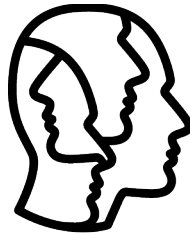


# HEALTHY INDIVIDUALS' DECISION MAKING IN ONLINE POKER

PERSPECTIVES ON EMOTIONAL STABILITY AND WELLBEING

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Academic dissertation

to be publicly discussed, by due permission of the Faculty of Behavioural Sciences, at  
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# ABSTRACT

In our previous studies it has been found that a phenomenon labeled “tilting” is a form of moral anger. When players are in “tilt” they make a series of bad decisions, chase their losses and express anger by cursing their opponents. In the context of tilting, the players also report episodes of memory loss. Additionally, we also developed a scale that measures the level of a player's poker experience, and we found evidence to suggest that poker experience is associated with mature self-reflection skills. We also found that the likelihood of a poker player making the correct decision in poker decision making tasks increased as a function of self-reflection and poker experience.

In Study 1 I found evidence supporting the hypothesis that the regulation of emotions is an important part of the skill set of poker players. Specifically, if poker players have read a story about betrayal where they are asked to take the position of the victim before they make their decisions in poker decision making tasks, they make mathematically worse decisions than those participants who have only read a control story. The effect was moderated by the presence of a pair of moving eyes placed on the screen, which were used as proxy for the social environment. The results support the hypothesis that tilting is related to moral anger, or at least some form of anger that seems consistent with the events taking place in the social context.

In Study 2, I assessed the associations between the HEXACO personality inventory -revised and poker experience. I obtained evidence supporting the notion that emotional stability is positively associated with accumulated poker experience.

In Study 3 I showed that poker experience does not seem to be correlated with emotional intelligence, selfishness, self-control problems, social alienation or lowered levels of life satisfaction. I also note that these measures correlate with instruments measuring problem gambling. However, I observed either no correlations, or correlations hinting towards health benefits, between these instruments and poker experience. I concluded that problem gambling instruments need further development. Taken together our results indicate that there are numerous benefits in approaching the field of gambling studies from a non-clinical angle.

# TIIVISTELMÄ

Väitöskirja koostuu kolmesta osatutkimuksesta, jotka laajentavat aikaisempia tutkimuksiamme. Aikaisemmissa tutkimuksissamme osoitettiin että “tilttaamiseksi” nimetty ilmiö on moraalisen raivon muoto. Tilttaaminen on ilmiö, jossa pelaajat tekevät sarjan huonoja päätöksiä ja jahtaavat häviöitään ja ilmaisevat suuttumusta mm. kiroten kanssapelaajiaan. Tilttaamisen yhteydessä pelaajat ovat raportoineet myös muistikatkoksia. Lisäksi kehitimme pokerikokemusmittarin ja löysimme todistusaineistoa, joka vittasi pokerikokemuksen olevan yhteydessä kypsiin itsereflektiotaipumuksiin. Huomasimme myös kokeneiden pelaajien tekevän sitä todennäköisemmin matemaattisesti oikeita päätöksiä, mitä korkeampi itsereflektiotaipumus heillä on.

Väitöskirjani enimmäisessä artikkelissa tulokset puoltavat hypoteesia jonka mukaan emootioiden hallinta rationaalisten päätösten tekemiseksi on tärkeä osa pokerinpelaajan taitopatteristoa. Mikäli pokerinpelaajat olivat luke-neet suuttumusta aiheuttavan tarinan, jossa heidän piti asettua petoksen kohteeksi joutuneen ihmisen asemaan, tekivät he matemaattisesti huonompia ratkaisuja rationaalista päätöksentekoa edellyttävissä pokeripäätöksentekotehtävissä. Kyseinen ilmiö oli riippuvainen siitä tekivätkö pelaajat päätöksiään silloin kun näytöllä oli liikkuva silmäpari. Silmäpari toimii vastineena pokeripelin sosiaaliselle ympäristölle. Tulokset tukevat hypoteesia että “tilttaamisessa” olisi kyse moraalisesta raivosta

Toisessa artikkelissa arvioimme HEXACO-PI-R persoonallisuusmittarin ja pokerikokemuksen välisiä yhteyksiä. Tulosten mukaan emotionaalinen tasapainoisuus on yhteydessä pokerikokemuksen kehittymiseen.

Kolmannessa artikkelissa toteamme ettei pokerikokemus näytä olevan yhteydessä alhaiseen tunneälyyn, itsekkyyteen, itsekontrolliongelmiin, syrjäytyneisyyteen tai alentuneeseen elämäntyytyväisyyteen. Samassa artikkelissa edellä mainitut ongelmat korreloivat ongelmapelaamista mittaavien instrumenttien kanssa ja ongelmapelaaminen näyttää korreloivan pokerikokemuksen kanssa (joka ei kuitenkaan korreloi negatiivisten hyvinvointivaikutusten kanssa). Toteamme, että ongelmapelaamismittareita pitänee vielä kehittää lisää.

