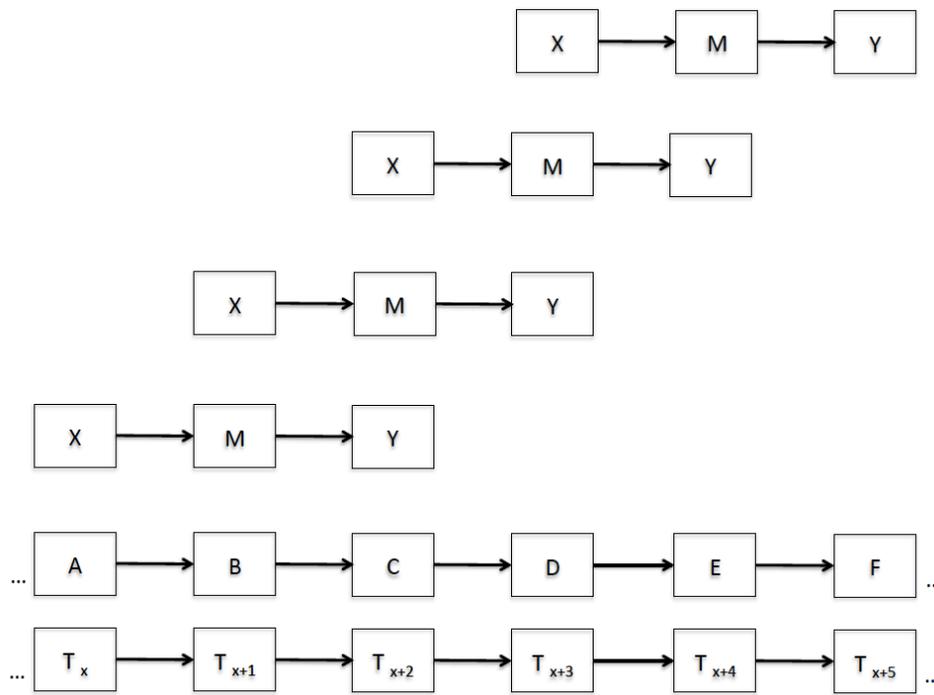
10. Abstractions, extensions and accounting for complexity

10.1. Time and complexity in mediation

Remarkably, Cox, Klinger and Fadardi (2017) just came out with an article in which they discussed the question of freewill in the context of the etiological framework of addictive behaviors that had originally been drawn up back in 1988. In the 2017 article, they reflected on their theories and have now clearly stated that, ultimately, there is "no such thing as free-will" because every behavior can be described by the events leading up to it. They argued that from a scientific point of view, even "creative" acts would be determined by "previously established associative pathways in the brain". Furthermore, researchers have demonstrated that they were

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able to identify which of two options people were going to "choose" before people were consciously aware of their choice (Dennett, 1992). The topic of free will is often overlooked in psychology, but still sparks debate among philosophers (e.g. determinism, soft determinism, free choice) and quantum physicians (e.g. multiverses wherein every possibility exists, or not). Serious ethical issues are raised by the endorsement of determinism which contributes to people rejecting the viewpoint, e.g. how to administer justice, because if choice is not real, there would be no responsibility. Consequently, most scholars endorse soft-determinism in which definitions are reworked in order for voluntary action and determinism to (paradoxically) co-exist (Bourget & Chalmers, 2014). However, when applying statistics, we arguably operate on the assumption of determinism. For example, we choose "determinants" and try to "predict" an outcome (as if this would be possible). Ideally, statisticians would completely eliminate the error in their estimates, which would allow them to perfectly determine the value of an outcome.

Another way to think about it would be to consider T, time, in the place of M, because M changes as time (the sequence) moves forward. For example, if we could account for everything, there would be no confounders, only parallel-sequential determinants accumulating moving forward in time. In other words, X, M and Y appear to leap frog forward and accumulate as time moves on (figure 4.9), and there would be many X, M and Y variables operating in parallel and interacting sequentially. At a specific point in time, a specific outcome would be produced. The most proximal M would become Y when we decide to measure it. Associations with the degrees of freedom of X to M with a probability collapse when Y is measured could be discussed, and potentially extended into quantum physics.

There would be steps and stages that are causally related and that can be quantified, sequenced and predicted. This can be done with good precision in hard sciences (e.g. biology) but results are more of an approximation within the soft sciences (e.g. psychology). For example,

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let the origin of X be conception of a human (T_0) (even if there could arguably be a T_{-1}). The interaction between a sperm and egg obey natural causal laws (T_1), as does the subsequent splitting of cells (T_2) and preliminary fetal development (T_3). Note that ideally, mediational analyses should exclusively use data collected longitudinally (Hayes & Rockwood, 2016) meaning that this temporal ordering is actually tied into the assumptions of mediation, but is most often ignored because it is next to impossible to respect. Indeed, researchers are obliged to make approximations and only take into account part of the sequence.

Figure 4.9. Accumulation of determinants over time
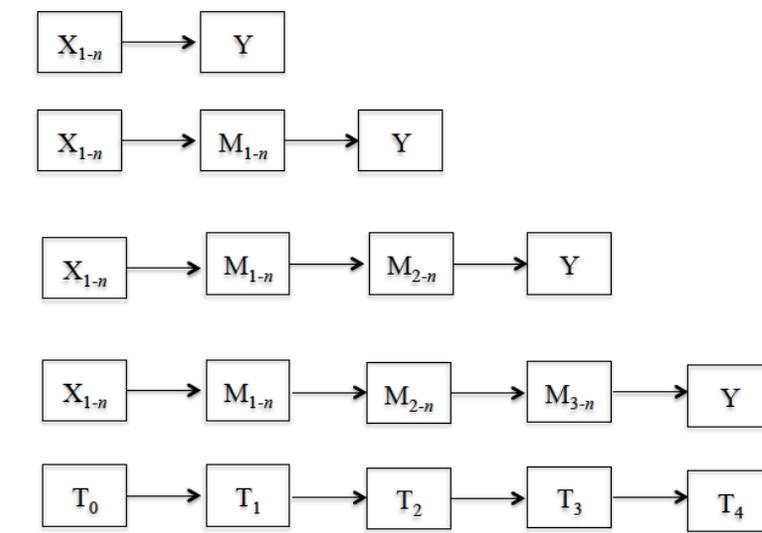
As time (age) advances, the individual would be determined by all factors that are sequentially distal to present time Y. When time moves forward, complexity increases, and our statistical precision decreases. At T_3 for example we would have to take into account the full causal sequence $T_0 => T_2$ (i.e. all the distal, intermediary and proximal factors) in order to determine the value of Y at T_3. T_3 would be placed as the most proximal mediator of the outcome at T_4 (figure 4.9). Understanding the causal processes leading up to T_{3700} for example would be complex because we would have to take into account all intermediary factors between T_0

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and T_{3700}. Ultimately, our studies were limited by the quantity and quality of all the causally related variables that we neglected to measure in the present study, as well as in our three previous chapters. Not to mention our negligence of moderators and our transversal, not longitudinal, study design…

To take our reflection on temporal ordering one step further, notice that in the example above, the distance between T_1 and T_2 was attributed arbitrarily; T_{3700} did not imply a specific age or date for example. In reality, the distance between T_x and T_{x+1} or T_{x-1} would be infinitely close. When one singular point in time (event A at T_{x-1}) transforms into another outcome at an infinitely close point in time (event B at T_x), a specific interaction would take place (event $A \Rightarrow$ event B) that yields a specific outcome (event C at T_{x+1}). When one event turns into another event infinitely close in time, we could observe a superposition of two simultaneous and contradictory truths, i.e. event A superposed with event B that is then defined at event C. Superposition one of the basic postulates underpinning quantum physics wherein things can simultaneously both "be" and "not be." Classic physics assumes that the superposition of two elements is equal to the action of their sums, whereas quantum physics does not assume that this would always be the case (Ludwig, 1995). "We are now becoming acutely aware of the overwhelming complexity of even the simplest of situations" and "…now the contingency of all that happens is becoming our paradigmatic example" (Weinberger, 2017).

If we could quantify all parallel internal (psychological) and external (environmental, social) playing factors in the sequential chain, we could arguably explain all variance in the outcome (behavior). By definition, we obtain a "true score" by eliminating all error, and we might be able to do so by measuring all variables infinitely close in time spanning from the origin of X to Y. As this would be clearly impossible because of methodological constraints, researchers must be humbled and content themselves with only telling a small piece of the story, all the while

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attempting to explain as much variance as possible. Findings from the present paper suggested that sometimes we must take into account complex interrelationships of causally related variables in order to observe a relationship with an outcome, and that neglecting such complexity yields false results in many cases. Indirect only mediation (Zhao et al., 2010) also fits this description, but merely related to our series 2 hypotheses (sufficient logic).

However, in series 3 and 4, we went beyond simply not needing "an effect to be mediated" in the serial context.   We observed that in some cases we must take into account the full serial chain in order for a part to hold true. As more than 40% of proximal or distal only serial hypotheses appeared to be true, researchers should be weary of the effects of leaving out pertinent variables when studying "causal" conditional processes. Because the methodological constraints brought up cannot be rectified for now, and as statistics are merely a tool undergoing constant development, we do not uphold that imperfect mediational analyses are useless. In fact, today, conditional process analyses appear to be among the most innovative and promising statistics in psychosocial research because they allow us to test relationships between variables within increasingly complex etiological frameworks.

To reiterate, respecting all assumptions in mediation analyses can be considered an ideal, but practically impossible because of methodological constraints. In chapters one to three, we had to set aside the meaning of cause and effect, and we did so because discussions on the topic have been classified as subject of philosophical debate (Hayes & Rockwood, 2016). Our purpose in the present study was in part to bring awareness to the impact of violating assumptions, as was exemplified and quantified herein. Having researchers keep up to date with advances in mediational analyses could be helpful, but it is understandable that not everyone has the time or motivation to do so. In the future, conditional processes analyses will be further developed and

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applied to psychosocial research. Using PROCESS v3 would be a good start and we can expect the product to be released to the public at the end of 2017.

10.2. Information processing

One particularly interesting and possibly unexplored avenue would be merging our techniques with the regression based algorithms used for programming machine learning (artificial intelligence (AI)), as their "neural networks" do appear to be (very) similar the parallel-sequential mediation framework proposed in this study (figure 4.10). These techniques are able to account for a bafflingly amount of interrelationships and have already reached a level of complexity that exceeds human cognitive capacity. Using "training sets", a possible equivalent of observed data points in psychosocial research, algorithms can be applied to new data in order to predict the most likely outcome given a set of specific conditions. Then the machine can learn from its mistakes and retro-correct predictive functions elaborated from the training set and new incoming data that could be collected longitudinally.

Figure 4.10. Example of a neural network used in machine learning (Ng, 2013)

Figure 2: An example of a neural network diagram with K=4 output units for a multi-class classification problem.
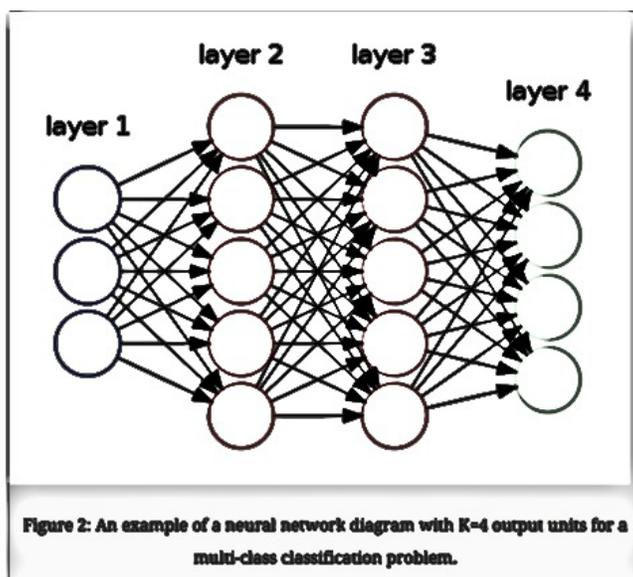
Furthermore, programmers readily admit that using tests founded on assumptions that cannot be verified or respected (e.g. those discussed in the present study) is a poor idea. AI techniques do not rely on the same assumptions (e.g. distribution characteristics), but instead view everything as a multilevel classification problem (is, is not, and then) (Ng, 2013). Interestingly, distal only serial and proximal only serial mediation seem to be analogous to generalization functions used to program AI (e.g. Dietterich & Michalski, 1983). Furthermore, research on the subject has been progressing rapidly and will continue to do so. For example, a market intelligence firm, Tractica, estimated that worldwide revenue from artificial intelligence will grow from $643.7 million (2016) to $36.8 billion over ten years (2025) (Tractica, 2017).The humanities may benefit from piggybacking off of methodological and statistical advances elaborated for machine learning because for now, the algorithms are imperfectly paired with our data. On a side note, it might be interesting to look into other mathematical realms, notably those that incorporate interrelationships of spatially related factors, such as algebraic topology or cellular automata, and then find a way to adapt the functions to time instead of space.

Paradoxically, the precision of complex etiological frameworks could be considered *too complex* for clinicians, in that conceptualizing all of these conditional processes might be more confusing for psychologists than helpful when working with clients in practice. In other words, using such research-derived knowledge in real-time with clients might be too complicated to implement because of our own cognitive limitations. Even merely conceptualizing, memorizing and applying results from this study could be considered a daunting task. Psychologists can however imagine that such a higher level of complexity and contingency could *exist*. In order to fully account for it, we would have to be able to identify and observe all pertinent determinants, and know exactly in what way the factors interact, e.g. have had fully memorized all pertinent research and run all necessary regressions for our clients data in our head in real time etc. Then,

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as a function of that knowledge, we would have to predict the behaviors of a specific individual and "act optimally" in order to obtain a specific therapeutic outcome, which would follow yet another set of complex algorithms, laden with contingencies.

And yet, even this could be considered an over-simplification… As people are cognitively limited in their capacity to process information, whereas algorithms are not, artificial intelligence may be more effective in "understanding" a clients needs and acting accordingly. Even if we cannot respect all assumptions of mediational analyses, a program may be able to, or at least come closer to that goal. Furthermore, this shift could fuse research with clinical practice and allow for a massive collection of longitudinal data. The machine could be programmed to correct itself with new input coming from *all* clients across cultures (if the future ethics of data sharing permit), which would fine-tune the predictions over time and further increase effectiveness in targeting and modifying behaviors.

On a side note, a fully automated psychologist named Ellie has already been created and implemented, but the algorithms used were not nearly as ambitious as those described above. The bot was unbiased by subjectivity and was programmed to detect subtle signs of emotional distress and react accordingly. Ellie made veterans feel more comfortable and share more, because they were sure that the machine was not judging them(Jolly, 2016). Ellie was embodied as a woman on a screen, but she could easily be exported into virtual reality. Furthermore, studies have shown that our psychophysiological reaction to stimuli in the virtual world can be equivalent to the real world (Wiederhold & Bouchard, 2014). As using machines could drastically increase the cost-effectiveness of clinical interventions, access to psychotherapy could be democratized by the use of artificial intelligence in the future. Such innovations could also be used in other areas of expertise including medical fields. In fact, experts recently projected that AI will outperform humans at *all* tasks (AI researcher, surgeons, pop-song writers…) in 120 years, and that there

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would be a 50% of this happening within 45 years. More specifically, voice to text translation was expected to outperform humans in 10 years (Grace, Salvatier, Dafoe, Zhang, & Evans, 2017) and though it was not stated explicitly, semantic analysis performed by an AI could follow shortly thereafter. Such advances could change the face of qualitative research in psychosocial sciences.

10.3. Sequential reasoning and behaviors

Nonetheless, for now, human psychologists are the most widely implemented and they can also benefit from our findings. Clinical reasoning already considers sequential chains of events that determine behaviors within etiological frameworks (diachronic and synchronic axes). Going through time, sequentially ordered experiences, contextualized within an environment, accumulate and yield behavior at given point in time. In cognitive-behavioral functional analyses for example, we take into account different temporal levels of determinants (historical factors, predisposing factors, triggers…), identify the ways in which they interact sequentially and produce an outcome within a context (problematic behavior). All pertinent factors must be taken into account in order for the analysis to be just. For example, one commonly observed phenomenon consists of clients sharing a piece of essential information later on in therapy that obliges the psychologist to rethink and reconstruct their evaluation of the client's problem, and consequently, treatment. The same phenomenon can be found in medical evaluations wherein gaining knowledge of a specific symptom can oblige the doctor to reconsider their diagnosis.

In order to highlight the evidence of the "sequential only" reasoning advanced in the context of our study, we decided to offer up fictive clinical narratives relating to proximal only serial mediation. Take case 36 (table 4.2.) wherein disagreeableness leads to past negative, which leads to coping depression, which leads to alcohol consumption. The first example (Noah)

takes into account the full serial effect, whereas the second example (Emma) neglects a piece of the chain.

Noah, 27, never really got along with others and tended to criticize everything and everyone. He always had trouble making friends and says he was never really happy in life. When reflecting his past experience, negative memories spring readily to mind : the time the love of his life left him, as did his father when he was young. Growing up, his mother was depressed, over-worked and did not often have the time to take care of Noah. He says that he has taken his fair share of rejection in the past and has a hard time recalling fond memories of his childhood. Noah has been feeling sad and rejected. His expression and his voice are clearly marked with sorrow. Everyday, as soon as he gets home, he cracks open a beer. He tells his housemate that it makes him feel better and forget about his troubles. He first started consuming alcohol after the breakup, but now he has gotten into the habit of drinking in order to stave off feelings of sadness whatever their source may be. This worried his roommate, who stepped in and encouraged Noah to seek help.

Disagreeableness leads to past negative perspective, but if we don't take into account drinking motives, we see no association between past negative and alcohol consumption.

Emma was critical and suspicious of others ; she never had a friend that she really looked up to or respected. Emma was hard working, just like her parents, and always thought she was better than her pairs. Emma, 25 years old, was studying finance and had lined up a high paying job upon completion her diploma. Nevertheless, it was always difficult to get Emma to identify positive memories of her past without having her immediately criticize the experience. For example, she can remember all the times she performed better than her colleagues, but adds that she was never recognized for her greatness and that she was often treated unfairly. She has always been critical of people who do drugs, calling them "stupid," "lazy" and "dirty".

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Consequently, nobody ever imagined that Emma could have an issue with substance use. ...Six months later, Emma's grades started slipping and she stopped answering her parents' phone calls. Her mother started to worry and went to check on Emma at her apartment. She found Emma heavily intoxicated, surrounded by empty bottles. She brought Emma to the emergency room and the next day, Emma was diagnosed an alcohol use disorder with co-morbid major depression. She later admitted that she had never talked to anyone about her struggles with depression because she didn't want to seem weak, fragile and incompetent.

This phenomenon is pertinent in clinical psychology, whatever the orientation may be, and even common to reasoning in general, as it could simply relate to the phenomenon of surprise, realization or misunderstandings. For example, we could be angry (Y) that a friend did not answer our calls (X), but then later learn that this was because they had gotten into a car accident (misinformed M). We could think that a relationship with someone was going great, and be surprised in the case of a breakup, because we missed the warning signs (intermediary variables). When we do not take into account the distal and intermediary factors, we could be surprised that Donald Trump became president and think that the event came out of the blue. By extension, the intermediary variables we do account for generate subjective meaning and beliefs by providing us with a coherent, but erroneous, vision of the world. Realizing that we missed something important can change our analysis and consequently, we "change our mind" (i.e. we rectify our analysis by incorporating new information). Even if people unconsciously fight to reduce their cognitive dissonance (e.g. confirmation bias), when engaging with culture, people often take pleasure in being proved wrong. For example, good novels have unexpected twists, funny jokes have cleaver punch lines and excellent art is moving. If our analysis of the world was exhaustive, we could predict everything, and maybe life would become quite dull.