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This thesis would have never been completed was it not for the people who have supported me along the way. There are no words that could express my infinite gratitude towards those who helped me get here and expected nothing in return. The help and support that I have received during the years that I have conducted my research is precious beyond measure. The most important person, the greatest enabler, for this thesis is without a doubt my supervisor assistant professor Markus Jokela who helped me prepare my research proposal and always supported me in my grant applications. He also gave me his academic shoulder to cry on during moments of professional despair. Without Markus, I would have never been able to go and do my methodological studies in Amsterdam. Without him, I wouldn't have started as a PhD student at Helsinki. I would also like to thank Kone and Alcohol Study foundations for the same reasons.

The second person I would like to thank is my first girlfriend Iida Lehtomäki, who showed me the value of science, critical thinking and gave me the gift of atheism. Without her I am relatively certain that I would have ended up somewhere where books and wisdom would never have been appreciated.

I would not be here without my teachers from high school. Especially my principal Markku Multanen M.A. (Psych.), who gave me my only A from any course I took during my high school years. This grade was from his social psychology course, due to him, I found this field of inquiry interesting. I also need to thank my most memorable teacher in philosophy, Päivi Arvonon, who was supportive of my eccentricity and who ignited a spark which is still alive today.

I had inspirational teachers during my undergraduate years as well. I would like to thank L.SocSc. Katarina Järvinen for making me realize that I can actually be good at something. Thanks to my anthropology teacher Docent Annika Teppo I learned that hard work is rewarded. I would also like to thank my m. thesis supervisors Prof. Vilma Hänninen and Prof. Pertti Töttö, who pressed me hard to work on the theoretical foundations of evolutionary psychology. Prof. Töttö also nudged me to become a researcher rather than just settle for a master's degree and a career in teaching.

I would like to thank the two departed lecturers of social psychology Pertti Rautio (L.Soc.Sci) and Dr. Jukka Tontti for being role models for intellectual development. They were academics in the classical sense of the term, widely read and they had a deep insight into societal processes and human psychology. They showed me that the limits of social psychology are only set by our own imaginations.

I would like to thank assistant professors L. Nummenmaa and T. Miettinen for reviewing my thesis. I did my best to incorporate all of their precious feedback. Thank you for my coauthor Docent Mikko Salmela for offering his wisdom and guidance on how to respond to peer reviewers during these years.

A special mention, without a doubt, goes to my coauthor and apprentice PhD Jussi Palomäki, without whom we would have never started working on poker, decision making and tilting in the first place. His optimism, sense of humor and sense for academic style combined with his kindness makes him unique in the academic world. It is my sincere wish to continue working with him in the future as well.

Dr. Otto Lappi, lecturer of Cognitive Science, deserves a special thank you for making me enthusiastic about the challenging ideas that forced me to think things again, from a different angle. Thank you for changing my orientation from social science to computational thinking. This is one of the biggest intellectual gifts I've ever received.

The biggest thank you of all goes to my beloved companion Marianna, with whom I hope to share my life for years to come. She listened to me whine about my failures and disappointments for hours – an unbearable torture that no one should bare. Truly, this is a sign of love.

For those who get it, I would also like to thank Apophenia and Peter J. Carroll. The funny thing is, this thesis was supposed to be about evolutionary psychology, now it turned out to be something related to chance and chaos. There is humor in life and the only thing we can do is to laugh about the mess we are in. As a final thing, thanks mom for paying for my courses at the Open University – despite the fact that you thought that I should go and study economics at the vocational level. Paying for my studies at the Open University was the smartest thing you ever did as a parent. Thank you.

15.03.2015; Michael Laakasuo,  
Planet Earth



## LIST OF ORIGINAL PUBLICATIONS

- Laakasuo, M., Palomäki, J., & Salmela, M. (2014). Emotional and social factors influence poker decision making accuracy. *Journal of Gambling Studies*. Advance online publication. doi: 10.1007/s10899-014-9454-5
- Laakasuo, M., Palomäki, J., & Salmela, M. (2014). Experienced poker players are emotionally stable. *Cyberpsychology, Behavior, and Social Networking*, 17, 668–671.
- Laakasuo, M., Palomäki, J., & Salmela, M. (2015). Poker players with experience and skill are not “ill”—Exposing a discrepancy in measures of problem gambling. *Journal of Gambling and Commercial Gaming Research*, 1, 1–17.

## FOREWORD

I have a confession... I am not a poker player. I have never played a single hand of online poker. My academic interests in general lie somewhere in consciousness studies, theories of computation, emotions, rationality, morality, evolution and decision making. I am interested in the big questions: why are we here, why does it feel like something to be alive, how does evolution work, why did evolution start utilizing consciousness? So why is my thesis about poker? Well, it isn't actually... I consider that it is a thesis about decision making and skill development, I just happen to observe some aspects of these processes with the help of poker. After all, poker is a unique game which brings together, rules, norms, strategies, emotions, social settings, rationality and decision making. Many of the things I am interested in academically take place in poker.

Originally my thesis was supposed to be on evolutionary psychology. During the years that I was conducting poker research with my colleague Jussi Palomäki, I also prepared four or five articles on evolutionary and moral psychology. One of these articles received such a crushing review that it can't be revived. The other three or four will still possibly be published in the near future. At least there is some hope for them, depending a bit on the details and luck encountered during the review process.

To say the least it was not expected that I would graduate with a poker related thesis. Life, however, has its way of taking its twists and turns and sometimes during those moments we just need to brace ourselves for the turbulence and hope for the best while the storm passes. To state it shortly, my PhD work has been a disaster. None of the plans I made pulled through. In Amsterdam I was promised help and guidance that I never received and on top of that, one of my research ideas was either just blatantly stolen or somebody accidentally had the exact same idea... This idea I had written up in full in 2009 and it was part of my original research proposal for University of Helsinki.

I mentioned this idea passing to a colleague in Amsterdam during 2012, who then published a set of studies (in 2014) with an almost identical design compared to the one I had written for a course there during the previous year (2011). Later on I had social problems with the same colleague, and I eventually had to quit my research

position in Amsterdam in February of 2014. It was becoming obvious after 18 months that none of my work was progressing, nor was I receiving guidance or support that would have been helpful for my own work – I was only being used to execute other peoples ideas.

While this was going on, the poker research I had been doing on the side as a hobby was gathering momentum. The funny thing about poker research was, that it was fun. Nobody was breathing down our necks or insisting that we should do things in a particular way. Both of us, Jussi and I, we had our supervisors, but in practice we were free to do as we pleased. I can't stress this enough, we had no bosses and for all practical purposes had complete academic freedom. We made all our judgments regarding the write-up, design and publication by ourselves. In my opinion, this also shows. Our body of work is coherent, it has a clear and a logical narrative and it very nicely builds on top of the previous work that we have done. We have seen science progress with our own eyes. The results are beautiful, even if I say so myself. For instance, the article that is listed now as the third study of this thesis received the best paper award from the *Journal of Gambling and Commercial Gaming Research* in November of 2013 (although for several reasons unrelated to me, its publications was delayed until 2015).

Ironically, almost immediately after I left Amsterdam in February of 2014, I received news that my experimental study had been accepted for publication without any revisions (Study 1 of this thesis)! At that moment I was looking at my published work, that was progressing and I was looking at the pile of diminishing resources that I had stocked up – I had used up almost all of my grant money for my studies in Amsterdam. At that moment I started thinking that maybe, indeed, I had to just suck it up, cut my losses and graduate with the work I had been doing as a hobby. This was confirmed when my HEXACO paper (Study 2 of this thesis) was accepted for publication in June of 2014. The summary part of this thesis was promptly written up after that and was finished by the end of September 2014. At that moment I was not quite sure if I was happy with my work

However, I felt that maybe the decision to graduate with a poker related thesis had indeed been a correct one when *Cyberpsychology* lifted our HEXACO paper as their cover story for their October issue. They had also sent out a press release regarding

this paper and it received international media attention from Greece to USA and from Poland to China. Finnish public radio and press had contacted us for interviews. According to the Altmetric.com, our short HEXACO paper received more media attention than 99% of science publications.

Nonetheless, I can't count the number of things that had to happen or go wrong for me to arrive here. My colleague Jussi also made remarks on how he was puzzled by the extensive streak of bad luck that was hitting me during my years as a PhD student. Well, in any case, my thesis turned into something I would have never expected and although the manuscript was finished already in September of 2014, several other things had to go wrong before I could get it reviewed. Notwithstanding, here it is finally, ready and polished and hot out of the press and ready to be defended.

I hope that who ever decides to read it, enjoys at least parts of it. I have made my best to make it as readable as I can, and I have done my best to avoid unnecessary technicalities. In my opinion, science writing does not need to be rigid and boring.

With love,

--Michael Laakasuo

# 1 BACKGROUND

*”The problem is not to find the answer, it's to face the answer”*

– Terence McKenna

## 1.1. Unanswered questions in previous poker research

The previous research I was engaged in resulted in three articles and my colleague and friend graduating with a poker related PhD thesis (Palomäki, Laakasuo & Salmela, 2013a; 2013b; 2014). During this time we realized that there were still unanswered scientific questions related to our work, and these open questions now form the backbone of this thesis (Laakasuo, Palomäki & Salmela, 2014a; 2014b; 2015). With our initial work (Palomäki et al., 2013a; 2013b; 2014), we managed to shed light on the following things:

We found out, using qualitative methodology, that the phenomenon known in the poker community as “tilting”(i.e. a state of mind associated with a series of bad decisions, loss of control and self-reported memory loss) seemed to be a variation of moral anger (i.e. feeling personally insulted and demanding retribution (in order) to feel that the world is fair) relevant to a poker playing context (Palomäki, Laakasuo & Salmela, 2013b). Based on our analysis, “tilting” appeared to be a common reaction for healthy poker players, who did not show any of the pathologies usually associated with gambling behaviors.

Nevertheless, this moral anger response was triggered by one out of two types of events where the player either I) lost a lot of money in a single event or II) had a series of consecutive losses. Both of these triggers were associated with the perceived unfairness of the preceding situation(s). The perceptions of unfairness are warranted, to some extent, from a subjective perspective since poker does have an intrinsic mathematical skill component (see below, Uniqueness of Poker as a form of Gambling). In many cases, the decisions to either *fold* (i.e. not to invest more money) or to *call* (i.e. to invest money) can be estimated to have approximate expected returns. However, due to the intrinsic chance element enmeshed into the very fibers of poker, the outcomes that

are unlikely to occur, do occur from time to time. Therefore, a poker player who plays in tune with the harmony of probabilities might still end up losing large sums of money – even when odds are on his/her side. It is during these moments that “tilting” occurs, especially if the player perceives rare chance events as personal insults against what is perceived as “fair” or “just”.