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10.4. Complexity as a gestalt

We could say that in many cases the whole serial chain (*ABCD*) was "more" or "other" than gluing together pieces of the serial chain one by one (*ABD, ACD, BCD*). It could be interesting to put this into tension with the fact that "mathematically, the whole is equal to the sum of its parts, neither more nor less" (Upton, Janeka, & Ferraro, 2014). Even if natural laws may obey this formulation (e.g. 1+2=3; 7×8=56 or A×B=D), determining the functions of mind or perception may necessarily involve something else that emerges from interactions, conditional processes, complexity or some other special ingredient.

As suggested by Heider (1977) (among many others), the whole (mind, person…) might have an emergent quality that is other than the sum of its parts (personality × culture ×…). For example, we cannot appreciate a song by listening to disorganized bits and pieces, or understand a painting by examining the individual brush strokes. We must take into account the sequential (song) or spatial (painting) organization in order to fully perceive these objects. Colliding dialectic polls relating to paradox could give rise to objects with emergent qualities. For example, when a thesis and an antithesis collide, something else would emerge: a synthesis (Mueller, 1958). Furthermore, we can see paradox and dialectics used all over psychology. To name a few: Freud's Id and Super-ego giving rise to Ego, Bateson's double binds yielding psychosis, or Socratic dialogue provoking change. Singularity (other) could be situated between two infinitively close points in time and could have an emergent quality when T_x turns into T_{x+1}.

However, especially in the humanities, it's difficult to design studies that test hypotheses relating to emergent qualities rising out of complexity or the whole being "more" or "other" than the sum of its parts. The way in which we approached complexity in the present study was multifaceted, and reached beyond another study that I conducted with colleagues with somewhat similar aim. Loose et al. (2017) observed that biopsychosocial complexity explained subjective

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life quality better than any one component. The group showed that the whole was more than any one part, whereas the present study loosely suggested that the whole was not more, but "other", than the logical stringing of the parts within a causal chain. Maybe one day we will be able to observe consciousness (i.e. "other") arise from machine learning (i.e. math), but research as not yet reached that point as of date, and may never will.

Figure 4.11. Illusions
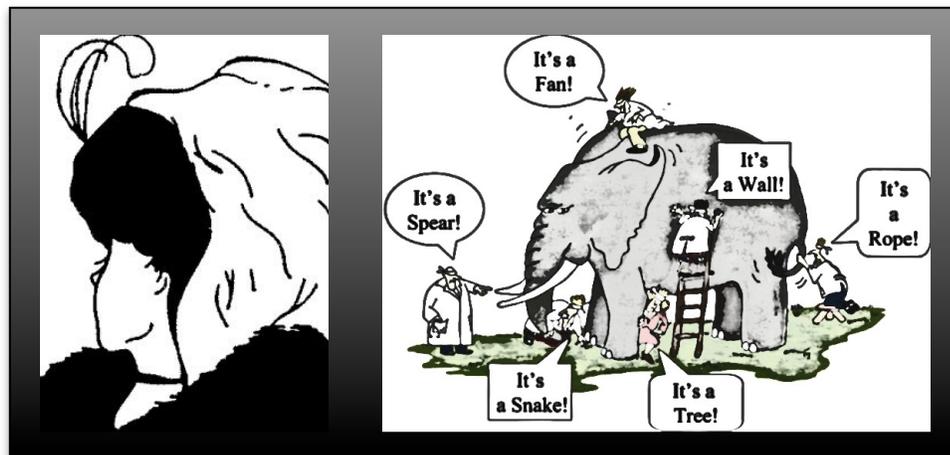
In sum, we may need to be considering the "whole" in order to clearly perceive the human mind, interactions and the determinants of agent behaviors, but this can only be considered an ideal. When we take into account only a piece of the serial chain, we are artificially and most often arbitrarily accentuating a piece of a whole, e.g. perceiving the old or young lady, e.g. a blind man believing that an elephant looks like a fan because he only touched the ear (figure 4.11.). The elephant or gestalt would be the simultaneous existence of multiple, seemingly paradoxical, truths but human perception would be confined to perceive only one side of the paradox (e.g. cognitively switching from the young to old lady). Even if we did use state of the art statistical techniques when studying mediation, our comprehension of the processes leading

up to (alcohol consumption) behaviors has been clearly limited by methodological constraints, as well as by our own cognitive capacity. As the present study was meant to foster thoughtful avenues rather than providing end-all responses, readers are invited to ponder possible implications of these observations on their specific fields or interests. Future works could fine-tune our theoretical standpoints, or recreate others, and provide additional empirical evidence, potentially with event level longitudinal data or statistical simulation studies.

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CONCLUSIONS

1. Review of studies and methods

Over four chapters, we studied the interrelationships of different levels of determinants of alcohol consumption among college students. This knowledge may allow researchers and practitioners to better understand the development of problematic drinking behavior among an at risk population. Furthermore, we took into account the social context of students by including two samples that differed across geographical location: France and Québec. In this manner, we were able to compare a North American setting to a European context while holding language constant. As sex and age have been known to impact alcohol consumption as well as the studied determinants, we controlled for these variables systematically throughout analyses. The determinants we decided to include in our analyses we chosen in order to reflect a continuum ranging from diachronic/dispositional to synchronic/contextual factors. In this manner we were able to appreciate the interaction between individual dispositions and motivated behavior contextualized within environment. Between these two extreme polls, we placed temporality, which has been described as a "dispositional-situational" variable. We were able to study how personality shaped temporality, and how temporality shaped motivation. There have been no studies on the topic to date, and we were able to advance the extent literature by placing the construct into an etiological framework. Finally, we were then able to take these levels together, and study the full serial chain: personality, temporality, drinking motives and drinking behavior.

We adopted a transversal quantitative study design. After having cleared the necessary ethical boards, we administered questionnaires online to student populations via social media and email diffusion lists provided by willing universities. The inclusion criteria were being a student aged 18 to 29, currently living in France or in Québec, fluency in French, and having drunk

alcohol at least once over the preceding year. Students answered questions about sociodemographic variables, alcohol use (Audit), personality traits (BFI-Fr) and drinking motives (MDMDQR). Two different measures of temporality were also included: the well-known ZTPI and the newly created TCT-5D, which we had designed to respond to specific limitations of the ZTPI. Two attention traps were set in order to control for random responses and over one hundred students were excluded because of their failure to respond correctly to these traps, which highlighted the importance of having included these questions in our study design. Participants who completed questionnaires were able to enter a lottery to win a 100$ or 100€ gift certificate to Amazon. The lucky winner was drawn in June 2017. 867 participants were used in subsequent data analyses. In chapters one to three, we studied two levels of determinants per chapter, which were then pulled together in chapter four. Each chapter was progressively more exploratory, and all in all, we concluded that the three chapters were intimately associated.

In chapter one, our primary objective was to study how personality traits developed into drinking motives. As chapter one was the most confirmatory, this was the only chapter where we were particularly interested in cultural differences. Before moving into the main analyses, decided to we study differences in mean across countries. We studied sample equivalency and found that the Canadian sample was older and had more women in comparison to the French sample. Total Audit scores did not differ across samples, but students in France scored higher on the hazardous use scale of the Audit. When looking into the individual items of the Audit, we found that those in France drank more drinks per occasion and had more episodes of binge drinking, but that students in Québec drank more frequently than those in France. Those living in Québec scored higher on extraversion, openness, conscientiousness and emotional stability. Those living in France scored higher on social, coping depression and conformity motives. This

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highlights differences in base line rates of dispositional and motivational constructs according to place of residency.

We carried out mediational analyses afterwards with the sample split according to place of residency. This allowed us to appreciate how personality traits developed into drinking motives within each cultural setting. All traits lead directly and/or indirectly to alcohol consumption, through specific drinking motives, suggesting that traits would led to alcohol consumption, but mostly just because they lead to drinking motives. Overall, there were more significant indirect effects among the French sample in comparison to the Canadian sample. However, these differences only concerned indirect effects stemming from extraversion, conscientiousness, and neuroticism. Interestingly, we found that extraversion was a protective factor among Canadians, but a risk factor among the French. This could be explained by the integration of drinking into French culture. More specifically, extraversion would protect against the development of coping depression motives among students living in Québec, whereas for those living in France, extraversion would develop into heightened enhancement motives. Once we partitioned out variance due to culture, we observed competitive mediation meaning that extraversion led to either increased or decreased alcohol consumption as a function of the emergent drinking motive. Neuroticism was another interesting example, in that the trait would develop into coping depression motives in both samples, but also into high enhancement and low conformity motives among the French, the later leading to decreased alcohol consumption. Taken collectively, these results highlight the importance of taking into account culture when studying how personality shapes drinking motives and consequently gives rise to drinking behaviors. As this chapter was quite confirmatory, we mainly advanced to the extent literature by investigating these cultural differences, by including all five traits and all five motives, and by using up-to-date statistical techniques.

The following two chapters aimed to place temporality between personality and motivation. As this was a novel goal in and of itself, we decided to use place of residency as a control variable alongside sex and age. In chapter two, our primary goal was to test the hypothesis that personality shapes temporality, which in turn gives way to drinking behavior. As we included two measures of temporality, one of which was brand new, we conducted supplementary analyses before moving into the main analyses. In an exploratory manner, we started off by studying bivariate relationships between traits, temporalities and total Audit scores. There was one particularly interesting finding raised by these correlations. TCT-5D past (learning from experience) and full present (engaging wholeheartedly in experience) were not related to alcohol consumption, but were strongly related to one another, and both of these dimensions correlated with "desirable" personality traits, suggesting that these dimensions of temporality could be pertinent to other behaviors aside from alcohol use.

All the other temporalities in both measures were significantly correlated with alcohol consumption and were carried over into regression analyses. In these analyses, some significant relationships disappeared, suggesting that common variance between temporalities would be responsible for significant effects observed in correlational analyses. This highlighted the effect of using different statistical analyses. The regression in which we entered in significant predictors issued from each instrument was interesting in that the relationship between ZTPI future and alcohol consumption disappeared once we accounted for TCT-5D anticipation. This suggested that accounting for short-term anticipatory capacity would be sufficient in tapping future projection when explaining alcohol consumption. Remarkably, our multi-measure approach was reinforced by recent research that suggested that only specific temporalities comprised in the ZTPI would be reliably related to drinking behaviors, and that it would be beneficial to take into account other temporalities by using other measures.

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We carried these temporalities over into mediational analyses (past negative, present hedonist, anticipation, and temporal rupture) as they were significantly related to alcohol consumption and because their relationship could not be explained by common variance between temporalities. We found that all traits led to alcohol consumption through a unique set of temporalities, and that all studied temporalities were significant mediators at least once. Interestingly, we observed two cases of competitive mediation, which could explain yet again the inconsistent and often contradictory results relating personality traits to drinking behaviors. More specifically, extraversion led to high present hedonism and low anticipation, which rendered the trait a vulnerability factor, but also to low past negative which had a protective factor function in regards to alcohol consumption. Similarly, neuroticism was a protective factor because it led to high anticipation, but also a vulnerability factor, because it led to high temporal rupture (a temporal coping mechanism). Both of these competitive relationships highlight the importance of taking into account temporality when studying relationships between traits and alcohol consumption.

In the third chapter, we looked into the last pair of determinants: temporality and motivation. This was entirely exploratory and was based in theory, as well as indirectly related experimental results. Thus, the fact that we found any significant mediational relationships in this chapter was interesting in and of itself, as there have been no studies on relationships between drinking motives and temporalities. Once again, unique indirect effects were observed in each of the four personality traits on alcohol consumption through drinking motives. Temporal rupture, past negative and low anticipation were uniformly vulnerability factors, whereas a case of competitive mediation was observed in the case of present hedonism. This was interesting in that present hedonism was initially deemed the ZTPI dimension that was the most reliably and

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strongly related to alcohol consumption, whereas we found that the temporality had a protective

quality through its negative relationship with coping depression motives.

In chapter four we took a step back, reflected and re-examined mediation as a whole. We

pondered the meaning of mediation, causal relationships, and ideals of respecting assumptions in

mediation analyses. We compiled the results from chapters one to three, and generated

hypotheses about serial mediation using different forms of logic that were more or less grounded.

We advanced and validated the hypothesis that in some cases we must take into account the full

serial effect in order for mediational relationships to appear and dubbed the phenomenon

proximal or distal indirect only serial mediation. In some cases, we had to take into account

proximal factors, whereas in others we had to account for distal factors in order to obtain positive

results. This was most clearly exemplified with proximal only mediation involving past negative

perspective because past negative was not directly related to alcohol consumption, but significant

effects appeared in the serial context, through drinking motives. Ultimately, this chapter

quantified in part our lack of respect for the ideal assumptions of mediational analyses because

we were only able to take into account two levels of determinants previously. We went ahead

extended the applications of logic behind our findings in and out of clinical psychology, in hopes

of sparking novel ways of conceptualizing mediation in our days and in the future.

2. Limitations

In chapters one to three, our work was limited in a number of ways, some of which were

quantified and explained in length in chapter four. As aforementioned, we did not respect the

ideal conditions of application for mediational analyses. We excluded variables from our

analyses relating both to individual differences (e.g. alcohol expectancies), and environmental

factors (e.g. access to alcohol). We could have added in more "intermediary" factors or "distal"

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factors and we could have added in more co-variates (e.g. socio-economic status) in order to partition out more variance due to confounders. Excluding such variables from our analyses over simplified the etiological framework that we proposed. Temporality may have been over-simplified, as we only took into account the temporalities comprised in two different measures. In this realm, another limitation related to the questionable status of temporality. We made a theoretical case that temporalities would be situated between a disposition and a motivational variable, but we could only really ground this hypothesis for the ZTPI. As for the TCT-5D, it is possible that certain temporalities, notably temporal rupture, would be on the same etiological level as drinking motives especially because the included items explicitly cited substance use, as did drinking motives, and temporal rupture was defined as a coping mechanism, as were coping depression motives. Furthermore, the TCT-5D has not been amply validated and might not have been a perfect operationalization of the desired constructs.

Continuing on with the validity of our measures, we must cite that even if all measures were validated in French, they were validated among people living in France, but not among francophone Canadians specifically. Even if the French language was held "equal", French in France and French in Canada is indeed different, and the factorial structure of constructs may have differed across cultures. This was however tempered by the fact that some of measures used (e.g. MDMQR) were studied in English speaking Canadian samples. The interpretation of questions may have differed according to culture, but we were not able to know if this was the case, and if so in what ways or to what point. The only measure that was validated specifically among people from Québec was our TCT-5D and it was our own doing.

There were several limitations tied to our sampling methods and to our definition of sample characteristics. First of all, we did not use randomization at any point. There may have been specific types of people that were drawn to answer our questionnaire. The monetary prize

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may have motivated some, whereas others may have been particularly keen on filling out questionnaires online. Women notably seemed to be more motivated to respond to questionnaires than were men, as was exemplified by the disproportionate representation in sexes. Speaking of sexes, we only asked about sex, not gender identity, which was a potentially offensive oversimplification. However, we could only include binomial variables as controls with the methods employed which is why we decided to oversimplify the construct. Furthermore, "place of residency" simplified the construct of culture because we coded where students were currently living instead of their background of residency places or nationality. We adopted a transversal design. Ideally, we would have done a longitudinal cohort study from birth into young adulthood, which would have been advantageous in many respects. For example we would have been better control for cultural aspects and to better reflect the temporal ordering of determinants for example. Nevertheless, such a design would have been very costly.

Our measure and analysis of alcohol consumption was also limited. We only used self-report measures of alcohol consumption, which may have provoked bias, and this critique goes of course for all of our self-report measures. For example, social desirability may have impacted our measurements, but was not assessed. The Audit measures alcohol consumption over the preceding year but people may have not been good at estimating their own consumption and may have incorrectly estimated how much they drank over the entire year, privileging recent memories of alcohol consumption behaviors. We did not split up the Audit into different sub-scales, which hindered the quality of interpretations that were drawn. For example some motives would lead directly to problems, whereas others would lead indirectly to problems, through alcohol consumption or to hazardous use but not to problems... Furthermore, from an epidemiological or clinical standpoint, it may be hard to interpret total Audit scores as a continuous variable. We could have for example used the Audit-C and spoken about exclusively

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about hazardous use or coded the Audit as binomial variable using clinically relevant cut-offs. For example, the difference between a score of one versus two would not be the same as the difference between six and seven. Studying binge drinking specifically may have been interesting because we focused on student populations who notoriously engage in the behavior. We could have also focused on event-level analyses or on drinking during the week versus on the weekend. However, we judged that taking all of this into account would have been too complex and we decided to code the Audit as a continuous variable. Also the DSM 5 criteria for AUD take into account a continuum of severities, which could be conceptually paired with the interpretation of continuous Audit scores.

Our measure of drinking motives was also limited. Coping anxiety motives did not seem to be clinically pertinent and may have created noise when added into models in chapter one. We ended up justifying their exclusion in chapter two in order to clean up our models, but this also made it so that motives were not accounted for in the same way across all chapters. Furthermore, even if a four or five factor measure of motives has the best factorial fit, there may have been issues with multicollinearity between approach motives (social and enhancement), which have a high correlation between them. This high correlation is however theoretically justified and consequently accepted when conducting research on the topic.

As described in length in chapter four, statistical analyses were limited in our use of PROCESS v2 because we were only able to account for multiple parallel mediators *or* multiple sequential mediators but not both at the same time. Co-variance between distal factors included in a given chapter was not taken into account. When studying serial mediation, we could not account for covariance between factors on the same level.

Furthermore, we relied on a purely quantitative design, which has extensive limitations in and of its self. Using a mixed design may have helped better grasp the meaning and clinical

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pertinence behind our results. It would have been interesting to conduct structured qualitative

interviews assessing desired constructs and trajectories. We could better account for life events

and the singularity of our participants rather than adopting a purely nomothetic approach. In this

manner, we could have better accounted for aspects that are not entirely consciously accessibly to

our participants and contrasted findings obtained by each methodological design. For example,

technically we measured "reasons to drink" instead of "drinking motives" because the former

only applies to what is consciously accessible, whereas the later incorporates aspects that would

not be accessible consciously. That being said, we had three years to complete this project.

Adding in all of these aspects would have expanded the project beyond what was feasibility

possible.

3. Take home messages and applications

Drinking behaviors do not arise out of the blue. There would be specific processes

leading up to alcohol consumption that can be figured into etiological frameworks. For example,

we could look at personality traits as protective or vulnerability factors, but mostly just because

they lead to specific drinking motives. When working with kids who do not yet drink alcohol, we

can observe their personality traits and be attentive as to how these traits give rise to drinking

motives when they come of age. However, before motives arise, we would be able to observe

how their personality shapes the way that they relate to time. Being attentive to this transition

would inform us that much more about the probability observing subsequent drinking motives. If

we were working with a pre-teen for example, we could focus more on temporality because it

would incorporate personality and be a more proximal determinant of different drinking motives.

Once young people become interested in alcohol consumption and start drinking, we can assess

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why they do so by looking at drinking motives and foresee the drinking patterns that would most likely arise.

Being able to understand the interplay of temporally ordered determinants could help practitioners tailor their interventions to the age of participants. For example, if a risky trait or later on, temporality, is observed, clinicians could work with their clients in order to positively impact the serial chain before problems with alcohol develop. When working with pre-teens, adolescents or young adults who already have a problematic relationship with alcohol, clinicians could act on different levels. Targeting motivation would have the most impact because they are the most proximal determinant. However, talking directly about drinking motives or behaviors might not be well accepted by young clients. In such cases, clinicians could talk about temporality instead in hopes of indirectly impacting drinking behaviors. Such a technique might heighten the chance of achieving and maintaining a therapeutic alliance.

We found that all the different levels of determinants studied were interrelated, and that all the different dimensions within a given level were meaningfully related to alcohol consumption (except coping anxiety). By extension, clinicians could choose the best levels and dimensions to act on as a function of their specific client, which could add flexibility to the clinical approach. For example, if a client has a high tendency towards present hedonism, clinicians could valorize how the temporality can lead to positive emotions and lead their client towards healthy ways of engaging in short term pleasures (e.g. sports teams). Alternatively clinicians could reinforce their client's capacity to anticipate the consequences of their behaviors. With clients who score high on present hedonism, clinicians could also act on the level of approach drinking motives with their clients and help them find other ways of achieving positive affect. This may help more young people "mature out" of heavy alcohol use before serious problems develop and become more responsible when moving into adulthood.

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Our findings could also help inform public policy targeting the prevention of problematic alcohol consumption among youth. We should be taking into account culture instead of generalizing campaigns uniformly across countries because the efficacy of specific techniques could differ across cultures. For example, in France, we saw that students were more likely to be neurotic and it may be particularly pertinent to target drinking to cope. We could for example stigmatize coping motives or drinking alone by putting up posters at universities. People living in France would have to deal with the normalization of drinking behaviors and it might be particularly beneficial to teach pre-teens to how to say no to alcohol consumption and feel good about doing so. We could also teach youth to not pressure their pairs to use alcohol in order to be "cool" and try to detangle sociability or popularity with drinking behaviors. Such an approach might be less effective in Québec because it would be less pertinent. Instead, we could focus on drinking frequency or how drinking behaviors can be detrimental towards their long-term goals. It may also be particularly pertinent in France to offer up free alternative social activities that do not involve alcohol consumption. This may help dissociate socializing from alcohol consumption.

4. Future directions

Though our study advanced the extent literature, there is still so much work to be done. First, we could investigate the reliability of our findings within student populations in France and Québec. If our findings prove to be reliable in these samples, we can extend our findings to other settings (i.e. enhance external validity).   We could take interest in students that are part of special populations in France or Canada (e.g. native Canadians), students living in other countries (e.g. China) or to students people who change culture (e.g. immigrants, ERASMUS students). Reaching beyond students, we could study young people who have entered into the workforce,

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those without a job or those who are homeless. We could also look into other age groups such as children or adults over the age of 30. Instead of looking at hazardous or low levels problematic alcohol use, we could focus on those who have developed serious problems with alcohol consumption or those who have diagnosed with an alcohol use disorder. For example, we could study the evolution of our determinants before and after an intervention targeting problematic alcohol consumption. Researchers could also modify our study design or measures in order to evaluate the impact of our operationalization. For example, as stated earlier, a longitudinal design or using multiple (or different) measures of our constructs might better tap the factors and the "causal" relationships of interest. As mentioned beforehand, using a mixed or qualitative design could also be useful.

The etiological processes proposed in our studies excluded many intermediary levels of determinants. Further works could insert more levels of determinants like alcohol expectancies or the availability of alcohol. This would allow us to further understand the specific pathways leading to drinking behaviors and better respect assumptions of mediational analyses. Others could also look into moderated mediation especially in light of the findings in chapter one. In other words, the associations between determinants observed in this study may be stronger or of a different sign among people living in specific places of residency. By extension, the strength or direction of observed indirect effects may vary according to other variables like sex or age.

We could also reach beyond alcohol consumption and study other addictive behaviors such as cannabis use or multiple addictive behaviors, such as cigarette smoking paired with alcohol consumption. Behavioral addictions such as gambling could also be studied as outcomes, as well as less pronounced "addictive" behaviors such as video game playing. Compulsive shopping, binge eating or anorexia might also be considered. In this manner, we could observe how the interplay of determinants differs across addictive behaviors.

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Beyond addictive behaviors, we could also study other clinical outcomes. As mentioned earlier, it might be particularly interesting to study reactions to negative or traumatic events but in that case, we would have to some other proximal outcome instead of motivation towards addictive behaviors. While we are talking about higher order extensions, we could extend our "serial only" mediation into other domains such as the medical field. We could also extend our statistics into other mathematical realms. Moving forward, we should continue incrementally adding complexity into models while checking for internal and external validity along the way. As this will inevitably become complicated quickly, we could work on our statistical techniques and methods (e.g. PROCESS v3 and beyond), as well as our capacity for massive data collection. We could create advanced algorithms that complete our work for us, but researchers may be cautioned against such advances, as they would eventually put us out of our jobs.

Annexes

(CV and unpublished articles)

Tianna Loose

Doctorante contractuelle, psychologue clinicienne

Tianna.loose@univ-nantes.fr

27 ans

Sélection des Expériences professionnels

Attaché Temporaire d'Enseignement et de Recherche (ATER) à l'Université de Nantes

Septembre 2017-aujourd'hui

Enseignement en Psychologie Clinique à l'Université de Nantes

Septembre 2015-Juin 2017

> Introduction à la Psychologie Clinique (Licence 1 - TD) : 2015, 2016
>
> Les courantes de la Psychologie Clinique (Licence 1 - TD) : 2016, 2017
>
> Psychopathologie (Licence 2 - TD) : 2016, 2017
>
> Supervision des TER, thème addiction (Master 1 - séminaire, encadrement) : 2015 - 2017

Vacataire à l'Université de Nantes, France

Octobre 2013 - Juin 2014

> Cours de soutien, licence 3 de psychologie, pour une étudiante en situation d'handicape

Aidant à domicile, couple en situation d'handicape moteur, Nantes, France

Aout 2013 - Septembre 2013

> Transferts, douche, toilette, cuisine, ménage etc.

Coordinatrice des Programmes Marketing à The Chief Marketing Officier Council, en télétravail

Septembre 2010 - Octobre 2012

> Vieille des statistiques et d'intelligence marketing – BtoB, niveau VP, CMO
>
> Gestion de contenu des sites internet rattaché à l'entreprise (e.g. Collaborate to Innovate)
>
> Création de listes de contacts, cadres ciblés

Tutrice d'Anglais à Sherwood Formation, Nantes, France

Avril 2011 - Aout 2011

> Intervenant pour élèves, niveaux 1- 4

Garde d'enfant à Nantes, France

Septembre 2009 - Juin 2010

> Enseignement d'anglais ; accompagnement aux devoirs et aux activités divers

Tutrice de Mathématique à Santa Cruz High School, California, USA

Septembre 2006 - Aout 2007

> Enseignement de mathématique aux particuliers : algèbre, algèbre avancé et géométrie

Leveur de fonds à Environment California, Santa Cruz, California, USA

Juin 2006 - Aout 2006

> Sollicitation porte à porte pour la défense de l'environnement

Éducation

Contrat doctoral, Région Pays de la Loire, codirection France-Canada

Titre : Mediational models of alochol use among French and Canadian college students : personnality traits, time perspectives, drinking motives. Décembre 2017 : Soutenance prévue

2015-2017 : Université de Nantes, Laboratoire de Psychologie des Pays de la Loire

Cours (18h) : How to write and publish your research paper

Séminaire (90h) : Centre d'Information, de Recherche et de Consultation sur les Expériences Exceptionnelles

2014-2015 : Université à Québec à Montréal : Programme PhD, PsyD ; Laboratoire des études sur la personnalité

Cours (336h) : Approche cognitive et comportemental (séminaire, évaluation, intervention) ; Psychologie Personnalité ; Statistiques (SPSS) ; Méthodes de recherche en intervention ; Déontologie. (GPA : 4.0)

Université de Nantes, UFR Psychologie, France

2013- 2014: Master 2 Psychologie Clinique et de la Santé, diplôme professionnelle ; titre du psychologue clinicienne

Mémoire de recherche : *Les déterminants biopsychosociaux de la qualité de vie des patients diabétiques*, mention très bien

Rapport de stage : *L'adaptation à la complexité : l'approfondissement d'une pratique clinique au chevet de malade*, mention très bien

Activités : Élue pour représenter les étudiants en Master et Doctorat au conseille de faculté Fondation 1ère association étudiant en Psychologie à Nantes ; poste de secrétaire

2012 – 2013 : Master 1 Psychologie clinique (majeur) et cognitive (mineur), mention très bien

Mémoire de recherche : *Validation psychométrique du M DMQ R : La motivation comme prédicteur de l'usage d'alcool et les problèmes associés*, mention très bien

Rapport de stage : *Psychiatrie de Liaison : l'adaptation à la complexité*, mention très bien

2009 – 2012 : Titulaire d'une licence en psychologie avec mention

Rapport de recherche : *Les traits de personnalité (Big 5) et le choix d'orientation théorique chez les psychologues Français,* mention très bien

Centre Hospitalier Universitaire (CHU) de Nantes, France

2012 –2013 : Hétéro-évaluation de complexité biopsychosocial utilisant l'INTERMED, visant l'accord inter-juge

Institut de Recherche et de Formation en Français Langue Etrangère, Nantes, France

2008 –2009 : Français comme langue étrangère (niveaux 4, 5, 6), avec mention

Titulaire **DELF B2** (Diplôme d'études en langue française)

Cabrillo College, Santa Cruz, California, USA

2005 – 2007 : Français (niveaux 1-3), Espagnol (niveau 5), Philosophie, Ethique. Avec mention

Santa Cruz High School, Santa Cruz, California, USA

2004 –2007 (36 mois) : Titulaire d'un High School Diploma, avec mention et avec saute d'année

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Stages

Psychologue Stagiaire au Centre Hospitalier Universitaire (CHU) de Nantes, France

Unité de Cardiologie et de Transplantation thoracique

Janvier 2014- Juillet 2014

Unité de Psychiatrie de Liaison du Pôle Universitaire d'Addictologie et Psychiatrie

Octobre 2012- Juillet 2014

Réalisation d'entretiens cliniques autonomes en multiples services de médecine

Co-animation des séances d'éducation thérapeutique (colostomies définitives ; insuffisances cardiaques)

Animation des séances de photo-langage (douleur chronique)

Études sur la complexité biopsychosocial, contexte mono-centrique et multicentrique

Assistante de Recherche au Laboratoire de Psychologie des Pays de la Loire, Nantes, France
Mai 2012 - Juillet 2012 (3 mois)

Création d'une base de données d'instruments psychométriques validés en Français, évaluant les addictions

de processus

Développement d'un projet de recherche étudiant l'alcool chez les jeunes

Mise à jour des informations sur les stages en psychologie clinique

Stagiaire en Psychologie Sociale à l'Université de Nantes, France

Mai 2011 - Janvier 2012 (8 mois)

Assistance à la rénovation de matériel et aux passations

Développement d'un projet de recherche visant le sexisme dans le recrutement

Stagiaire en Marketing International à The Chief Marketing Officer Council, Palo Alto, California, USA

Juin 2010 - Aout 2010 (3 mois)

Initiation à la coordination des programmes et à la veille marketing

Stagiaire en Education Spécialisée à The Bay School, Santa Cruz, California, USA

Juin 2010 - Aout 2010 (3 mois)

Observation de l'analyse de comportement appliqué (ABA) : adolescents autistes, modérés à sévères

Réalisation de documentaires exposant la progression des programmes individualisés

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Compétences

Langue : Anglais (langue maternelle), Français (bilingue), Espagnol (compréhension d'écrit)

Informatique : Connaissances approfondies en Microsoft Word, Excel, Powerpoint, Zotero, SPSS, AMOS, LimeSurvey ; Netvibes ; connaissance de Rcmdr, Microsoft Outlook, Systèmes de gestion de contenu (CMS), Google Surveys; bases de XHTML, Optimisation de moteurs de recherche (SEO)

Sport : Athlétisme (10 ans), Formation au sauvetage aquatique (9 mois 3h/j), Formation de survie en nature (1 mois en situation de survie), Equipe de natation (4 ans), Equipe de Water polo (2 ans), Equipe d'athlétisme (1 an)

Communications scientifiques

Articles scientifiques avec comité des lectures

 - Publiés -

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 - Articles de thèse -

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Robiou du Pont, L., **Loose**, T., Acier, D. Consommation problématique d'alcool chez les jeunes : implications des traits de personnalité et des perspectives temporelles**,**

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Annex 2: Drinking motives as mediators between personality traits and problematic alcohol use among young French people

Abstract

Introduction: In order to positively impact drinking behaviors among French young people, it is beneficial to understand interrelationships of various determinants of drinking behaviors. Bivariate relationships between personality traits and alcohol consumption were a popular research topic of the past. Since, studies have suggested that personality traits only had associations with drinking behaviors because traits led to different drinking motives. We aim to investigate if such mediational relationships are present among French young people. *Methods*: Participants (N=690; M_{age}=20.8, SD_{age}=2.8) were administered the Alcohol Use Disorders Identification Test, the Modified Drinking Motives Questionnaire-Revised, and the Big 5 Inventory-French. Five multiple parallel mediator models were elaborated in order to appreciate which drinking motives mediated the relationship between each trait and alcohol consumption once having controlled for age and sex. *Results*: Enhancement, social and conformity motives mediated the relationship between extraversion and alcohol use. The indirect effect between agreeableness or conscientiousness and alcohol use was mediated by decreased coping-depression, enhancement and social motives. Interestingly, neuroticism alone did not predict alcohol consumption, but a case of competitive mediation was observed. Neuroticism led to

heightened coping-depression motives, which led to increased alcohol use, but also to increased conformity motives, which led to depleted alcohol consumption. *Conclusions*: Our study suggests that most Big 5 personality traits have a relationship with alcohol consumption because they develop into drinking motives. Prospective studies could focus on techniques targeting motives rather than traits. The interrelationships of determinants could be further understood by the identification of other intervening mediators.

Keywords: alcohol, drinking motives, personality

1. Introduction

1.1. Problematic alcohol use in France

Problematic alcohol use is an international public health concern and reportedly 16% of 18 to 29 year olds have been diagnosed with an Alcohol Use Disorder (American Psychiatric Association, 2013). In France, in the region Pays de la Loire where this study was conducted, alcohol consumption often starts at a young age, as drinking is strongly integrated into French social culture. For example, 91% of 15 year olds reportedly have consumed alcohol at least once in their lifetime and all 18-19 year olds reported having done so. In comparison to young women, young men tended to start drinking at an earlier age and to consume alcohol at a higher frequency and intensity. For example, 53% of young men aged 18-25 binge drank at least once a month, whereas this was true for 22% of young women (ORS Pays de la Loire, 2012). In light of the

prevalence of problematic alcohol use and the gravity of its consequences, it is crucial to understand the determinants of problematic drinking behavior, especially among young people.

1.2. Personality traits as determinants of alcohol consumption

Personality traits, notably those included in the Big 5 model, may determine alcohol consumption behaviors. At least 24 studies previous have looked into bivariate relationships between traits and alcohol related outcomes. A meta-analysis conducted on such studies found that emotional stability, conscientiousness and agreeableness were associated with depleted alcohol consumption across studies (Malouff, Thorsteinsson, Rooke, & Schutte, 2007). However, every personality trait has been significantly associated with alcohol related outcomes in at least one study and each has trait yielded null findings in another. For every trait, there is at least one study that revealed a positive and negative relationship with alcohol consumption. Furthermore, when significant effects were found, they were weak (2-4% of variance explained) suggesting that there are many other variables that were not measured determinant of alcohol consumption. Such inconsistencies may be explained in whole or in part by the intervention of other more proximal variables (i.e., mediators) such as alcohol expectancies or drinking motives.

Drinking motives are thought to be the most proximal predictive factor of drinking behavior in which all other distal factors converge (Kuntsche, Knibbe, Gmel, & Engels, 2005). According to Cox and Klinger's framework (1988) that outlined the processes leading up to drinking behaviors, distal factors (e.g., personality traits) gave way to proximal factors (e.g., motives) that in turn determine drinking behaviors. In this framework, drinking motives were defined by the valence of the anticipated reinforcement: some people drink in order to reduce negative affect (e.g., drinking when sad), while others drink in order to increase positive affect

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(e.g., drinking at parties). This conceptualization of drinking motives was operationalized and complexified by Cooper (Cooper, 1994; Cooper, Russell, Skinner, & Windle, 1992) who elucidated that motives can also differ according to the source of reinforcement, which can be either internal (psychological) or external (social). By crossing the source and the valence of reinforcement in a 2 x 2 cross-table (source x valence), four motives to drink were rendered: *social* (positive, external), *coping* (negative, internal), *conformity* (negative, external) and *enhancement* (positive, internal). More recently it was suggested to split coping motives into two distinct dimensions according the specific type of negative affect that they were destined to reduce, be it anxiety or depression (Grant, Stewart, O'Connor, Blackwell, & Conrod, 2007).

Research generally has shown that social motives lead to heightened frequency of alcohol consumption, but not necessarily to alcohol related problems. Those who drink for enhancement motives do so in order to spice things up. This often leads to heavy alcohol consumption and can become problematic because with this internally driven motive, there may be a wide variety of situations that merit a boost. Conformity motives led to decreased alcohol use, but supposedly to increased problems. People who drink for these motives personally may not want to drink, but they do so on specific occasions in which they think they need to drink in order to obtain social acceptance. Generic coping motives are consistently the most problematic of drinking motives and have led to a variety of hazardous drinking behaviors (Cooper, 1994; Kuntsche et al., 2005). Coping depression motives were related to increased alcohol use and related problems, but findings were inconsistent regarding the relationship between coping-anxiety motives and drinking behaviors (Grant et al., 2007; Mezquita et al., 2011; Loose & Acier, 2017). Among young French people, social, enhancement, and coping-depression motives led to increased

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alcohol consumption, conformity motives led to decreased alcohol use and coping anxiety motives were generally unrelated (Loose & Acier, 2017).

1.3. Drinking motives as mediators between traits and alcohol use

Bivariate relationships between drinking motives and personality traits have been the subject of many works, but researchers often leave out or gloss over discussions about mediation (e.g. Theakston, Stewart, Dawson, Knowlden-Loewen, & Lehman, 2004). Nevertheless, several studies have concluded that motives mediate the relationship between personality traits and alcohol consumption, but again specific findings are inconsistent. For example, Hussong (2003) found that coping motives explained the relationship between neuroticism and drinking behavior, whereas social or enhancement motives mediated the relationship between extraversion and alcohol consumption. Conversely, Stewart and Devine (2000) found that external motives (social and conformity) were unrelated to Big 5 personality traits. Enhancement motives have mediated the relationship between low conscientious and alcohol consumption in multiple studies (Kuntsche, von Fischer, & Gmel, 2008; Stewart & Devine, 2000; Stewart, Loughlin, & Rhyno, 2001). In Stewart's studies (2000, 2001), neuroticism expectedly led to increased alcohol use and this relationship was partially mediated by coping motives. On the other hand, Kuntsche et al. (2008) surprisingly found that high neuroticism predicted decreased alcohol use, but also increased coping motives, which in turn led to inflated alcohol consumption. Mezquita et al (2010) found that low conscientiousness or neuroticism predicted coping anxiety motives whereas coping depression motives were only predicted by the later. Generally speaking, internal motives (coping, enhancement) should be more in line with traits than are external motives (social, conformity). For example, among Canadian college students, more variance is explained

by adding personality traits to the models explaining internal drinking motives (6-11%) than when explaining external drinking motives (3%) (Theakston et al., 2004).