Thus, tilting, was associated with an anger reaction. This in turn was related to *chasing* – trying to win back lost money – behaviors, where the poker player starts making increasingly worse decisions from a rational perspective. In the words of a participant of ours, the player tries to “restore the cosmic balance” of fairness by sacrificing his money on the *Altar of Fortuna* (i.e. the poker table). This sometimes results in cursing the other players or even breaking physical objects (see also McCormick & Griffiths, 2012). In our qualitative study experienced poker players also reported that tilting had stopped occurring for them and that they were not, supposedly, bothered by even large losses.

From this point on, we started thinking that maybe some form of emotional maturity or emotional intelligence plays a role in developing efficient poker decision making skills. In our second study, we found evidence to support this (Palomäki et al., 2013a). The poker players who were more capable of self-reflection were also more likely to make mathematically correct decisions in hypothetical poker decision-making scenarios. These effects were moderated by skill and driven specifically by those poker players who were more experienced than average (as measured with our Poker Experience Scale). However, since this second study was both exploratory and correlational, we could not make causal inferences: do emotionally stable people become better poker players, or does the game of poker itself train people into “micro economic zen-masters”?

We further aimed to clarify this question by running another survey which was a build-up on the findings of our two previous studies (Palomäki et al., 2014). In this third survey, we investigated whether such factors as self-perceived skill, actual skill and ability to withstand losses predispose people to – or even prevent them from – tilting. We found that experienced poker players reported more frequent and more severe tilting than inexperienced ones. However, the effects were mediated by

emotional sensitivity to losing. In other words, people who could not stand losing money tilted more. These findings were very interesting, since they suggested that experienced poker players, compared with inexperienced ones, were more “emotionally mature” and well-functioning, and at the same time, they reported more tilting.

The apparent discrepancies in our previous studies suggested that there could be genetic, non-pathological and situational components related to tilting. Furthermore, our studies also suggested that tilting could be unrelated to pathological gambling. Especially our qualitative data showed that poker players seemed to be fairly well in control of their lives. More specifically, they seemed to be capable of remorse and self-reflection after arduous losing streaks or after a series of bad decisions. In other words, our previous data show that our sample consisted mostly of rational and healthy adults and that the problematic issue of tilting was something that could more or less happen to anybody.

Given the details described above, three questions regarding tilting and emotional health in poker were raised. These are the research questions that form the basis of my thesis:

A) If tilting is something induced by the situation, can we simulate tilting or moral anger experimentally to observe its effects on poker decision making? The answer to this question is “yes”. We successfully created an online experiment where we observed angry poker players making worse decisions than neutral controls. This is the first study of this dissertation (Laakasuo et al., 2014a). – However at the time of writing we do not know if all the negative emotions would have a similar effect on decision making in poker.

B) Does acquiring poker experience make people better at emotion regulation, or do people who are naturally apt at such skills choose to persist with poker? The short answer is that there seems to be a statistically significant personality component involved (Laakasuo et al., 2014b). People who are naturally emotionally stable play more poker at higher stakes than people who are emotionally unstable.

C) What is the relationship between pathological gambling, socio-emotional well-being and poker experience? The short answer seems to be that self-report measures of problematic/pathological gambling correlate well with poker experience

and with lowered emotional wellbeing. However, poker experience is either not associated, or in very weak positive association with socio-emotional wellbeing. The results of this third study suggest that the present instruments measuring problematic gambling are not well suited to be used in the context of poker (or possibly other games with significant skill components; Laakasuo et al., 2015).

## **1.2. Uniqueness of poker as a form of gambling**

McCormack and Griffiths (2012) characterize poker as a “game of inference and investment played with limited information”, where the player must “infer the strength of their own cards compared to their opponent’s cards based on the information they get from their opponents wagers.” According to an emerging consensus in the field of gambling studies, poker is generally considered to be a game with a substantial skill component (Berg, 2010; Biolcati, Passini & Griffiths, 2014; DeDonno & Detterman, 2008; Fiedler & Rock, 2009; for a dissenting view, see Meyer et al., 2013). This makes poker-playing a type of gambling with some unique properties as compared to other games of chance (e.g. roulette, craps, or lottery games).

In poker, it is entirely possible for a gambler to be a winning player in the long run and to make substantial earnings (Hopley & Nicki, 2010). According to a classic paper by Browne (1989), skill in poker can be divided into technical and emotional components. The emotional skills in poker are related to self-regulation, wherein the player attempts actively to stay calm and not to lose his nerve, while his opponents are “needling” or harassing him verbally. The technical poker skills are related to understanding the mathematical dimensions of the game. These are usually related to estimating the relative strengths of different card combinations (i.e. *hands*) and to understanding the concept of *statistical variance* (see also Palomäki et al., 2013a; 2013b; McCormack and Griffiths, 2012). Based on a short review (Cronson, Fishman & Pope, 2008), argue that the skill component in poker is comparable to the skill component inherent in golf.



There is further evidence to suggest that the specific sub-category of online poker called *No Limit Texas Hold'em* has a unique sub-culture, where individual characteristics related to self-control and mathematical aptitude are explicitly appreciated (Biolcati et al, 2014; McCormack and Griffiths, 2012; albeit these properties are needed for other types of poker as well). Poker players who engage in online poker games also spend substantial time and effort in reading strategic poker playing guides and participate in extensive discussions in online forums that serve as a meeting point for the poker community (O'Leary and Carroll, 2013). This also makes poker a profoundly *social* game. Not only are poker players engaged in competitive situations against other players, but they are also steeped in their social identities as poker players within the larger society as well. Their failures and success are discussed in online forums and poker players worry about their reputations.

Social reality and the societal context outside of the gaming table also influence the moods and feelings of poker players, who might be bringing these emotions into the gaming table, which in turn might influence their decisions. There is indeed some evidence that especially poker players who are classified as pathological gamblers might be engaging in poker to lift their moods, whereas the primary motivation for professional poker players is to earn money (McCormack and Griffiths, 2012; Binde, 2013). However, given that one of the major motivators behind gambling is escapism, it is very likely that bad mood predisposes some people to gamble. However, in poker it is important to keep a clear mind, playing to escape is not something that can be easily combined with making money. In our qualitative study, we found evidence supporting these contentions (Palomäki et al., 2013b). Respondents with strong professional poker player identities portrayed a certain pride in being able to prevent the emotions generated by the game from interfering with their lives outside of the gaming arena (Palomäki et al., 2013b).

## 1.3. Dual process models, emotions, presence of others and expertise

### 1.3.1 Dual processing models

From the perspective of decision-making sciences, one would expect poker to attract more interest than it does in the present, as it seems to be an ideal environment to utilize the dual processing models and (bounded) rational choice models. Poker is a technical game that requires careful rational, logical and mathematical aptitude as one needs to make decisions in limited time in a social setting and under emotional pressure.

Dual process models are a family of models that aim to describe how decisions and judgments take place (Hassin, Uleman & Bargh, 2005; Fiske & Taylor, 2008). Most commonly, it is assumed that there are two processing systems involved with human cognition, *System 1* and *System 2*. System 1 is a automatic and fast-acting and mostly “unconscious”. What makes System 1 fast, is that it has been organized in to a network that processes several things at once. This parallel processing network also uses shortcuts and fast reflex-like reactions, or simplistic decision rules in its processing. These fast decisions rules are commonly known as heuristics (e.g., Gigerenzer, 2007).

In common parlance heuristics are usually called “rules of thumb”, meaning that there are general principles for making decisions, which lead to good outcomes most of the time. For example, when I think of the biggest city in any country I usually get it right if I suggest that the capital of the country is the biggest. However, there are several countries where the capital is not the largest city (e.g., the biggest city in The United States is New York). In our everyday lives we also call heuristics intuitions and hunches. Depending on the dual processing model, it is sometimes assumed that System 1 is evolutionarily old.

System 2, on the other hand, is postulated to be a serial processing system which works slowly. It is usually assumed that it is slow because it can only operate on very few things at any given moment. System 2 is also deliberate, calculative, logical and evolutionarily new or unique to humans. Very often System 2 is equated with

conscious or controlled decision-making. Depending on the dual processing model, System 2 is likely to be constrained by working memory capacity (Carruthers, 2006). In humans, ecologically-rational decision making happens through the integration of both systems. When we are solving math puzzles or playing chess or writing computer programs, we are using System 2. Also, one could argue that the classical rational choice model of economics is based on System 2 type of processing (for a review see, Palomäki, Laakasuo & Lappi, 2012).

The Rational Choice Model of economics assumes that people choose the option that is best for them (e.g., Briggs, 2014). Also, given that some decisions or choices can be expected to have a probabilistic outcome, the rational choice model assumes that people choose the option that has the highest expected pay-off (Briggs, 2014). The standard or classical rational choice theory assumes that emotional processes or irrational factors should not influence individuals' decisions, this makes the rational choice theory compatible with the dual processing theory, by subjugating classical rationality under the domain of System 2 (Palomäki, Laakasuo & Lappi, 2012). We used this for our advantage and utilized the rational choice theory in creating our poker decision making scenarios, by estimating an expected return value for both fold and call options in the scenarios (see Method section below for further elaboration).

Some dual processing theories (Carruthers, 2006) assume that System 1 has several context sensitive sub-systems or sub-components functioning within it. System 1 could have automatic and heuristic processing systems for social cues and emotional cues separately. Depending on the context and the relevance of the information that is needed to make proper decisions, System 1 might feed different information to System 2 on different occasions. If System 2 tries to parse several pieces of qualitatively different information together in complex situations where time and processing resources are limited, it is likely to perform sub-optimally.

As an example regarding context sensitivity in economic decision making we could think of the following experiment ran by a team in Jyväskylä, Finland (Puurтинен & Mappes, 2009). They brought people into a lab in groups and they made them play a *Public Goods Game*, where participants put money into a collective pot, where the money is doubled and then redistributed back to the players. What they found was that

people who only played the game in their own group acted more or less selfishly and the average investment into the common pot was low. However, when the participants were introduced to a competing group, whose decisions made no difference to them, the investment to the common pot suddenly shot up to a very high rate. Here the System 1 feeds one form of information to System 2 when there is no out group and another form of information when there is an out group. Although, the cost-benefit structure for the people in their own group stays exactly the same in both situations. The explanation for this effect is that the presence of competing out-groups makes the in-group structure salient and observable for the social brain/cognition.