Specific methodological differences may in part be responsible for inconsistent findings. Notably, these studies did not necessarily measure all five motives and five traits (e.g., Stewart, Loughlin, et al., 2001), and the conditions for mediation, when present, were based on the classic causal steps approach (Baron & Kenny, 1986) which has important limitations that may have led researchers to discard some viable solutions. For example, in Stewart and Devine (2000), because extraversion did not directly predict drinking behaviors, the authors stated that they could not perform mediational analyses involving this trait. More recently, indirect only mediation has become part of the extent literature and statistical methods (Hayes, 2013). Furthermore, there are no studies to date that investigate this topic among French populations and cultural differences may be observed. Taking into account these limitations of the extent literature, this study aims to reveal which motivations, if any, mediate the relationship between each personality trait and alcohol consumption while controlling for participant age and sex. In this manner, we aim to investigate new possibilities, such as indirect only or competitive mediation, by using recent advances in mediational analyses.

2. Methods

2.1. Population and procedure

University and high school students filled out a larger set of questionnaires that included the Drinking Motives Questionnaire Revised in French (Loose & Acier, 2017), the Five Factor Inventory French (Plaisant, Courtois, Réveillère, Mendelsohn, & John, 2010) and the Alcohol

Use Identification Test (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001) among other measures. University students were recruited online via social networks and student email diffusion lists. High school students were administered the questionnaires during school hours. Questionnaires were still administered online using the secure platform LimeSurvey, but groups of adolescents met us in their computer lab and filled out the questionnaires in that context. Additionally, for high school students their parents were alerted of study and could exclude their child if they so wished. For all participants data was collected anonymously and participation could be interrupted at any time. The procedure followed in this study complied with French ethical standards for non-interventional research.

2.2. Measures

The *Modified Drinking Motives Questionnaire Revised* (MDMQR) was first validated among English-speaking Canadians (Grant et al., 2007, 2009) and has since been validated in French (Loose & Acier, 2017). This questionnaire was chosen because of its groundings in Cox and Klinger's theories (1988) and because it more finely taps coping motives than models based on 2, 3, or 4-factor conceptions. The MDMQR has 5 dimensions (social, conformity, enhancement, coping anxiety, coping depression), 28 items and takes approximately 10 minutes to administer. An elevated score on a given dimension indicates that the participant is motivated to drink for the corresponding motive.

The *Alcohol Use Identification Test* (AUDIT) was originally validated in the United States (Babor et al., 2001) and has since been validated in France (Gache et al., 2005). The French version is internally consistent ($\alpha=0.87$) and has good specificity and sensitivity when predicting

various alcohol use behaviors. A recent study carried out in England among 18-35-year-olds demonstrated that the AUDIT has good to very good accuracy in detecting hazardous drinking, DSM-IV alcohol dependence and DSM-5 AUD (Foxcroft, Smith, Thomas, & Howcutt, 2015). Furthermore, a systematic review demonstrated that the AUDIT is the best questionnaire for tapping problematic alcohol use among existing screening self-report questionnaires (Fiellin, Reid, & O'Connor, 2000). An elevated total score indicates increased risk of problematic alcohol use. The AUDIT contains 10 items and takes 2 minutes to administer.

The *Big Five Inventory French* (BFI-Fr) was used to measure personality traits. Plaisant et al. (2010) found that the questionnaire had good psychometric proprieties among young French people. The questionnaire had 5 dimensions, 45 items and takes about 10 minutes to administer. After reverse coding necessary items, elevated scores relate to increased openness, extraversion, conscientiousness, agreeableness or neuroticism, whereas low scores relate respectively to closedness, introversion, undirectedness, antagonism or emotional stability.

2.3. Overview of data analysis

A series of five parallel mediator models were elaborated using SPSS and the macro PROCESS (Hayes, 2013). In a given model, one personality trait was entered as a distal factor (X), the five motivations as multiple parallel mediators (M_i), and the total AUDIT score was entered as the outcome (Y); we systematically controlled for sex and age. This analytical technique reached beyond Baron and Kenny's causal steps approach (1986) in several ways. Notably, there was no need for the direct effect X→Y to be significant in order for mediation to have occurred which allowed us to possibly detect cases of indirect only or competitive mediation. Bootstrapping was used instead of the Sobell z-test which has the advantage of not

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operating on the assumption that path a*b is normally distributed. Also, effect sizes and contrasts of the indirect effects can be reported rather than merely speaking of partial and full mediation (Hayes, 2013).

3. Results

550 University students (M_{age}=21.65, SD_{age}=2.45; women: n=394, 72%) and 140 high school students (M_{age}=17.46, SD_{age}=1.40; women: n=77, 55%) participated in this study. A series of Ordinary Least Squares regression analyses were conducted in order to draw up five parallel mediator models (Figures 1-5). Path a_i was determined by a regression that included one personality trait, age and sex as predictors of one motive. Path b_i was determined by a regression that included all five motives, a personality trait and control variables as predictors of total Audit scores. The direct effect of a personality trait on alcohol use (X→Y) while controlling for age and sex relates to path c, and path c' describes the effect of X on Y while controlling for all motives and control variables. The significance of indirect effects was determined using confidence intervals calculated using 20,000 bootstrapped samples; results pertaining to indirect effects are displayed in table 1. When multiple significant indirect effects were revealed, contrasts of effect sizes were figured. The following paragraphs detail each of the five multiple mediator models (Figures 1-5) and should be considered in conjunction with the results figured in table 1.

Extraversion directly predicted total AUDIT scores when controlling for age and sex (R^2=0.11). Extraversion was associated with increased social (R^2=0.04) and enhancement motives (R^2=0.06), as well as depleted scores on the conformity scale (R^2=0.03). When motives were added into the regression model, social, enhancement, coping depression and conformity

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motives all significantly predicted AUDIT scores; 44% of variance was explained. The indirect

effect of extraversion through enhancement, social or conformity motives was significant. The

size of the indirect effect through enhancement motives was significantly greater than that of

social or conformity motives (Figure 1, Table 1.1.).

Figure 1: Drinking motives as mediators between Extraversion and alcohol consumption
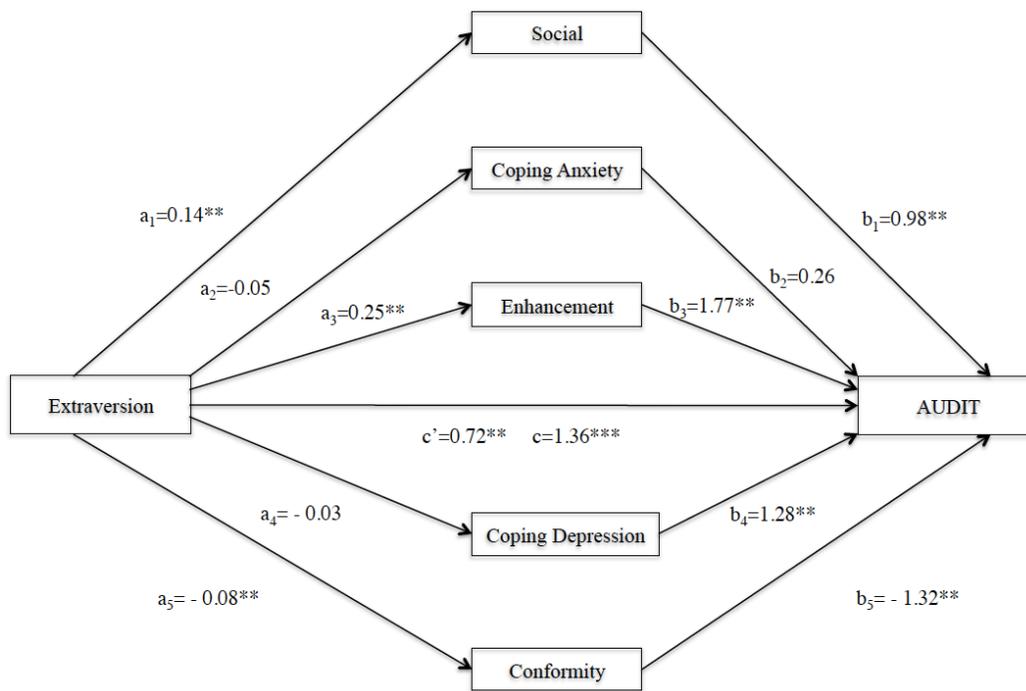
Agreeableness was directly associated with decreased alcohol consumption once having

accounted for sex and age (R^2=0.07). This trait significantly predicted diminished social

(R^2=0.03), enhancement (R^2=0.03) and coping depression (R^2=0.02) motives. With all motives

and control variables entered into the model, 43% of variance was explained. The indirect effect

of agreeableness was significant through enhancement, social and coping depression motives.

Enhancement motives accounted a greater amount of the indirect effect than did coping depression motives (Figure 2, table 1.2).

Figure 2: Drinking motives as mediators between Agreeableness and alcohol consumption
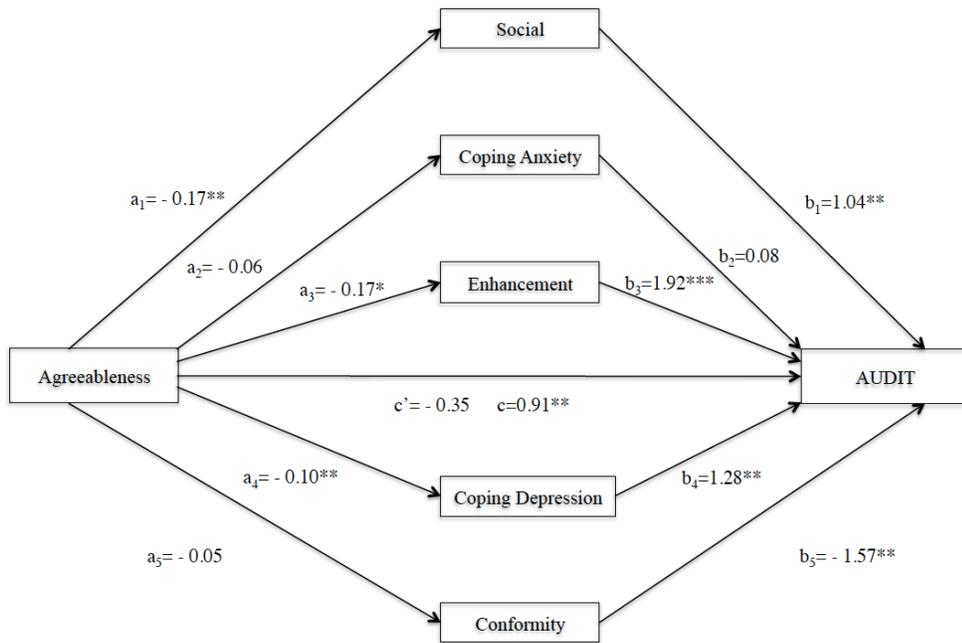
Conscientiousness was directly associated with depleted AUDIT scores when controlling for age and sex ($R^2=0.10$). This trait was associated with decreased social ($R^2=0.03$), coping anxiety ($R^2=0.02$), enhancement ($R^2=0.05$), and coping depression ($R^2=0.02$) motives. With all studied variables added into the model, 44% of variance was explained. The indirect effect of conscientiousness through enhancement motives was the biggest, followed by social or coping depression motives (Figure 3, table 1.3).

Figure 3: Drinking motives as mediators between Conscientiousness and alcohol consumption
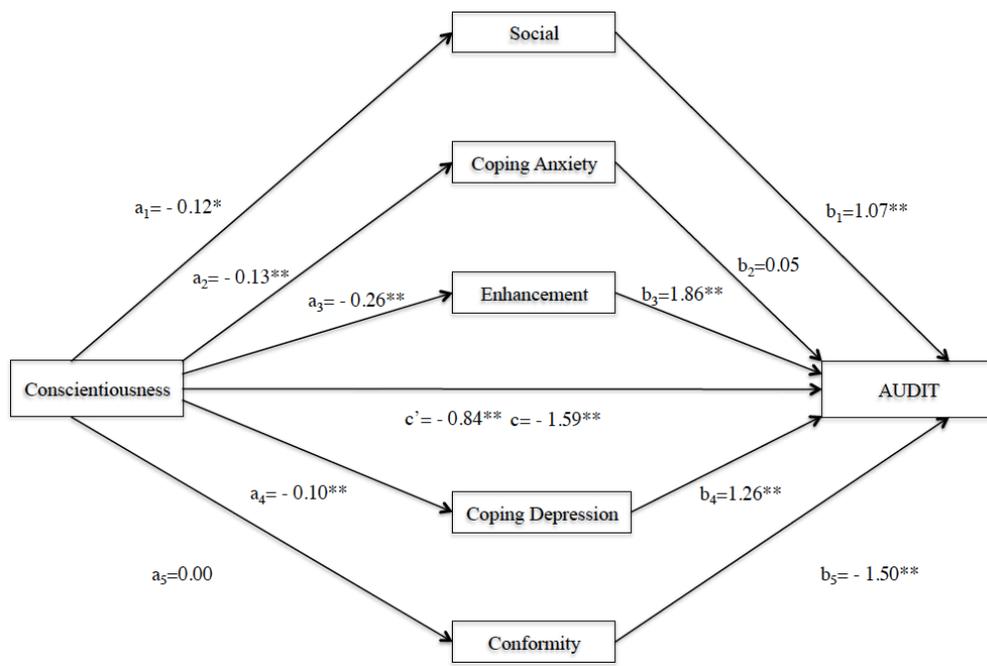
Openness did not significantly predict Audit scores when controlling for age and sex. The only MDMQR scale that was significantly associated with openness was coping anxiety ($R^2=0.01$). With all studied variables added into the model, 43% of variance was explained. No cases of indirect only mediation were found (Figure 4, table 1.4.).

Figure 4: Drinking motives as mediators between Openness and alcohol consumption
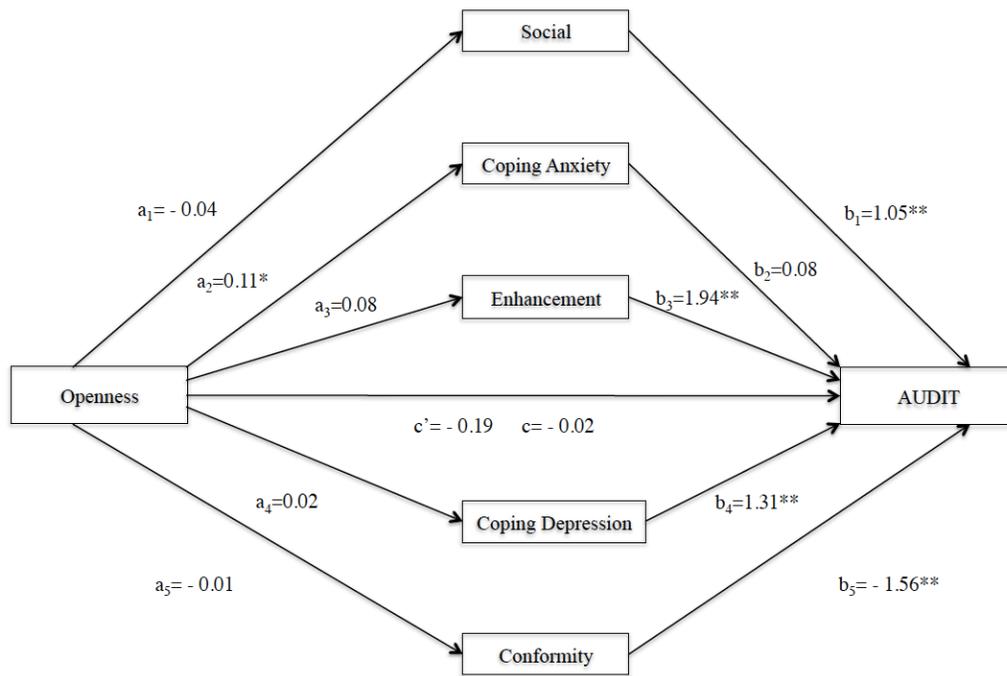
Neuroticism did not significantly predict total AUDIT scores when controlling for age and sex. Neuroticism did however predict heightened coping anxiety ($R^2=0.07$), coping depression ($R^2=0.08$) and conformity ($R^2=0.03$) motives. With all motives and control variables added into the model, neuroticism significantly predicted depleted AUDIT scores; 44% of variance was explained. The indirect effect of Neuroticism on alcohol consumption was positive and significant coping depression motives. Conformity motives also partly accounted for the indirect

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effect, but were associated with decreased alcohol consumption (Figure 5, table 1.5). No pair-

wise comparison can be meaningfully calculated with the conformity scale because the sign of

the effect was negative whereas the other effects were positive (Hayes, 2013).