Dual processing models have been used to predict human decision making in various settings. For instance, Ariely and Loewenstein (2006) found that if their participants were sexually aroused (activation of System 1), they were more likely to report willingness to have sex with siblings or with animals (overriding the norm-aware System 2), as compared to situations where they were not aroused. Sanfey et al., (2003) found that anger (emotional reaction at the level of System 1) motivated the rejection of unfair offers in the *Ultimatum Game*<sup>1</sup>. This is an irrational decision, since in the Ultimatum Game one either takes the money that is offered, or is left with nothing. Arguably, the anger reaction is an evolutionarily old mechanism intended to regulate resource-sharing in an equitable manner. Given that this reaction takes place when people play against other humans, but not against computers, it can be argued that anger reaction is also sensitive to the social context. The function of anger is to make the transgressor change his/her behavior, so that it does not reoccur in the future. Computers do not, yet, change their behaviors based on anger motivated human feedback. The prevalence of dual processing models is also noticeable in the rapidly growing field of moral psychology. As an example, it has been found (Greene, Morelli, Lowenberg, Nystrom & Cohen, 2008) that being under time pressure makes human moral judgment more *deontological* (emotional heuristic: “it is never permissible to kill”) and less *utilitarian* (calculation: “it is permissible to kill one, if it saves five”).

System 1-level processing often leads to relatively acceptable and fast solutions

<sup>1</sup> Ultimatum game is a game where one player can split some number of money or candy between him-/herself and another player. The other player can then either accept or reject the offer. If the offer is rejected neither of the players gets to keep anything if the offer is accepted they both get to keep their share.

to everyday problems in a reliable manner. However, intuitive solutions of System 1 only have a limited applicability and the decision strategies it employs do not generalize across domains. A classic example of this can be seen in certain logical puzzles labeled *Wason Selection Tasks* (e.g., Cosmides & Tooby, 2005). Without going into technical details, there are two types of versions of these tasks. Some of the tasks are abstract, where the solution is based on numbers and letters, and some of the tasks are social, where the task deals with people and norms-violations. However, both versions of the tasks have the exact same logical/syntactic structures, i.e., they have the same solution. The abstract versions of the tasks are notoriously difficult to solve and only about 5–15% of the people manage to solve it correctly. However, if the same logical puzzle is presented in a form where people need to figure out if someone has broken a social norm (i.e. “cheated”), about 90% of the respondents solve the task correctly.

### **1.3.2 Audience effect and emotions in poker**

Given the previous findings regarding the nature of poker, we concluded in our previous studies that poker is emotionally engaging and evokes several negative feelings (fear, anger, self-loathing, anguish, anxiety, depression) as well as positive feelings (sense of accomplishment, joy, happiness). However, failing in emotional self-regulation very likely leads to detrimental decision making from the rational perspective, if emotional reactions can overwhelm rational and deliberate processing, as dual processing theories suggest.

Moreover, in poker, the decisions are made under the watchful eyes of one's competitors, and players must have self-constraint to avoid giving away informative signals to them. This adds further constraints to the amount of mental resources that could otherwise be used for mathematical processing. There is a long-standing tradition in the field of social psychology, where the impact of real or imagined presence of others on socio-cognitive processes has been investigated. This is known as the *audience effect* and it has been linked to economic decisions regarding charity giving (Powell et al., 2012), paying for coffee voluntarily (Bateson et al., 2006) and punishing

those who defect in the *Trust Game* (Kurzban et al., 2007). Usually the audience effect has been triggered with static pictures of eyes or reminding people that there are cameras in the room watching them.

### **1.3.3 Development of expertise in poker**

Automaticity research in the area of (social) cognitive decision-making also claims that the development of expertise occurs after a slow and effortful System 2-based training process. However, once mastered, the skill is “moved” into the domain of System 1 (Dienes & Perner, 1999). Thereafter the individual has more System 2 level resources to use for other mental operations. As an example, if a person wishes to learn how to ride a bike, they first need to master the motor operations for keeping their balance, pedaling and steering. Once these skills are mastered, it is possible for the individual to start thinking about the traffic rules, and conduct their bicycle-riding according to these more abstract rules. Once an individual has internalized the motor behaviors and the traffic rules, s/he can then automatically follow the traffic rules, while dedicating part of her cognition to a pod-cast coming from her mp3 player. All these, while driving in a traffic-rich city environment. This is an important analogy with respect to poker decision making (see also Tandler, 2011).

Since poker players engage in millions of decisions and possibly use thousands of hours to train themselves in their craft, we argue that their level of skill needs to be taken into consideration in the analysis of the data. For this reason, we included a measure assessing the level of individual's poker skill in Study 1 (see below). We assume that the level of poker expertise is relevant for all the studies presented in this thesis. Presumably, an expert poker player is capable of concentrating on different aspects of the game as compared to a novice and thus more likely to be able to make better decisions under cognitive load.

This links our studies with the field expertise studies. Study of expertise, as an academic field, is relatively limited in comparison to many other fields on inquiry. Large portions of the work have been done during 1980s and since 1990s the field has

become less active (see Farrington-Darby & Wilson, 2006, for a review). What is surprising is that this area of research, for large parts, have been conducted with qualitative methods and in the fields that neighbor sociology. Nonetheless, the work in this area has been reviewed extensively (see also Baker & Horton, 2004 and McDaniel, Martin & Maines, 2002), and at least three different definitions are presently available.

Here we will only concentrate on the cognitive analysis of expertise. According to Farrington-Darby and Wilson (2005, who refer to Glaser and Chi, 1988). Cognitive expertise builds up from the following parts: experts are better at perceiving patterns in their domain. They are also faster than novices and they produce less errors and analyze the problems at a more deeper level. Furthermore, experts use more time analyzing their problems qualitatively and they have better self-monitoring skills than novices. This seems to nicely agree with our previous results (see especially Palomäki et al., 2013b), where we have observed that best decisions are made by those experienced poker players who have higher self-reflection capabilities and in their accurate perceptions regarding “luck” or chance in poker.

However, Farrington-Darby and Wilson (2006) also report that decision-making research has shown that experts do not necessarily out-perform novices and that they do often score poorly on coherence, reliability and accuracy. Gigerenzer (2007) has also recently reviewed economic decision making literature in the area of stock market investment. He concluded that expert investors do not fare any better than list of randomly produced company names. This then seems to be at odds with the results that we have obtained (see Palomäki et al., 2013b and Laakasuo et al., 2014a).

This seeming discrepancy between the previous literature and our results could be an artifact of different study designs. In our study we use big samples ( $N > 350$ ) and we use quantitative methods and controlled decision making scenarios where we have mathematically calculated the correct decision that the participant should make. In contrast, almost all the studies that Farrington-Darby & Wilson (2006) report are more or less small data sets consisting of qualitative data. Indeed Farrington-Darby & Wilson (2006) conclude the following in their review: "We have suggested [...] that a source of the apparent confusion and conflicting findings [...] on expertise arises from the variety of [...] disciplines and perspectives, and of the many domains in which it is

studied, and the impact these factors have on methodological choice.”

Thus, not only is poker a suitable new tool for decision making researchers, it also has the potential to increase our knowledge regarding the development of expertise in individuals. We therefore think that poker is a valuable addition to the field of expertise studies as well.

## **1.4 Models of personality and problem gambling in poker-research**

### **1.4.1 What is personality?**

Personality is a constellation of individual behavioral tendencies or traits, which are considered to be relatively stable once the individual reaches the age of 30 (McRae & Costa, 2005; Rutter, 2006). According to modern personality theories, there are five or six major dimensions along which personality is expressed in humans. These traits are reliably normally distributed and are able to predict about 9% of behavioral variance, from moving patterns to consumer choices to mate selection. Personality is also considered to be relatively highly heritable, and therefore it probably has a significant biological basis (either genetic or epigenetic or both). Measuring personality traits and analyzing their correlates gives us a strong theoretically founded reasons to suggest possible directions for causality that go from genes to behaviors.

At the moment, there is an on-going scientific conversation about the exact number of personality traits and about whether these traits can be reduced to smaller number of dimensions. The evidence is mixed, but according to a recent analysis by De Vries (2011), there is no basis for trying to reduce the number below six (the HEXACO model, see 1.4.3. below).



### 1.4.2 Psychopathology and Personality factors in Poker Players

In our previous research (Palomäki et al., 2013b; 2013b), we developed and validated an instrument called the Poker Experience Scale (PES). Since then, this scale has been used in three decision-making studies (see Palomäki et al 2012a; Palomäki et al., in preparation, Study 1 of this thesis) and it reliably predicts mathematically accurate decisions in fictional poker decision-making scenarios. The more experienced the poker player is, the more likely he is to choose the mathematically correct decisions in situations where the expected values of *folding* and *calling* have been calculated. Furthermore, accumulated experience in poker (as measured by PES) has been linked to self-reported capability to control the negative emotions caused by monetary gaming losses.

These findings shed light on aspects of gambling behavior that have been overlooked in previous research, which has mostly concentrated on the pathological aspects of gambling and online gaming. For instance, extensive gambling has been associated with distorted cognitions, substance abuse (Ramirez, McCormick, Russo & Tabler, 1983), social anomie (Trevorrow & Moore, 1998), depression (Becona, Lorenzo & Fuentes, 1996), schizophrenia (Potenza & Chambers, 2001), economic problems, impaired impulse control (Blaszczynski, Steel & McConaghy, 1997), anti-social personality disorders and psychopathy (Blaszczynski, McConaghy & Frankova, 1989; Slutske et al., 2001). However, due to poker being a unique form of gambling, it is not straightforward to generalize results obtained from one form of (pathological) gambling context to another. More specifically, behavioral markers associated with psychopathologies in games of chance are not necessarily indicators of psycho-pathology in the context of games of skill, like poker (Dickerson, 1993).