Figure 5: Drinking motives as mediators between Neuroticism and alcohol consumption
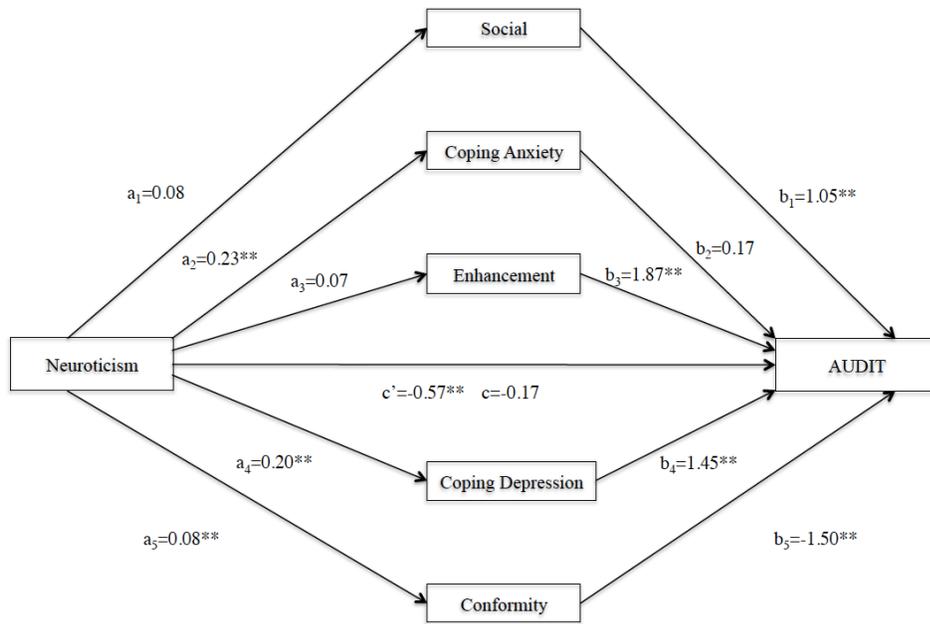
*Table 1.*Indirect Effects of Traits on Alcohol Use Through Drinking Motives

	Effect	LLCI; ULCI
2.1. Extraversion		
Total indirect effect*	0.64	0.34; 0.94
Social (a1b1)*	0.13	0.05; 0.27
Coping Anxiety (a2b2)	-0.01	-0.09; 0.02
Enhancement (a3b3)*	0.45	0.26; 0.70
Coping Depression (a4b4)	-0.04	-0.15; 0.02
Conformity (a5b5)*	0.11	0.03; 0.22
Contrasts		
*Social- Enhancement**	-0.32	-0.57; -0.12
*Enhancement - Conformity**	0.34	0.11; 0.62
Social-Conformity	0.03	-0.12; 0.17
2.2. Agreeableness		
Total indirect effect*	-0.56	-0.97; -0.16
Social (a1b1)*	-0.18	-0.38; -0.05
Coping Anxiety (a2b2)	-0.01	-0.09; 0.04
Enhancement (a3b3)*	-0.32	-0.62; -0.06
Coping Depression (a4b4)*	-0.13	-0.31; -0.03
Conformity (a5b5)	0.08	-0.01; 0.23
Contrasts		
Social-Enhancement	0.14	-0.08; 0.43
Social-Coping Depression	-0.05	-0.24; 0.13
*Enhancement-Coping Depression**	-0.19	-0.45; -0.05
2.3. Conscientiousness		
Total indirect effect*	-0.75	-1.11; -0.38
Social (a1b1)*	-0.13	-0.29; -0.02
Coping Anxiety (a2b2)	-0.01	-0.13; 0.09
Enhancement (a3b3)*	-0.48	-0.75; -0.25
Coping Depression (a4b4)*	-0.13	-0.31; -0.03
Conformity (a5b5)	0.00	-0.10; 0.09
Contrasts		
*Social-Enhancement**	0.35	0.15; 0.62
Social-Coping Depression	0.00	-0.17; 0.19
*Enhancement-Coping Depression**	-0.34	-0.63; -0.11
2.4. Openness		
Total indirect effect	0.17	-0.22; 0.58
Social (a1b1)	-0.05	-0.19; 0.07
Coping Anxiety (a2b2)	0.01	-0.07; 0.12
Enhancement (a3b3)	0.16	-0.07; 0.44
Coping Depression (a4b4)	0.03	-0.07; 0.16
Conformity (a5b5)	0.02	-0.07; 0.13
2.5. Neuroticism		
Total indirect effect*	0.41	0.07; 0.75
Social (a1b1)	0.08	0.00; 0.20
Coping Anxiety (a2b2)	0.04	-0.12; 0.23
Enhancement (a3b3)	0.13	-0.06; 0.33

Coping Depression (a4b4)*	0.29	0.11; 0.50
Conformity (a5b5)*	-0.13	-0.23; -0.05

Note. 95% confidence intervals. LLCI=Lower limit confidence interval. ULCI=Upper limit confidence interval. *significant effect.

4. Discussion

4.1. Mediating effects of drinking motives

As suggested by Cox and Klinger (1988), our study broadly suggests that drinking motives are a proximal predictor of alcohol consumption through which distal factors exert their influence. All personality traits, with the exception of openness, were associated with alcohol consumption through the proximal mediator of drinking motives. All motives, with the exception of coping anxiety motives, were responsible for indirect effects in at least one model. This alone was surprising because external motives have not significantly mediated the relationship between traits and drinking behaviors in other works (Stewart et al., 2001). Previous studies have indicated that internal motives are more in line with traits because they are less dependent on external contexts (Theakston et al., 2004). In our study, internal motives explained more of the variance of indirect effects than did external motives.

The cases in which social and conformity motives were significant mediators may be attributable to our specific population or study design. Regarding social motives (external, positive), this unexpected finding may be due to cultural or contextual influences on drinking behavior. In France, drinking culture is tightly engrained in social norms and social motives would be dangerous in contexts where drinking behavior is highly normalized. For example, studies have found that social motives led to alcohol related problems among a young Brazilians (Mezquita, Stewart, & Ruipérez, 2010), young Australians (Lyvers, Hasking, Hani, Rhodes,

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&Trew, 2010) and American high school drop outs (Kong & Bergman, 2010). Likewise, another study conducted among French young people found that social motives led to increased alcohol consumption, and in turn, to alcohol-related problems (Loose & Acier, 2017). Conformity motives may have been particularly salient because of the age of our sample: some studies suggest that these motives become less pertinent as age advances (e.g. Cooper, 1994). Furthermore, conformity motives have been associated with a reduced frequency of alcohol consumption multiple times elsewhere, but explained little variance in alcohol use in comparison to other motives (Cooper, 1994; Kuntsche et al., 2005; Loose & Acier, 2017).

Extraversion mostly led to high enhancement motives, but also to high social and low conformity motives. Those who are extraverted would typically engage in more social situations (Pervin & John, 2005), such as parties, in which alcohol may be present and consumed. Extraversion may be tied to enhancement motives because both of these constructs have been associated with positive emotion and sensation seeking (Ham & Hope, 2003; Pervin & John, 2005). Extraversion and enhancement motives both relate to people with a low level of arousal who need stimulation in order to be entertained which may take the form of drinking behaviors. People who are introverted may be more inclined to drink for conformity reasons because they are described as loners who generally avoid social interactions (Costa & McCrae, 1992). When people who are introverted do end up engaging in social activities, alcohol may be present, especially in France. When one is lacking social skills, adhering to social norms (by means of alcohol consumption) may be a particularly attractive solution in order to facilitate social integration. As those who are introverted would generally avoid social interactions, conformity motives were related to depleted alcohol consumption.

Neuroticism did not directly predict total AUDIT scores once having controlled for sex and age. This is surprising in regards to the meta-analysis that found a direct effect of neuroticism on alcohol consumption across studies (Malouff et al., 2007). However, a case of competitive mediation was revealed in our study, meaning that neuroticism led to both increased and decreased alcohol consumption. This contradiction in signs would stamp out the direct effect (Zhao, Lynch, & Chen, 2010). Those who score high on neuroticism tend to have more negative affect and may wish to alleviate themselves of these feelings by means of alcohol consumption (Malouff et al., 2007). Neuroticism can also be associated with anxiety (Costa & McCrae, 1992) and in social situations, to a corresponding motive to drink in order to be accepted by a well-liked group. As conformity motives led to decreased alcohol consumption, emotional instability could be perceived as a "protective factor". Nevertheless, other studies suggest that conformity motives led to decreased frequency of alcohol consumption, but led directly to problems (Cooper, 1994). As our study did not separate drinking frequency from drinking problems, conformity motives may not be considered a protective reason to drink alcohol.

Antagonism led directly to increased alcohol consumption while controlling for age and sex. This trait led to increased enhancement motives but also to coping depression and social motives which all led to heightened alcohol consumption. Interestingly, agreeableness was one of the three traits to be associated directly with alcohol consumption across studies (Malouff et al., 2007). However, the association between agreeableness and alcohol consumption vanished once we added motives into the model i.e., full mediation was observed as defined by Baron and Kenny (1986). This suggests that it might be premature to neglect including this trait in mediational analyses as did Kuntsche et al. (2008) for example.

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Conscientiousness had a direct relationship with reduced alcohol consumption. This has been a common finding across studies (Malouff et al., 2007). Enhancement motives were the most responsible for the indirect effect and this mediational relationship has been found in other studies (Kuntsche et al., 2008; Stewart & Devine, 2000; Stewart et al., 2001). Those who lack direction would be more inclined to develop enhancement motives and to consequently develop heavy alcohol consumption behaviors. However, the indirect effect through social and coping depression motives was also significant. This is interesting because these two motives are theoretically opposites (positive, external versus negative, internal)(Cooper, 1994). This may contribute to findings suggesting that conscientiousness could be the trait that is the most associated with alcohol use (e.g. Malouff et al., 2007) because it shapes heterogeneous motivational constructs which all directly lead to alcohol consumption.

Openness did not directly or indirectly predict alcohol consumption behaviors. This null finding may suggest that openness is not a particularly pertinent trait in regards to alcohol consumption or rather that the action of this distal factor operates through other mediators. For example, Loose et al. (under review) followed a nearly identical methodology as the present study, but five time perspectives took the place of drinking motives. Openness had no direct effect on Audit scores, but a case of indirect only mediation was observed. There were significant indirect effects of openness through past positive and present hedonist time perspectives. This finding may call into question the blanket statement that motives are the most proximal predictive factor in which *all* other distal factors converge (e.g., Cox & Klinger, 1988).

Coping anxiety motives were the only motivational construct that did not account for indirect effects. This motive was only associated with low conscientiousness, high neuroticism

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and high openness (paths a_2). Coping anxiety motives were not well associated with alcohol consumption in this study and elsewhere (Loose & Acier, 2017), which does call into question their clinical pertinence. For example, Mezquita et al. (2010) also found that low conscientiousness led to coping anxiety motives, but that coping anxiety motives did not predict alcohol use. Our null findings add to the extent literature questioning the validity of coping anxiety motives (Loose & Acier, 2017).

4.2. Strengths and limitations

This study had several strengths including its reach beyond the bivariate relationships between traits and alcohol consumption. New analytical techniques were employed with clear-cut and seldom used conditions for mediation. Cases of indirect only mediation with competitive mediators were revealed, which may help us elucidate divergent findings in the extent literature. We also took into account all five motives and all five traits, rather than a selection of these variables. Using a French population was also a strong point of this study in that findings concerning the studied mediational relationships have not yet been generalized to this group. Targeting young people was another strength because they are particularly at risk for developing problems stemming from alcohol consumption.   Several limitations were also present in our study. Firstly, all measures were self-report and bias due to social desirability may have been present but was not measured. We constrained alcohol consumption to a single measure, which over-simplified the complex construct of problematic alcohol use. Furthermore, the procedure we used for questionnaire administration was not entirely standardized among participants: high school students were in a group setting whereas we have no definite information regarding the context in which university students filled out our questionnaires. Also, the amount of high

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school and university students was disproportional. Lastly, there was a disproportionate amount of women in the total sample and the university sample, whereas there was a proportionate amount of men and women in the high school sample. Nevertheless, we controlled for sex and age in an effort to dampen the impact of these disproportions.

4.3. Conclusions and implications

Our study suggests that personality traits have a relationship with alcohol consumption through the multiple parallel mediators of drinking motives. Some traits, such as undirectedness, would develop into uniformly maladaptive drinking motives and in turn into problematic alcohol use. Other traits, such as neuroticism, may positively or negatively impact alcohol consumption as a function of the specific drinking motive that emerges. Psychologists and health care practitioners may focus on how personality traits develop into motives, rather than focusing purely on the role of traits in drinking behavior. When a client presents a "risky" personality trait such as neuroticism, practitioners should be attentive as to how this trait develops into motivational constructs. Prevention techniques may benefit from targeting drinking motives rather than personality traits, as they may be a more proximal predictor of alcohol use. In sum, among French young people, personality traits may be linked to the consumption of alcohol because they develop into specific drinking motives, which in turn give way to alcohol consumption behaviors.

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Annex 3: Development and validation of the Temporal Competency Test-5D

Abstract

Objectives : We developed and validated a new version of our test of temporal competency. In three studies we 1) defined dimensions, created items and studied face and content validity, 2) examined dimensionality and reliability, and 3) confirmed factor structure and studied convergent validity.

Methods : Focus groups were held in which we drew up temporal concepts that articulated well with clinical observations. We derived a questionnaire that was administered to French young people and this data was used to reduce the questionnaire to 15 items. Reliability and validity of the 15-item version was studied among samples: French college, French high school, and Québec college.

Results : Five dimensions were defined and retained : anticipation, full present, temporal rupture, past, future. 15 items explained 68% of variance. The model provided adequate fit in confirmatory analyses across samples. Scales converged with hypothesized dimensions of the ZTPI and scales mostly maintained acceptable reliability.

Conclusions : Conceptual issues with ZTPI were addressed, possibly rectified and discussed in light of clinical practice. The past was defined by how much one grows from experience independently of how "happy" or "sad" events were. Full present and temporal rupture relate to living in the now, the first by means of flow and engagement, the second by means of addictive behaviors. Future entailed a projection unto uncertainty, whereas anticipation defined adapting behavior in order to achieve short-term goals. Contrary to hypotheses, the model did generalize well to North America and might be extendable to other populations.

INTRODUCTION

Subjective Time

Over the centuries, time has fascinated writers, poets, scientists and philosophers, as it

may be key in understanding the world and human behavior. Time can be looked at as a

fundamental concept structuring language and identity: it is the most used noun in the English

language (Zimbardo & Boyd, 2008) and identity itself has been described as the integration of

self over time (Cardeña & Alvarado, 2014). Famously, Heidegger (1927/1996) opened his book

Being in Time with goal of "the interpretation of time as the possible horizon for any

understanding whatsoever of being."

As time is also an extraordinarily vast concept, we decided to focus on how people

psychologically integrate time. Lewin defined Time Perspective (TP) as the totality of one's

perspective on past and future at a given moment (Klapproth, 2011). Since, multiple facets of TP

have been defined (Apostolidis & Fieulaine, 2004; Thiébaut, 1998) including temporal

orientation or *directionality* (proportion of thoughts consecrated to the present, past and future),

temporal *density* (richness temporal content), temporal *extension* (the distance that the individual

is able to project himself into the future or past), temporal *coherency* or *realism* (in part defined

by the clarity or degree of realism of temporal projection) and temporal *attitude* (valence of the

emotional experience associated with the temporal frame). The utility of time as a psychological

characteristic and plurality of temporal concepts has sparked the creation of a multitude of

measures.

Existing measures

Broadly, measures of time perspective include projective tests, questionnaires and behavioral

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techniques (Klapproth, 2011). In scientific publications, the most widely used measures of TP are the and the Consideration of Future Consequences Scale (CFCS) (Strathman, Gleicher, Boninger, & Edwards, 1994) and the Zimbardo Time Perspective Inventory (ZTPI) (Zimbardo & Boyd, 1999). The CFCS measures to what extent people take into account the future consequences of their actions when behaving in the present. Scores lie on a continuum ranging from future orientated to present orientated. Convergent concepts to future orientation include locus of control and delay of gratification. The scale is valid, reliable and explains an impressive 96% of the variance. However, Zimbardo and Boyd (1999) criticized the CFCS for over simplifying TP, in part because it constrained time onto a single dimension.

The ZTPI is a five dimensional measure of TP that was developed notably by means of qualitative interviews, focus groups and introspective reflections, as well as multiple factorial analyzes and criterion validity studies. The model takes into account the valence of the temporal attitude in past and present perspectives, as well as a future perspective that does not distinguish between valences. The ZTPI draws out five dimensions of TP : 1) *Past Negative* refers to reflecting negatively on distressful events that occurred in the past. 2) *Present Hedonism* refers to people being careless and focused on maximizing current pleasure. 3) *Future* refers to striving to attain long-term achievements and rewards. 4) *Past Positive* refers to pleasant recollections of the past. 5) *Present Fatalism* is characterized by disengagement in goal-orientated behavior because one believes their efforts are futile (Zimbardo & Boyd, 1999). Each TP dimension has been capable of predicting diverse outcomes related to physical and psychological health (Stolarski, Fieulaine, & Beek, 2015). In order to maximize well-being, it has been theorized that it would be ideal to for people to have high past positive, low past negative, moderate present hedonism, low

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present fatalism, and high future perspectives (Zimbardo & Boyd, 1999). Nevertheless, there are conceptual aspects of the ZTPI that may need to be addressed and rectified.

First, the ZTPI model upholds that past experiences are classified as subjectively positive or negative (temporal attitude). However, it is possible to reframe past negative experiences (e.g. outbreak of a deadly illness) into positive ones (e.g. all the good friends one made at the hospital) (Zimbardo & Boyd, 2008, pp. 71-73). In other words, it appears that the subjective valence of experience primes over the objective nature of the experience being positive or negative (e.g. losing a loved one). This may create issues when one recalls objectively negative or mixed-valence experiences as the one described above. Denying or repressing negative aspects of experience is not necessarily beneficial. Rather, we could be focusing on how one integrates experience into identity independently of valence. The capacity to construct self and to learn from experience may hold the most importance, instead of how "happy" or "sad" reconstructed memories are thought to be at a given point in time. There may be a way to look at past in which higher past competency is a protective factor independently of emotional valence. This could allow us to better account for phenomena such as resiliency or post-traumatic growth (e.g. a veteran giving meaning to traumatic experience through activism, or a domestic violence survivor helping others to break free).

The present hedonist dimension of the ZTPI relates to both healthy and unhealthy hedonistic activities, e.g. mindfulness practices and addictive behaviors. This has been a cause of concern and debate (Mello, Worrell, & Buhl, 2016). In order to help respond to this limitation, the present-eudaimonic scale was created. The questionnaire measures a construct called "positive present" which transcribes flow and mindfulness rather than consumption behaviors (Vowinckel,

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Westerhof, Bohlmeijer, & Webster, 2015). It could be that there are two distinct ways of deriving pleasure from current experience, one relating to mindfulness related constructs and the other to hedonistic consumption behaviors.

When people are cognitively projecting themselves into the past or future at a given point in time, we do not consider them to be in the "present". The Present Fatalist scale of the ZTPI has been criticized for implying a perception of the future, rather than of the present, because it refers to a bias towards thinking one's present efforts are futile in the attainment of future goals (Mello et al., 2016). There may be a projection unto uncertainty tied into the present fatalist scale, whereas with the future scale, people could be anticipating foreseeable future events and planning accordingly. It's worth noting that the future scale seems to imply that the goal is concrete and foreseeable, meaning that there must be concrete steps that need to be taken in order to make progress. Because of this, it seems like the temporal extension of the future dimension of the ZTPI is shorter than that of present fatalism, and that the future scale is less abstract than the present fatalist scale.

Justifications and aims: Creating the TCT

Even if many measures of psychological time have already been created, several reasons led us to develop a new self-report questionnaire. While we contend that the ZTPI is viable multidimensional measure of TP that has been validated in French, the following limitations are raised: 1) The psychometric proprieties of the ZTPI in French are not as good as in the American-English version. This was the case for the full version of the questionnaire (Apostolidis & Fieulaine, 2004) and even more so for the shortened 15 item version (Loose, Acier, Pilet, & Sysaykeo, 2017). We aimed to create a short questionnaire that explained more variance than the

ZTPI and had improved factor structure and reliability. 2) Psychological time and more specifically time perspective, could vary according to cultural and linguistic differences. In our elaboration process, we aimed to focus on French specificity, rather than on universality and invariance. For example, many items generated contained words or expressions commonly heard in French discourse, but that would not necessarily translate well. 3) We also aimed to create a questionnaire based on a conceptualization process that was firmly grounded in our clinical observations and our psychologists' clinical reasoning. We hoped that such an elaboration process would render a questionnaire better catered to clinical practice. 4) Lastly, we aimed to address certain conceptual issues concerning the dimensions of the ZTPI, as previously described.

Thus, over the last decade our group in France has also been conducting studies on temporality. Our main goal was to create a model and a corresponding questionnaire that tapped what we thought to be key aspects related clients' perception of time. The first version of the questionnaire was in binary response format and incorporated different life domains (Acier et al., 2015). The second version adopted Likert-type response format and retained three dimensions : anticipation, temporal rupture and future. 57% of variance was explained and model fit in confirmatory factor analysis was excellent, but our work still had other limitations (Loose et al., in press) which we aim to develop. In part, the present study aimed to advance a 5-factor questionnaire by validating two additional dimensions: full present and past. We also aimed to better theorize and operationalize our definitions of dimensions, and to better focus on temporal competency, rather than temporal orientation, as this notion accentuated dynamic psychological processes.

We conducted series of three studies that aimed to recreate and psychometrically validate a new version of our questionnaire: the TCT-5D. In study 1, we held focus groups in order to develop or refine theoretical definitions of our scales and to generate better performing items. The items and definitions were then submitted to psychologists (experts) and to first year psychology students in order to explore content validity and face validity respectively. In study 2, we mainly conducted exploratory factor analysis using a sample of French young adults and chose the 15 best performing items. In study 3, confirmatory factor analysis was conducted on the 15 items using three new samples. The first was comparable to that of study 2 and was composed of French college students. In order to explore the generalizability of our model, we also confirmed factor structure in a sample of French high school students and a sample of French-speaking university students living in Québec. Lastly we studied divergences and convergences between the TCT-5D dimensions and the ZTPI scales among French and Canadian college students. In brief, we aimed to: 1) elaborate dimensions, definitions and items for five scales measuring aspects of temporality, 2) choose the best performing items for each scale and explore factor structure and 3) confirm factor structure using independent samples and study correlations between TCT-5D and ZTPI scales.

Study 1: Development of the TCT

1.1. Participants and procedures

Focus groups were held and composed of researchers and practitioners in psychology, sociology and methodology, as well as two graduate students. Note that the first and second authors were among these participants. A total of 11 people were implicated in the project but not all were present for each focus group. Six meetings were held over a 12-month period (January 2015-16). During meetings, we defined temporal concepts and articulated them our clinical observations and practice. Our conceptualization of temporal competency and its facets was based on a dialectical discussion between clinical observations, reflections and existing literature. Definitions of dimensions were progressively drawn up and reworked. Items were generated by all members of the group, and were subsequently discussed in focus groups.

In this manner, we settled on a first version of the TCT-5D and conducted an outside expertise of items in which experts were asked to comment on the correspondence between dimensions and items. We also received input from first year university students concerning the face validity of the questionnaire. Students (*n*=27) and experts (*n*=5) were asked to read our definitions of dimensions, rate how pertinent they thought each item to be in light of the definition, and to provide any comments or critiques they may have. On the basis of student and expert opinions, our focus group held our last meeting and we modified the measure as we saw fit.

1.2. Results

This procedure led us to maintain 5 dimensions and 104 items. The following paragraphs detail the retained temporal concepts and their definitions, as elaborated by the focus group.

Temporal competency refers to the capacity to manage and integrate time appropriately. People who are temporally competent are able organize their time while maintaining flexibility and adaptation between internal and external realities. This progressive adaption of Self (Ego) to inner and outer worlds rears a progressive structuring of the mental world. By drawing on past, present and future situations, people may obtain an integrated notion of self. Temporal competency would be shaped over time and incorporated into the typical developmental stages (childhood, adolescence, adulthood) and developmental spheres (cognitive, affective, social and biological) (Bourdin & Lambertucci-Mann, 2007). Temporal competency would favor the development of self-continuity and allow the subject to prolong their feeling of existence of self over time (Winnicott, Harrus-Révidi, Kalmanovitch, Michelin, & Rosaz, 2006). We conceptualized temporal competency as a stable and conscious or subconscious disposition that can be tapped in part by objective measures.

Anticipation is defined as « a prior action that takes into account or forestalls a later action » (Merriam-Webster, 2016). Thus, anticipation would be a temporal dynamic that takes into account a chain of events as time moves forward i.e. a dynamic process entailing a forward projection over time. We restrained the concept to involve only incremental short-term goals (<1 year) as they allow the individual to project himself into the future (e.g. pass a class) and to act towards future goals that may be more long term in nature (e.g. obtain a diploma) (Carré, 2004). This capacity allows people to work effectively within society and to complete valorized projects

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or goals. In the TCT-5D, anticipation only relates to goals that are foreseeable or concrete (e.g. pass a class), rather than abstract or imaginary (e.g. fall in love). Because the capacity for anticipation seems to conceptually imply the capacity to delay gratifications in order to accomplish short-term goals, we hypothesized that this construct would converge with the future dimension of the ZTPI. A translated sample item from this scale is "I'm the kind of person who tries to anticipate everything."

In the French language, there are two words for *future* which differ according to how foreseeable the future event is thought to be: *futur* (what will happen, what is going to happen) and *avenir* (the time that will come) (Collectif, 2016). In the TCT-5D, we attempted to take into account both long-term abstract future events (e.g. imagining having a family) and beliefs about future uncertainty (e.g. lack of knowledge about what the future holds). The TCT-5D future is in line with the possibility to prolong one's feeling of existence (desire to have a child, a professional project…)(Nowack, Milfont, & van der Meer, 2013) and is fueled by imagination, fantasy and motivation (Aurégan, 1998). Unlike the ZTPI or CFC, the TCT-5D future is associated with an absence of control over the imagined object or future project, meaning that the subject projects himself towards a goal that he is not certain he can or will obtain. This concept was supposed to converge with the present fatalist scale of the ZTPI. "The future is completely unpredictable" is a translated sample item from this scale.

The *past* was operationalized as the capacity to draw on past in order to learn from experience, to adjust actions accordingly, and establish an integrated representation of self over time. Using the past as a source of reference and stability (Aurégan, 1998) entails using past experience in order to structure current identity, choice and action. We view the past as a

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learning process in which people draw on past experiences, remember errors and adapt behavior accordingly. As this concept implies an adaptive capacity to learn from mistakes rather than looking at past experiences as "negative", we hypothesized that this dimension would converge with protective dimensions of the ZTPI, notably past positive TP. For example, "I think we learn a lot from our mistakes" is an item from this scale translated from French.

 Temporal rupture was hypothesized as a need in the present to escape from the linearity of time passing. In theory, the concept has been described as « a break in the temporal linearity of daily life » (Duteille, 2002) or as the « incapacity to inscribe in a time that passes » (Feder, 2001). This process corresponds to the capacity to breach or unhook from ones routine life, thus breaking the organization of objective time in order to escape a psychological overload. In other words, this process is theorized to be a temporal defense mechanism that enables the psyche to unhook from the linearity of time that would otherwise structure reality and identity, somewhat like the defense mechanism of dissociation. As temporal ruptures can disconnect the individual from temporal continuity, they allow the individual to take a break from their distress, angst or even identity. These temporal breaches would mainly take the form of addictive behaviors and thus it was hypothesized that this dimension would converge with the present hedonist dimension of the ZTPI and be related other to maladaptive time perspectives (high past negative, low past positive, low future, or high present fatalism). A sample item from this scale translated into English is as follows: "Drinking alcohol on the weekend helps to break up the week."

 Among others, humanist psychologists have long upheld the psychological benefits of certain ways of being anchored in the present now. As mentioned earlier, our *full present* dimension was developed in accordance with this theoretical standpoint. For example, Shostrom

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(1976) describes "presence" as "the capacity to live fully in the present moment and to be orientated towards that which is passing in the here and how." The full present is a temporal resource entailing a synchronic engagement in the now accompanied by an attitude of acceptance and appreciation. This open space may allow the subject to generate creativity, positive affect and change. The full present was hypothesized to converge with the present hedonist dimension of the ZTPI and translate to an adaptive profile (low past negative, high past positive, high future or low present fatalism). This scale is made up of items such as "I enjoy every instant, we never know what tomorrow will bring."

1.3. Discussion

Our new version of the questionnaire included 104 items across five dimensions of temporal competency: anticipation, future, temporal rupture, full present and past. As mentioned beforehand, the anticipation dimension ought to converge the most with ZTPI future dimension and would be related to other adaptive perspectives (i.e. moderate present hedonism, low past negative, high past positive, low present fatalism). The TCT-5D future was theorized to be the most similar to the ZTPI present fatalism because both of these concepts imply a projection unto uncertainty. Temporal rupture and full present were both supposed to be related to present hedonism. However, we hypothesized that temporal rupture would be in line with maladaptive perspectives of the ZTPI, whereas full present would transcribe a more adaptive profile. The TCT-5D past dimension was supposed to be positively correlated with the past positive perspective of the ZTPI, and generally transcribe a protective profile in terms of other time perspectives.

Study 2: Selection of items and exploratory factor analysis

2.1. Participants and procedure

After having provided their consent, young adults living in France were administered the 104 items of the TCT-5D and additional questionnaires used for other studies. In sum, participation took approximately 45 minutes and involvement in the study could be interrupted at any time. Questionnaires were administered online using the secure platform LimeSurvey.

In analyses, we decided to first examine each dimension of the TCT-5D separately in an effort to study dimensionality and to choose the best performing items for each scale. We aimed to select items that fit the best together and that described practical latent constructs. In doing so, several criteria were simultaneously taken into account: 1) Item distribution was studied in terms of kurtosis and skew. 2) Average intra class inter-correlations were studied in order to maximize dimensional homogeneity. 3) Similarly, Cronbach's alpha was used to maximize the internal coherency of dimensions. We also checked if internal coherency could be improved by taking out any item from its respective scale. 4) When dimensions proved to be excessively heterogeneous, exploratory factor analysis was run in order to seek out items that revealed similar latent constructs. 5) Theory and logic were also used especially when choosing between items with similar psychometric proprieties. Our ultimate goal was to create a short, valid and reliable 5-dimensional measure of temporality by choosing the best performing items for each dimension including, but not limited to, those included in the previous version of the questionnaire.

After having completed this preliminary selection, principal component analyses were conducted on the remaining items and the model was re-specified many times. Throughout this

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stage, we discarded items that 1) did not saturate the hypothesized latent construct, 2) did not saturate with a loading > 0.3, or 3) had excessive cross-loadings (within 0.2 of the hypothesized loading). When deleting items, we made sure that the dimensions maintained adequate internal coherency. We used the cut-off of $\alpha > 0.6$ because we aimed to create short scales and Cronbach's alpha is inversely proportional to the number of items included. At the end of study 2, we retained three items for each of the five dimensions.

2.2. Results

2.2.1. Preliminary selection of items

The 16 items in the *past* dimension were positively correlated. Two items were deleted because of their distribution and four items with the lowest intra-class correlations were also thrown out. Ten items remained. All 23 items in the *anticipation* were positively correlated and we were able to retain items with average intra-class correlations that were >0.20. Two items were deleted because of their distribution. Because there were still so many functional items in this dimension, we used Cronhach's alpha to delete items that decreased internal coherency the least. After these procedures, ten items were retained. Three out of the 31 items developed for *full present* dimension were discarded because of their distribution. Any item that had an average intra-class correlation lower than 0.2 was discarded. Two additional items were deleted because their suppression did not meaningfully change the scale's homogeneity, which left us with ten items for this dimension.

The 18 items developed for the *future* all sufficiently followed a normal distribution, but intra-class correlations were heterogeneous in both their sign and significance. Accordingly, we

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ran a principal component analysis on the items and two clear latent constructs were revealed. This was also theoretically comprehensible as eight items alluded to an uncertain future whereas others referred to a sense of control over one's future or the capacity to be in psychological proximity with one's future (e.g. being able to imagine retirement). We decided to separate the "uncertain" ("avenir" in French) and "certain" ("futur" in French) future items in order to see if an internally coherent dimension could be salvaged. Unfortunately, the certain future dimension was too heterogeneous to subsequently analyze. However the eight items pertaining to an uncertain future were adequate and maintained.

The 16 items developed for the *temporal rupture* scale also revealed intra-class correlations that were heterogeneous in their sign and significance, which posed threat to the internal coherency of the scale. Principal component analysis was run on these items and two interpretable latent constructs were revealed, the first generally relating to the items that explicitly mentioned addictive behaviors and the second to other ways of taking breaks from the passing of time. We conserved nine items that positively loaded the first dimension and which did not have excessive, or numerous cross-loadings on other latent factors.

2.2.2. Principal component analysis

The remaining 47 items were put into Principal Component Analysis (PCA). More specifically, PCA with a Varimax rotation and Kaiser normalization was run on the correlation matrix of remaining items. Barletts test of sphericity was significant ($\chi^2(1035)= 6969.101$; $p<0.001$), the Kaiser-Meyer-Olkin (KMO) test of sampling adequacy was well above 0.5 (KMO=.814) and communalities were above 0.5. Here 13 dimensions were extracted with an

Eigen value >1, five of which were only somewhat interpretable in regards to our hypotheses: 1-Full Present, 2- Anticipation, 3-Rupture, 4-Past and 5- Future.

Consequently, items were taken out progressively, and factorial analyses were rerun many times until an acceptable solution was found. First the items that were not saturating >0.1 on the hypothesized dimension were deleted. Next, the four worst performing items (high cross loadings and low factor loadings) in the anticipation and full present dimensions were discarded in order to have a more equal number of items per scale. Then all items that did not load >0.3 on the hypothesized dimension were deleted. Next items with cross loadings within 0.2 of the hypothesized loading were deleted. Cronbach's alpha was calculated for the remaining scales in order to verify the adequacy of internal coherency and to see if alpha could be improved by deleting any items from their respective scales. This was the case for two items, which were deleted. PCA for this model is figured in table 1. Table 1 includes the names of latent factors, the percent of variance explained, internal coherencies as well as loadings and communalities. 15 items were included (three per scale), 68.36% of variance was explained, KMO was superior to 0.5 (KMO=0.712), and Barlett's test of Sphercity was significant ($\chi 2(105)=2188.556$, $p<0.001$).

2.3. Discussion

In study 2, we first examined each dimension separately in order to investigate the homogeneity of developed items and to choose the best preforming items for each scale. The past, anticipation, and full present scales contained items that went well together, whereas the constructs conveyed in future and temporal dimensions were heterogeneous. Using factor analysis, we decided to conserve items that related to an uncertain future, as well as items that

related to taking breaks in the linearity of time by means of substance use. 47 items were deemed possible contenders for the TCT-5D and were put into principal component analysis. Analyses were then rerun several times in order to optimize the solution by progressively deleting items. In the end, we settled on a 15-item version of the TCT-5D that explained 68% of variance.

Study 3: Confirmatory factor analysis and validity

3.1. Participants and procedure

In study 3 we conducted confirmatory analyses using three independent samples. The first sample was meant to be similar to that of study 1 and was composed of college students living in France. The second and third samples allowed us to explore if the model could be generalized to younger French people and to French-speaking people living in North America. The second and third samples were French high school students, and college students living in Québec, Canada. The two university samples were recruited via social media or email diffusion lists. Questionnaires were administered online and included the 15-item version of the TCT-5D and the 54-item version of the ZTPI (Apostolidis & Fieulaine, 2004) among other measures not analyzed in the present study. High school students were administered the TCT-5D alongside questionnaires used for other studies. Among high school students, questionnaires were administered during school hours and classes of students met us in the school's computer lab. All participants provided their consent; minors' parents were alerted of the study in advance and were able to exclude their child if they so desired but no parent did so.

For Study 3, we first ran confirmatory factor analysis in each sample in order to study model fit. Afterwards, we correlated ZTPI and TCT-5D scales using the sample of French-

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speaking university students living in Québec and France. As mentioned in the introduction, TCT-5D future was supposed to converge with ZTPI present fatalism; TCT-5D anticipation with ZTPI future; TCT-5D past with ZTPI past positive; TCT-5D temporal rupture with present hedonism and maladaptive dimensions of the ZTPI; TCT-5D full present with present hedonism and adaptive dimensions of the ZTPI.

3.2. Results

3.2.1. Confirmation of factor structure independent samples

Data was analyzed from 162 high school students (M_{age}=17.39, SD_{age} =1.37; female, n=93, 57%), 389 college students living in France (M_{age}=21.49; SD_{age}=2.50; female n=286, 74%) and 478 college students living in Québec, Canada (M_{age}=23.94; SD_{age}=2.57; female n=381, 80%). Confirmatory factor analyses (CFA) were conducted on each sample using SPSS and AMOS. Maximum likelihood estimation was used and factors were allowed to co-vary. Model fit was studied with the following fit indices and criteria: The ratio between Chi-square statistic ($\chi2$) and the degrees of freedom (*df*) should not exceed three. The Goodness of Fit Index (GFI) should exceed .95. The Tucker–Lewis Index (TLI) and Comparative Fit Index (CFI) were used to study comparative fit. These indices should be >.95 for acceptance. The Root Mean Square Error of Approximation (RMSEA) should not exceed 0.06 or 0.08 and is interpreted with a 90% confidence interval (Schreiber, Nora, Stage, Barlow, & King, 2006). Standardized loadings and errors for CFA are presented for the samples of college students living in France and in Québec, Canada (table 2). Table 3 displays the fit indices exposed above in each of the three samples used in study 3. Alpha coefficients for TCT-5D scales in the two college samples are displayed in table

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4. All coefficients were above 0.65 with the exception of the temporal rupture scale in the Canadian sample. In the high school sample, Cronbach's alpha coefficients were as follows: Anticipation (α=0.727), future (α=0.542), rupture (α=0.655), full present (α=0.707) and past (α=0.691).

3.2.2. Convergent and divergent validity

We calculated Pearson correlations between TCT-5D scales in order to make sure that they are related but not redundant. Correlations between the TCT-5D scales and the ZTPI-SF scales were also calculated in order to test hypotheses pertaining to convergent validity. Table 4 exhibits the corresponding correlation matrixes. Correlations between TCT-5D scales were small and most often non significant with the exception of the association between full present and past ($r_{xy} \geq 0.70$). Anticipation related to future and low present hedonism in both samples. In the French sample, high past positive and high past negative were also associated. In both samples, TCT-5D uncertain future was related to high past negative, high present hedonist, high present fatalist, and low future. Full present was related to high present hedonism, high past positive and low past negative. The past exhibited the same relationships, in addition to an association with high future. Among the French, the past was also negatively correlated with present fatalism. The temporal rupture was related to high present hedonism, high past negative, and high present fatalist. This TCT-5D dimension was also related to low future time perspective in the Canadian sample.

3.3. Discussion

In study 3, confirmed factor structure of the TCT-5D in three independent samples: college students in France, college students in Québec, Canada, high school students in France. Ideally the CFI, TLI and GFI would have all fell above 0.95, but instead they all fell above 0.90. According to some, this is an acceptable threshold for satisfactory model fit (Hu & Bentler, 1998). The $\chi2$ /df ratio and the RMSEA was less desirable in the French sample than in the other two samples. This may suggest that contrary to hypotheses the model elaborated in the present study fits Canadian students better than French college students, and fits younger French students better than older French students. Nevertheless, the differences in model fit are not particularly stark which may suggest that the model adequately fits all of these samples and might even be generalized to others. Furthermore, in the CFA conducted on college students in France and in Canada, all items loaded >0.30 on their respective scales and standard errors were minimal. Reliability of scales was acceptable (>0.60) for all scales in the each sample with the exception of the temporal rupture scale among Canadians and the uncertain future scale among high school students. Future uncertainty may be a concept that is too heterogeneous and abstract for minors and maybe even young adults, because it implies a larger temporal extension, and extension increases with age (Mello & Worrell, 2015).

Correlations between TCT-5D dimensions were generally small and insignificant with the exception of the full present and past dimension which correlated at approximately 0.70. Even if this could pose threat to the discriminate validity between the scales, these two constructs are clearly different. First of all, one relates to the present and the other to the past. More specifically, the full present relates to living fully in the present moment, taking advantage of

every second, and an expression relating to jumping into experience with two feet. The past scale describes maturing from past experiences, learning from errors, and learning from experience. Integrating the past into the present as a form of learning would be strongly associated with living present experience to the fullest. We had expected that these scales would be positively related, but the strength of the association was interesting and may allude to the importance of the interplay of past and present experiences. These scales may describe how much one invests in a given moment. When one fully engages in a present experience, and then moves forward in time, and fully invests in a later present experience, one would be likely to draw on all pertinent information from past experiences in the present in order to be fully engaged. Nevertheless further studies would be necessary in order to investigate if these two variables predict outcomes in the same manner.

The two measures of temporality were related among one another. As expected, TCT-5D anticipation was related to high ZTPI future, TCT-5D uncertain future was related to high present fatalism, TCT-5D past was related to past positive, and the TCT-5D temporal rupture and full present were related to present hedonism. In theory, it is ideal to have high past positive, low past negative, moderately high present hedonism, low present fatalism and high future perspectives (Zimbardo & Boyd, 1999). Our hypotheses pertaining to the adaptive quality of associations with ZTPI scales was confirmed: temporal rupture and uncertain future were associated with undesirable dimensions of the ZTPI, whereas anticipation, full present and past were associated with adaptive characteristics of the ZTPI.

GENERAL DISCUSSION

The Temporal Competency Test 5D was developed and validated in a series of three studies. First we generated new items in focus groups and refined our definitions of dimensions. Psychologists and undergraduate students then examined the items, alongside their definitions, in order to explore content validity and face validity respectively. In the end of study 1, a preliminary final version of the questionnaire was settled upon. In study 2, this questionnaire was then administered to a sample of young people living in France. With this data, we first looked at each dimension separately in order to examine elementary psychometric proprieties and how well items together within a scale fit (multi or uni-dimensionality). After this selection process, 47 items were conserved and put into principal component analysis. Items were progressively taken out until there were 3 items per scale ; 68% of variance was explained. In study 3, three independent samples were used (French college, Canadian college, French high school) and model fit in confirmatory factor analyses could be considered acceptable in all three samples. All scales were reliable (a>0.60), with the exception of uncertain future in the high school sample, and of temporal rupture in the Canadian college sample. Correlations revealed that scales were related but not redundant, with the possible exception of the past and full present scales. Hypotheses concerning associations between ZTPI and TCT-5D scales were essentially confirmed. In sum, the TCT-5D proved to be a valid and reliable measure of temporal competency among French speaking young people living in Québec or in France. In comparison to the ZTPI 15 items in French (Loose et al., 2017) or the long French version (Apostolidis & Fieulaine, 2004), the TCT-5D had an improved factorial structure, explained more variance, and

scales generally had better reliability. The 5 dimensions retained were anticipation, temporal rupture, full present, uncertain future and past.

In creating the TCT-5D, we may have effectively addressed some of the conceptual criticisms we had about the ZTPI. For example, we successfully created a past dimension that did not directly speak about the emotional valence tied to the experience, but instead referred to what one reaps from past experience when moving forward through time. We hope that the proposed conceptual shift will allow us to better explain potential benefits derived from objectively bad experiences (e.g. civil war). Rather than asking if happy or sad memories spring readily to mind, we could be asking if one learned something useful from the experience. Instead of advising that people reframe objectively negative experiences into sappy happy memories, we can help patients work the experience into their life narrative and to use their mistakes or hardships in order to grow. Low past competency would correspond to a tendency to disregard the consequences of one's past behavior which could lead to a repetition of similar patterns or mistakes and to a negative devalorization of past experiences. Furthermore, contrary to the past valence approach of the ZTPI, our way of looking at the past was strongly associated with living present experiences to the fullest.

As present hedonism translates to both adaptive and maladaptive hedonist activities, we aimed to split a similar concept into temporal rupture and full present. These TCT-5D scales were unrelated, but they were both associated with high present hedonism. Furthermore, as expected, full present transcribed a protective profile (high past positive, low past negative), whereas temporal rupture transcribed negative tendencies (high present fatalism, high past negative; low future in the Canadian sample). As the association between full present and past was strong,

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being fully engaged in the present moment would be associated with a tendency to use past experiences to mature. This temporal dynamic may transcribe an upward spiral in which one fully engages in the present and learns synchronically from experience. Subsequently, at later present times, people then diachronically draw upon these rich past experiences in order to even more fully engage and excel in new present events. Because these two aspects of temporal competency vary together, psychologists who are able to provoke a positive impact on one of these dimensions might see the other dimension consequently improve. As both dimensions relate to the absence of judgment about the valence of experience, clinicians could lead their clients towards a non-judgmental perception of experience in which a past or present moment is valued by its worth in terms of learning, instead of by its emotional valence.

In the TCT-5D, the uncertain future and anticipation dimensions referred to ways of projecting self unto future events. Anticipation referred to the capacity to foresee short-term future events and to adapt accordingly, whereas the uncertain future dimension designated unforeseeable long-term events that would be seemingly impossible to act on. The future dimension of the ZTPI correlated the most strongly with the anticipation dimension, whereas present fatalism correlated the most strongly with uncertain future. Interestingly, the anticipation dimension does not include items that refer to disengaging from fun activities in order to work, whereas this is incorporated into the ZTPI future scale. For example, using the capacity of anticipation, one could hypothetically plan a vacation, plan a workout program or plan meals for one's kids. Hopefully this will help us to account for heterogeneous life goals (e.g. executives, artists, parents…). Psychologists could help clients set meaningful short-term goals whose summation over time would lead to long-term goals or aspirations that could be abstract in

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nature. Helping clients to clarify their goals and the steps necessary for their attainment may provoke an increase in adaptive behaviors. When clients are convinced that there is no way to predict what happens in the future, they may disengage from present experience because they would have little belief in their agency.   With such clients, psychologists could assess the objective environment of the individual and restructure their client's beliefs about agency when appropriate.

As the creation of new instruments is lengthily process, this three-part study had several limitations that could be the object of future works. For example, we did not assess test re-test reliability, which is an important psychometric characteristic. Also, we have not looked into associations between TCT-5D scales and different behaviors such as well-being, substance use, academic achievement etc. Exploring associations between personality traits and TCT-5D scales may be an interesting avenue and could allow us investigate if we are simply describing personality traits under a different label. Another hypothesis could be that our temporality scales mediate the relationship between traits and behaviors, as did time perspectives (Loose et al., submitted). Lastly it would be interesting to translate the questionnaire into other languages in order to explore its extension into other cultural contexts. Contrary to hypotheses, our study suggested that the TCT-5D model could potentially be generalized outside of French culture.

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Table 1. Principal component analysis of 15 item version of TCT-5D among French young people (N=482)

	Component					
	1	2	3	4	5	*Communality*
Variance explained	19.9%	16.9%	11.9%	10.7%	8.4%	
Cronbach's alpha	.800	.792	.779	.719	.681	
4. Je suis du genre à tout prévoir.	-.106			**.836**	-.118	*.728*
5. Je m'organise pour arriver en avance lorsque j'ai un rendez-vous.		.117	-.131	**.723**		*.558*
10. J'ai besoin de tout vérifier pour éviter d'avoir de mauvaises surprises.	-.125			**.799**		*.655*
1. Je vis pleinement le moment présent.	**.847**	.160				*.751*
7. Je profite de chaque instant, on ne sait jamais de quoi demain sera fait.	**.764**	.128				*.604*
12. Je croque la vie à pleine dent.	**.834**	.213				*.752*
6. Imaginer ma vie dans les années à venir, c'est incertain.	-.146			-.137	**.772**	*.638*
11. L'avenir est complètement imprévisible.	.149	-.115	.103		**.718**	*.571*
13. Mon destin est incertain.	-.106				**.828**	*.705*
2. Mes expériences passées me font mûrir.	.110	**.789**				*.648*
8. Je pense que mes expériences passées sont source d'apprentissage.	.178	**.836**				*.734*
15. Je considère que l'on apprend beaucoup de nos erreurs.	.201	**.828**				*.731*
3. Clope ou café, c'est idéal pour une vraie pause.			**.870**			*.770*
9. Fumer une clope aide à supporter les contraintes de la journée.	-.107		**.889**			*.811*
14. Boire de l'alcool le week-end permet de couper avec la semaine.	.192		**.672**		.106	*.510*

Note. All loadings +/- <.1 are not shown. Hypothesized loadings in bold.

1- Full present. 2- Past. 3- Temporal Rupture. 4- Anticipation. 5- Uncertain future.

Table 2. Confirmatory Factor Analysis of the TCT-5D among college students in France and Canada

	Anticipation	Full Present	Future	Past	Rupture
	SL (SE)	SL (SE)	SL (SE)	SL (SE)	SL (SE)
4. Je suis du genre à tout prévoir.	0.841 (--) [b] 0.867 (--) [c]				
5. Je m'organise pour arriver en avance lorsque j'ai un rendez-vous.	0.419 (0.069) [b] 0.473 (0.075) [c]				
10. J'ai besoin de tout vérifier pour éviter d'avoir de mauvaises surprises.	0.710 (0.102) [b] 0.561 (0.090) [c]				
1. Je vis pleinement le moment présent.		0.755 (--) [b] 0.765 (--) [c]			
7. Je profite de chaque instant, on ne sait jamais de quoi demain sera fait.		0.778 (0.076) [b] 0.707 (0.072) [c]			
12. Je croque la vie à pleine dent.		0.843 (0.079) [b] 0.827 (0.073) [c]			
6. Imaginer ma vie dans les années à venir, c'est incertain.			0.614 (--) [b] 0.698 (--) [c]		
11. L'avenir est complètement imprévisible.			0.623 (0.098) [b] 0.580 (0.071) [c]		
13. Mon destin est incertain.			0.918 (0.145) [b] 0.896 (0.104) [c]		
2. Mes expériences passées me font mûrir.				0.722 (--) [b] 0.680 (--) [c]	
8. Je pense que mes expériences passées sont source d'apprentissage.				0.866 (0.083) [b] 0.811 (0.089) [c]	
15. Je considère que l'on apprend beaucoup de nos erreurs.				0.719 (0.079) [b] 0.647 (0.072) [c]	
3. Clope ou café, c'est idéal pour une vraie pause. [a]					0.854 (--) [b] 0.773 (--) [c]
9. Fumer une clope aide à supporter les contraintes de la journée. [a]					0.844 (0.109) [b] 0.614 (0.105) [c]
14. Boire de l'alcool le week-end permet de couper avec la semaine.					0.328 (0.057) [b] 0.348 (0.092) [c]

[a] "clope" was changed to "cigarette" in Canadian version. [b] French sample. [c] Canadian sample. SL = Standard Loading. SE = Standard Error. (--) = Standard error was not estimated.

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Table 3. Comparison of CFA model fit of the TCT-5D in three samples

	χ2	df	χ2 / df, p	TLI	GFI	CFI	RMSEA [LLCI; ULCI] [a]
French University	200.437	80	2.505, *p*<0.001	.916	.937	.936	0.062 [0.052, 0.073]
French High school	98.615	80	1.233, *p*=0.077	.944	.928	.958	0.038 [0.000, 0.061]
Canadian University	139.408	80	1.743, *p*<0.001	.955	.964	.966	0.039 [0.028, 0.050]

Note.[a] 90% confidence intervals. LLCI = Lower Level Confidence Interval; ULCI= Upper Level Confidence Interval

Table 4: Pearson correlations between time measures among college students residing in France (*N*=389) and in Québec (*N*=478)

	α	PP	PN	PH	PF	F	2	3	4	5
France										
1. Anticipation	.684	.110*	.159**	-.235**	.034	.496**	-.082	-.068	.104*	-.090
2. Future	.746	-.064	.348**	.275**	.342**	-.209**		.039	-.092	.179**
3. Full Present	.835	.236**	-.197**	.489**	-.026	.053			.699**	-.040
4. Past	.810	.205**	-.168**	.340**	-.136**	.179**				-.021
5. Rupture	.695	-.074	.170**	.203**	.185**	-.083				
Canada										
1. Anticipation	.663	.074	.077	-.288**	.006	.517**	-.121**	-.058	-.006	-.077
2. Future	.761	.008	.325**	.392**	.415**	-.151**		.011	.013	.125**
3. Full Present	.808	.219**	-.248**	.421**	.012	.001			.707**	-.072
4. Past	.747	.217**	-.209**	.258**	-.071	.092*				-.038
5. Rupture	.563	.062	.150**	.260**	.150**	-.112*				

Note. All correlations are two tailed. α = Cronbach's alpha. PP = Past Positive. PN = Past Negative. PH = Present Hedonism. PF = Present Fatalism. F = Future.

Annex 4: Time perspectives mediate the relationship between personality traits and drinking behavior

Loose, T., Robiou-du-pont, L., Acier, D., & El-Baalbaki, G. Time Perspectives Mediates the Relationship Between Personality Traits and Alcohol Consumption.

Introduction: Personality traits are considered distal determinants of various behaviors, meaning that the association between traits and behaviors would be mediated by other intervening variables. We explored the novel hypothesis that time perspectives mediate the relationship between personality traits and drinking behavior. *Methods*: 549 young adults were administered measures of Big 5 personality traits, time perspectives and alcohol consumption behavior. *Results:* Specific time perspectives mediated the relationship between all personality traits and alcohol consumption. *Conclusions*: Inconsistent findings relating personality traits to behaviors may be explained in part by time perspectives. Future works could extend our findings to other behaviors.

Key words: Time perspective; personality; mediation; alcohol; France; young people

1. Introduction

Numerous researchers have studied bivariate relationships between personality traits and alcohol consumption. However, personality traits are thought to be among the most distal factors related to behaviors, meaning that in order to best understand their relationship with behaviors, we must to take into account more proximal variables (Cox & Klinger, 1988). Most studies on the topic have used the Big 5 model, which includes the following polar dimensions: extraversion (introversion), agreeableness (antagonism), conscientiousness (undirectedness), neuroticism (emotional stability) and openness (closedness) (Costa & McCrae, 1992).

Twenty-four studies on the relationship between alcohol consumption and Big 5 personality traits have been regrouped in a meta-analysis. Across studies, only conscientiousness, neuroticism, and agreeableness were significantly related to alcohol consumption measures (Malouff, Thorsteinsson, Rooke, & Schutte, 2007). When examining the results of the individual studies included in this meta-analysis, inconsistent and often contradictory results were observed. This was notably the case for extraversion and openness, as their effect was null across studies. However, all traits, even conscientiousness, have exhibited a positive or negative relationship with alcohol consumption in at least one study. Accounting for more proximal intervening variables may allow us to elucidate such inconsistencies.

Accordingly, numerous works have studied mediators responsible for relationships between personality traits and addictive behaviors. For example, mediational analyses suggested that people who scored high on neuroticism were more inclined to consume alcohol, but only because they were motivated to reduce their negative affect (Hussong, 2003). In other words, coping drinking motives mediated the relationship between neuroticism and alcohol consumption. Other variables, along the same lines as drinking motives, could also mediate the

relationship between traits and alcohol consumption. We hypothesized that "time perspectives" could act as parallel mediators between traits and behavior.

Time perspective is a dispositional-situational construct that refers to the organization of experience into time frames (present, past and future) (Zimbardo & Boyd, 1999). Five dimensions have been outlined: 1) *Future* : engaging in behavior in order to steadily work towards achievements, 2) *Present hedonism*: taking pleasure in the present moment with little regards for the consequences, 3) *Present fatalism* : believing that one's present efforts are futile and consequently disengaging from goal-orientated activities, 4) *Past negative* : recalling negative or traumatic past experiences, 5) *Past positive*: recalling nostalgic and pleasant memories of the past. As with personality traits, many have studied bivariate relationships between time perspectives and health related behaviors including alcohol consumption. Across studies, present or future perspectives have been the most strongly and consistently associated with alcohol use measures (McKay, Perry, Cole, & Worrell, 2017).

Personality traits would be associated, but distinct, from time perspectives (Kairys & Liniauskaite, 2015). Conscientiousness was associated with future perspective and to a lesser extent with high past positive, and low present hedonist, present fatalist and past negative perspectives (Zhang, Howell, & Bowerman, 2013). Extraversion was related to high present hedonist and past positive perspectives, and to low past negative and present fatalist perspectives (Beek, Berghuis, Kerkhof, & Beekman, 2011). Agreeableness was associated with high future and past positive perspectives, and with low past negative perspective. Openness was related to high present hedonism and low present fatalism (Zhang et al., 2013). Neuroticism was associated with increased past negative and decreased past positive perspectives (Kairys & Liniauskaite, 2015). Nonetheless, all of these studies focused on bivariate relationships between traits and time

perspectives rather than mediation, and no studies investigated relationships with outcomes, such as addictive behaviors.

In sum, personality traits are stable dispositions that effect behavior across a variety of situations but their effect would be dependent on more proximal, situational, factors. Personality traits may contribute to shaping how people organize experience into temporal zones, which in turn could give way to (drinking) behavior. The situation-personality debate regarding time perspective is "essential" and ongoing which has led some authors to describe its status as "two-fold" (Kairys & Liniauskaite, 2015). More specifically, it was paradoxically affirmed that time perspective is both a stable disposition and a transient attitude (Zimbardo & Boyd, 1999).Furthermore, regression analyses demonstrated that time perspectives were related to personality traits, but that they cannot be reduced to traits (Kairys & Liniauskaite, 2015). It seems quite possible that time perspective could be acting as mediators between personality traits and behavior but surprisingly, discussions about mediational effects seem to be inexistent. The present study aimed to examine, for the first time, time perspectives as mediators between personality traits and alcohol consumption by using multiple parallel mediator analyses.

2. Methods

2.1. Participants and Procedure

Questionnaires were administered online using a secure platform (LimeSurvey). Participants were recruited via social networks and email diffusion lists provided by the university. After having read an information and consent form, participants were asked to continue only if they consented to participate in the study. All data was collected anonymously and participation could be interrupted at any time. Eligible participants were young people living in France, aged between 18 and 30 years old who consumed alcohol at least once over the proceeding year (*N*=549).

2.2. Measures

The *Zimbardo Time Perspective Inventory Short Form* (ZTPI-SF) in French was used to measure time perspective (Loose, Acier, Pilet, & Sysaykeo, 2017). The ZTPI-SF has three items for each of the fivefollowing dimensions: past negative (e.g. "I think about the bad things that have happened to me in the past"), past positive (e.g. "Happy memories of good times spring readily to mind"), present fatalism (e.g. "Since whatever will be will be, it doesn't really matter what I do"), present hedonism (e.g. "It is important to put excitement in my life") and future (e.g. "I complete projects on time by making steady progress").

The *Alcohol Use Disorders Identification Test* (AUDIT) in French measured alcohol consumption(Gache et al., 2005). The AUDIT takes two minutes to administer and has good validity, reliably and sensitivity.Ten items yield a global score when summed together indicative of problematic alcohol use.

The *Big Five Factor Inventory in French* (BFI-Fr) was used to measure the aforementioned Big 5 personality traits (Plaisant, Courtois, Réveillère, Mendelsohn, & John, 2010). Among French people, this is a valid and reliable measure of personality traits. The BFI-Fr takes ten minutes to administer and has 43 items.

3. Results

Three participants who were over 30 years old and 40 participants who reported not having consumed alcohol over the last year were discarded. 549 participants remained and all data was complete.72% of participants were female (*n*=393) and mean age was 22 years old (*SD*=2.31). Five multiple parallel mediator models were calculated using PROCESS (Hayes, 2013) run on SPSS. The model is exemplified in Figure 1. Each model entered one personality trait as a distal factor (*X*), five time perspectives as multiple parallel mediators (M_{1-5}) and the total AUDIT score as the outcome (*Y*). Path a_i, b_i, c and *c'*were calculated using ordinary least square

regressions. a_i coefficients reflect the regressed effect of X on M_i. b_i coefficients were the effect of M on Y when controlling for X. Path c related tothe effect of X on Y and path c' is the effect of X on Y while holding all mediators constant. When alpha was inferior to 0.05, effects were considered significant.

Figure 1. Multiple parallel mediator model
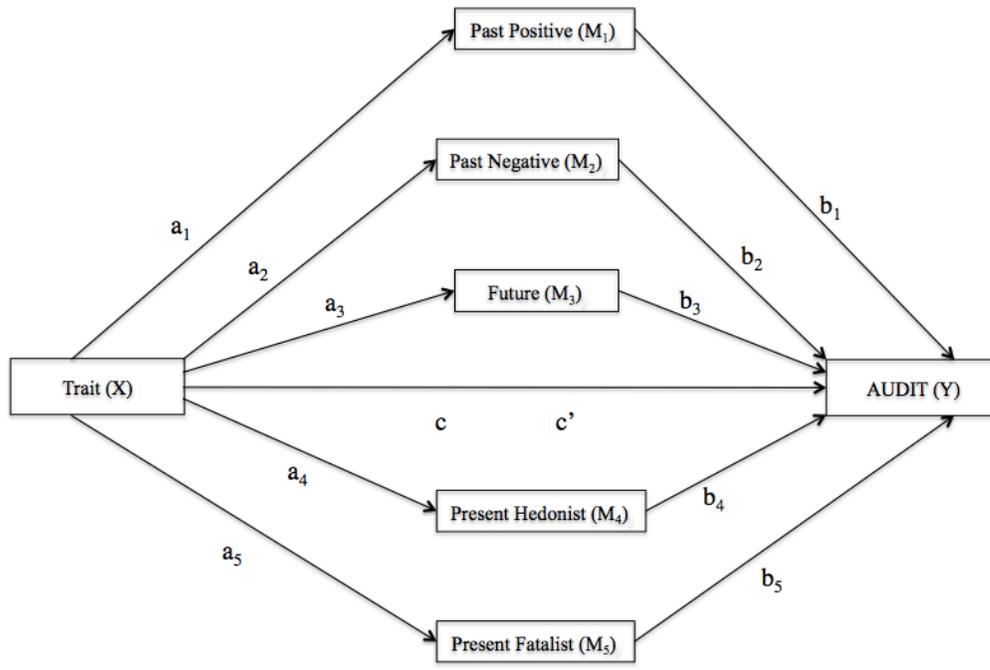
Table 1 displays the indirect effects (path $a_i \times b_i$) for each of the five mediation models. 20,000 biased corrected bootstrap samples were used in order to calculate 95% confidence intervals (CI) for indirect effects. In addition, table 1 provides the effect size of the indirect effect expressed by the ratio of the indirect effect to the total effect ($a_i \times b_i / c = P_M$). This coefficient is widely interpreted as the percent of the total effect accounted for by the mediator, but technically P_M is not a proportion because in some cases it exceeds 1 or is negative. In cases where P_M exceeds 1, P_M values are provided, but not discussed in order to avoid possible confusion (Hayes, 2013). When multiple parallel mediators were identified as significant, bootstrapped contrasts of their effect sizes are figured. The following paragraphs detail each of the five multiple mediator

models and should be regarded in conjunction the complementary information provided in Table 1.

Extraversion alone explained 3.2% of the variation in AUDIT scores (B=1.05, $F(1,547)$=18.17)(path c). Extraversion significantly predicted past positive (B=0.20, $F(1,547)$=29.27), past negative (B=-0.34, F(1,547)=50.87), future (B=0.10, $F(1,547)$=6.29), present fatalist (B=-0.15, $F(1,547)$=16.74) and present hedonist (B=0.35, $F(1,547)$=86.72) time perspectives (paths a_i). Taken together, extraversion and the 5 time perspectives accounted for 22.1% of variance in AUDIT scores ($F(6,542)$=25.58)(paths b_i and c'). More specifically, path c' was significant (B=0.70), as were path b_1 (B=-0.62), b_3(B=-2.02) andb_5 (B=1.72), whereas path $b_2$and b_4 were not. Past positive, present hedonist and future perspectives mediated the relationship between extraversion and alcohol consumption. Contrasts of indirect effects suggested that the present hedonist dimension was a significantly stronger mediator than the future or past positive dimensions (Table 1.1).

Agreeableness alone did not significantly predict AUDIT scores ($F(1,547)$=2.33) (path c). This trait significantly predicted past positive (B=0.24, F(1,547)=18.05), past negative (B=0.41, $F(1,547)$=31.75), future (B=0.26, $F(1,547)$=21.70) and present fatalist (B=0.15, $F(1,547)$=7.47) time perspectives, but not present hedonism ($F(1,547)$=0.00) (paths a_i). Taken together, agreeableness and the five time perspectives accounted for 21.0% of variance in AUDIT scores ($F(6,542)$=23.96)(paths b_i and c'). More specifically, path $b_1$was significant (B=-0.54), as was path b_3 (B=-1.96) and b_5 (B=1.97), whereas path c', b_2, and$b_4$were not. The indirect effect of agreeableness on alcohol consumption was significant through past positive and future time perspectives. Contrasts revealed that the past positive dimension was a stronger mediator than future time perspective (Table 1.2).

Conscientiousness explained 8.8% of the variance in AUDIT scores (B=-2.15, F(1,547)=53.05)(path c). Past negative (B=-0.26, F(1,547)=18.96), future (B=0.73, F(1,547)=391.15), present fatalist (B=-0.27, F(1,547)=36.87) and present hedonist (B=-0.15, F(1,547)=10.36) dimensions were significantly predicted by conscientiousness, whereas the past positive dimension was not (F(1,547)=0.94)(paths a_i). Taken together, the five time perspectives and conscientiousness explained 21.9% of the variance in AUDIT scores (F(6,542)=25.37) (paths b_i and c'). More specifically, path c' was significant (B=-0.94), as was path b_1(B=-0.58), b_3(B=-1.45) and b_5 (B=1.92), whereas path b_2 and b_4 were not. The indirect effect of contentiousness on alcohol use through future perspective, and to a lesser extent through present hedonism, was significant (Table 1.3).

Openness by itself did not significantly predict total AUDIT scores (F(1,547)=0.42)(path c). Nevertheless, this trait significantly predicted past positive (B=0.19, F(1,547)=14.82), present fatalist (B=0.14, F(1,547)=7.88) and present hedonist (B=0.30, F(1, 547)=32.99) time perspectives. Past negative (F(1, 547)=0.00) and future (F(1, 547)=0.88) perspectives were not significantly associated with openness (paths a_i). The five time perspectives and openness as predictors of AUDIT scores was significant and explained 21.0% of variance (F(6,542)=24.08) (paths b_i and c'). More specifically, path b_1 was significant (B=-0.53), as was path b_3 (B=-1.96) and b_5 (B=2.02), whereas path c', b_2, and b_4 were not. The indirect effect of openness on alcohol consumption was significant through present hedonist and to a lesser extent through past positive perspectives (Table 1.4).

Neuroticism alone did not significantly predict AUDIT scores (F(1,547)=2.34)(path c), but it did significantly predict all five time perspectives: past positive (B=-0.17, F(1,547)=20.93), past negative (B=0.51, F(1,547)=128.57), future (B=-0.07, F(1,547)=4.01), present fatalist (B=0.16, F(1,547)=19.26) and present hedonist (B=-0.15, F(1,547)=15.60) (paths a_i). When the

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five time perspectives and neuroticism predicted total AUDIT scores, 21.0% of variance was explained ($F(6,542)=24.08$) (paths b_i and c'). More specifically, path b_1 was significant ($B=-0.57$), as was path b_3 ($B=-1.96$) and b_5 ($B=1.95$), whereas path c', b_2 and b_4 were not. The total indirect effect was not significant, but there were significant specific indirect effects of neuroticism on alcohol use through three different time perspectives: past positive, future and present hedonist. Present hedonism was the strongest mediator, whereas the effects of past positive and future perspectives did not significantly differ (Table 1.5).

Table 1. Total, Direct and Indirect Effects of Personality Traits on Alcohol Consumption Through Time Perspectives

	Coefficient (BSE)	[LLCI; ULCI]	P_M
2.1. Extraversion			
Past positive (a_1b_1)*	-0.127 (0.062)	-0.270; -0.024	-0.120
Past negative (a_2b_2)	0.027 (0.071)	-0.110; 0.170	0.026
Future (a_3b_3)*	-0.204 (0.092)	-0.408; -0.044	-0.192
Present fatalist (a_4b_4)	0.047 (0.041)	-0.021; 0.145	0.045
Present hedonist (a_5b_5)*	0.606 (0.116)	0.398; 0.857	0.572
Past Positive- Future	0.077 (0.112)	-0.132; 0.306	
*Past Positive- Present hedonist**	-0.732 (0.141)	-1.038; -0.480	
Future- Present hedonist *	-0.810 (0.136)	-1.091; -0.558	
2.2. Agreeableness			
Past positive (a_1b_1)*	-0.131 (0.079)	-0.328; -0.011	0.228
Past negative (a_2b_2)	0.088 (0.085)	-0.066; 0.274	-0.153
Future (a_3b_3)*	-0.527 (0.160)	-0.892; -0.258	0.918
Present fatalist (a_4b_4)	0.059 (0.051)	-0.006; 0.208	-0.102
Present hedonist (a_5b_5)	-0.005 (0.131)	-0.264; 0.255	0.008
*Past positive- Future**	0.396 (0.185)	0.065; 0.791	
2.3. Conscientiousness			
Past positive (a_1b_1)	-0.027 (0.035)	-0.124; 0.023	0.012
Past negative (a_2b_2)	0.064 (0.055)	-0.028; 0.191	-0.030
Future (a_3b_3)*	-1.062 (0.280)	-1.628; -0.530	0.493
Present fatalist (a_4b_4)	0.121 (0.077)	-0.009; 0.298	-0.056
Present hedonist (a_5b_5)*	-0.306 (0.107)	-0.536; -0.113	0.142
*Future- Present hedonist**	-0.756 (0.302)	-1.359; -0.179	
2.4. Openness			
Past positive (a_1b_1)*	-0.106 (0.064)	-0.263; -0.007	-0.476
Past negative (a_2b_2)	0.001 (0.020)	-0.037; 0.050	0.003
Future (a_3b_3)	-0.099 (0.117)	-0.341; 0.122	-0.443
Present fatalist (a_4b_4)	0.058 (0.044)	-0.003; 0.179	0.262
Present hedonist (a_5b_5)*	0.623 (0.143)	0.373; 0.933	2.801
*Past positive- Present hedonist**	-0.729 (0.164)	-1.090; -0.445	

2.5. Neuroticism			
Past positive (a_1b_1)*	0.098 (0.053)	0.012; 0.225	-0.257
Past Negative (a_2b_2)	-0.071 (0.109)	-0.295; 0.137	0.187
Future (a_3b_3)*	0.152 (0.082)	0.012; 0.337	-0.400
Present fatalist (a_4b_4)	-0.058 (0.045)	-0.166; 0.015	0.154
Present hedonist (a_5b_5)*	-0.304 (0.090)	-0.502; -0.145	0.801
*Future- Present hedonist**	0.456 (0.119)	0.239; 0.713	
Past positive – Future	-0.054 (0.097)	-0.261; 0.121	

Note. LLCI=Lower limit confidence interval. ULCI=Upper limit confidence interval. BSE=boot standard error.

P_M=Percent Mediation. * significant effect (CI does not include zero). Pairwise contrasts in italics

4. Discussion

4.1. Personality traits, time perspectives and alcohol use

Five models were elaborated in which personality traits predicted alcohol consumption through the multiple parallel mediators of time perspectives. Significant indirect effects of time perspectives were identified in all five models suggesting that some time perspectives did indeed mediate the relationship between traits and alcohol consumption. Several cases of indirect effects without the presence of a direct effect were found. This highlights the importance of not requiring the existence of an "effect to be mediated" (Hayes, 2013) especially when studying personality traits, because they are among the most distal factors leading up to alcohol use (Cox & Klinger, 1988) and because competitive mediational relationships may be operating, as was observed in the present study. Only past positive, future and present hedonistic time perspectives were identified as mediators in this study. However, effects differed according to personality traits and each model reflected a unique pattern of direct and indirect pathways to alcohol consumption.

In the case of extraversion, partial mediation occurred which accounted for 57% of the total effect. Extraversion led most strongly to increased present hedonism, which led to increased alcohol consumption. However, extraversion also led to increased future and past positive, which led to depleted alcohol use. Respectively, these time perspectives accounted for 19% and 12% of

the total effect. Thus, extraversion could be considered both a protective factor and a risk factor for alcohol consumption. Interestingly, this may help to explain inconsistent findings regarding extraversion's relationship with alcohol use observed in the meta-analysis (Malouff et al., 2007). However, as the direct effect was not fully accounted for by indirect effects, other intervening mediators whose identification could the object of future works.

Agreeableness was a case of indirect only mediation, meaning that we had take into account time perspectives in order for an association between agreeableness and alcohol consumption to appear. This was surprising in regards to the findings of the meta-analysis that identified a significant direct effect of agreeableness on alcohol use when taking into account the effects of 24 studies (Malouff et al., 2007). Agreeableness led to heightened past positive and future time perspectives which were both protective factors guarding against problematic drinking behavior. In other words, our study suggested that agreeableness only had a relationship with alcohol consumption because this trait favored the development of past positive time perspective, and to a lesser extent, future time perspective.

The protective effect of conscientiousness alone on problematic alcohol use accounted for 8% of variance in AUDIT scores. This effect was partially mediated by increased future perspective (49%), and to a lesser extent, by decreased present hedonism (14%). This study identified no vulnerability factors tied to conscientiousness and this trait probably favors protective time perspectives in regards to alcohol use. Conscientiousness may lead to other adaptive behaviors that were not included in this study. For example, several mediational analyses have shown that conscientiousness leads to decreased enhancement drinking motives which in turn lead to decreased alcohol use (Mezquita, Stewart, & Ruipérez, 2010).

The relationship between openness and alcohol use was fully mediated by past positive and present hedonistic perspectives. Openness led to an increase in both of these time

perspectives, but present hedonism was a risk factor for problematic alcohol use, whereas past positive time perspective was a protective factor. This may help clarify divergent findings relating openness to alcohol consumption. When assisting people who score high on openness with problematic alcohol use, it may be useful to help direct their present hedonistic tendencies away from alcohol use to other pleasant substitute activities. If clients who score high on openness have an under-developed past positive time perspective and problems with alcohol consumption, it may be particularly useful to reinforce positive memories of their past.

Neuroticism led most strongly to low present hedonism, which rendered the trait a protective factor in regards to alcohol consumption. This may seem surprising because neuroticism has an impulsivity facet (Costa & McCrae, 1992) and impulsivity is positively related to present hedonism (Baumann & Odum, 2012). However, negative affect is also tied into the neuroticism construct (Costa & McCrae, 1992), whereas positive affect is associated with present hedonism (Zimbardo & Boyd, 1999). This may explain the observed negative relationship between present hedonism and neuroticism. Neuroticism also led to a small decrease in future and past positive perspectives, but these perspectives were protective factors that led to decreased alcohol consumption.

4.2. Limitations

We used a convenience sample, all questionnaires were self-report and the ratio between sexes was disproportional. Any interpretations implying that traits developed or shaped time perspectives were limited by the cross sectional design of this study. As the ZTPI did not account for all existent time perspectives, using only one measure of temporality may have limited our work and future studies could be advised to use multiple measures of temporality, as did McKay et al. (2017). The generalizability and reliability of our findings could also be questioned and could become a subject of future works.

4.3. Conclusions

Our study suggested that personality traits were related to alcohol consumption because they led to the development of specific time perspectives: past positive, future and present hedonism. Clinicians could be attentive to how personality traits develop into time perspectives and give rise to drinking behaviors. Future studies could extend our findings to other behavioral patterns in order to continue to resolve debates regarding the relationship between personality, time perspective and behavioral outcomes.

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Thèse de Doctorat

UNIVERSITE BRETAGNE LOIRE

UNIVERSITÉ DE NANTES

Tianna LOOSE

**Les déterminants de la consommation problématique d'alcool:
Les traits de personnalité, l'orientation temporelle et les motivations**

**Etiological models of problematic alcohol consumption among Francophone
college students: Personality, temporality and motivation**

Résumé

Introduction : La question de l'étiologie des déterminants de l'usage d'alcool est importante, notamment auprès des étudiants. Certains déterminants, tels que les motivations à consommer, mènent directement à l'usage, alors que d'autres, tels que les traits de personnalité, influent sur l'usage de manière indirecte. D'autres déterminants, tels que la temporalité, pourraient être des facteurs intermédiaires. Nous faisons l'hypothèse que les traits de personnalité conduisent aux temporalités qui conduisent aux motivations qui donnent lieu à l'usage d'alcool. Méthodes : Nous avons inclus 867 étudiants francophones vivant en France (N=389) ou au Québec (N=478). Nous avons administré des mesures d'usage d'alcool, des motivations à consommer, des traits de personnalité et des temporalités. Résultats : D'abord nous avons observé que les traits de personnalité menaient à l'usage d'alcool à travers des motivations spécifiques. Ensuite nous avons observé que les traits mènent aux temporalités et que des temporalités menaient à l'usage car ils influent sur des motivations. La quatrième étude figure des pistes de médiation sérielle qui incluent l'ensemble des niveaux des déterminants.
Discussion : Certains traits de personnalité seraient des facteurs de risque, mais surtout parce qu'ils favorisent le développement des motivations. De plus, nous avons éclairci le statut étiologique de la temporalité, à considérer comme une disposition stable et une caractéristique situationnelle. Dernièrement, nous avons trouvé que parfois les trois niveaux de déterminants ne pourraient pas être dissociés, ce qui souligne l'importance de considérer l'ensemble de ces facteurs.
Mots clés
Alcool, étudiant, France, Québec, personnalité, temporalité, motivations à consommer, médiation

Abstract

Introduction: In the interest of positively impacting alcohol use among college students, we studied determinants of consumption behaviors within an etiological framework. Personality would be associated with alcohol use, but the link would be mediated by more proximal variables. Drinking motives would be the most proximal predictive factor of alcohol use. A situational-dispositional construct called time perspective has sparked recent interest and we hypothesized that it would be etiologically situated between traits and motives.
Methods: Students living in France or in Québec were administered questionnaires online. We measured Big 5 personality traits, time perspective, temporal competency, drinking motives and problematic alcohol use. In data analysis, we draw up multiple parallel mediator models reflecting different etiological relationships.
Results: Indirect effects of traits on alcohol use through drinking motives appeared. Study 2 found that traits led to alcohol use through specific temporalities. In study 3, drinking motives explained the relationship between temporalities and alcohol use. Study 4 accepted and rejected hypotheses about serial mediation as a function of different forms of logic.
Discussion: Understanding etiological pathways leading up to problematic alcohol use could aide practitioners to positively impact drinking behaviors. Personality would be related to alcohol consumption but mostly because traits led to drinking motives and in turn led to temporalities. Our results may allow us to better foresee among which students problems will develop and prevent the onset or the aggravation of problematic alcohol use through emerging adulthood.
Key Words
Alcohol, student, France, Québec, personality, temporality, drinking motives, mediation

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