The above listing of forms of psychopathology associated with gambling is noteworthy. Especially of interest in the context of poker is the possible link between gambling and anti-social personality disorder, or psychopathy. Poker is inherently a competitive zero-sum game, where one person's loss is another's gain. It could be possible that poker attracts social predators and those who wish to exploit others. However, this is as likely as finding psychopaths in any form of competitive skill based

sports. Also of interest in the above listing is the association of social anomie or alienation with gambling, since lately Griffiths et al., (2010) have suggested that internet has given rise to a new form of problem gambling where people do not lose money, but time. This suggests that if internet poker players can be classified in the same category of problem gamblers as those who mainly engage in games of pure chance, poker players could be low in agreeableness and extroversion and have severe psychopathological problems as well. However, this does not seem to be the case (see Study 3).

The profile of a recreational poker player which comes out of recent scientific evidence is that of a young male who reports drinking problems and who scores higher on problem gambling indices than their non-poker-gambling controls (Shead, Hodgkins & Schear, 2008; Hopley & Nicki, 2010). Poker players are reported to spend more time and money per month on gambling than their peers who do not play poker (Shead, Hodgkins & Schear, 2008). Other results also suggest that poker players are alexithymic (Mitrovic & Brown, 2009), have lower levels of impulse control (Hopley & Nicki, 2010), and are more prone to magical thinking than the population average (Dufour, Brunelle & Roy, 2013).

However, since the majority of poker players are healthy normal people, extensive focusing on psychopathology overshadows other interesting phenomena. In many ways poker is a naturalistic and a controlled micro-economic decision-making environment. What also makes poker a relatively naturalistic in its set-up, is that it is competitive and involves uncertainty in betting outcomes. Poker would thus offer a rich environment in which to study decision-making, probability estimation, risk taking, cognitive load, emotional processes and so on. However, since poker is an emotional game of skill and chance where clinical instruments seem ill suited for detecting pathology, drawing conclusions regarding the deeper personality profiles and possible psycho-pathological tendencies of healthy poker-players might not be warranted. Healthy emotional reactions could also be confounded with behaviors that would normally be classified as pathological reactions in other circumstances – persistent focus on pathology would not detect this.

In a recent study by Berg (2010), it was concluded that poker is a unique form

of gambling, since it is a social game of skill that also has a chance component. Therefore, the multifaceted nature of poker is probably attractive to a variety of people for a variety of reasons. Indeed, in a recent latent component analysis Dafour, Brunelle & Roy (2013) conclude that there are at least three classes of poker players: recreational players, internet players and multiform players. These different types of players have differing motivations and cognitions for engaging in poker, differing gaming strategies or even substance use habits.

More specifically, internet poker players had more pronounced forms of magical belief (illusion of control) than other types of poker players, but they showed less pathological symptoms of alcohol or other substance abuse (Dafour, Brunelle & Roy, 2013). In addition, internet players were more likely to report that they were making a living through their gambling and less likely to be depressed or suffer from anxiety disorders as compared to the other two classes. At the same time, they were also more likely to spend money on gambling compared to the other two groups.

It is possible that the illusion of control in poker players can be attributed to the detail in which they perceive poker as a game of skill and therefore feel they can influence the outcome of the game with a skillful play. Dafour et al., (2013) argue that the instrument used for profiling poker players (Problem Gambling Screening Instrument, PGSI) is too sensitive. One of the central themes of Study 3 (see 1.6) was indeed to critically evaluate some of the tools used in clinical psychology to diagnose pathological gambling. The instruments that are most commonly used (PGSI and SOGS) have been mostly developed before the widespread use of internet. Hence, they are probably not very well suited for the internet poker context, where skill and the fact that for professional poker players “repetitive behavior” of gaming is comparable to having a day job. Future problem gambling screening instruments could be improved by taking these notions into consideration when the questionnaire items are formulated.

Notwithstanding, the internet players described by Darfour et al., (2013) seem to be similar to the casino/internet players described by Shead et al., (2008) or the professional players described by Bjerg (2010) and by McCormack and Griffiths (2012). These players give special attention to not playing while they are under the influence of cannabis or alcohol, take pride in emotional self-control and in keeping

their budget tight with respect to potential losses. Internet players, or experienced professional and semi-professional players also seem to be motivated in becoming more skilled at something which they consider to be their work, whereas other types of poker players do not. This also is in line with our previous studies (Palomäki et al 2013a; 2013b), where we found that experienced poker players are more self-reflective and more mature with respect to their emotional experiences as compared to less experienced players.

In summary, if these profiles are translated into the language of personality theories (Big-5 or HEXACO, see 1.4.3. below), a non-professional poker player is most likely going to be a person low in Agreeableness, high in Extroversion, low in Honesty-humility, and low on Conscientiousness, since he is seeking for excitement and is not in control of himself. On the other hand, an experienced poker player is most likely an introvert (i.e. has low levels of extroversion), with relatively high levels of Conscientiousness, since he does not crave the social stimuli of the live games and is meticulous about controlling himself. Nonetheless, as far as we are aware with respect to personality, there has not been any extensive report or analysis available reporting the FFM or HEXACO personality profiles of healthy internet poker players. However, there is a previous study trying to separate between poker playing styles and FFM personality profiles of poker players, but without finding any statistically significant differences among the gaming styles (Brown & Mitchell, 2009). Also, if emotional intelligence is to be considered as part of the personality constellation, then we would also expect poker players to be low in emotional intelligence, since some researchers have suggested that alexithymia is associated with poker and gambling more generally (Mitrovic & Brown, 2009). However, Mitrovic and Brown (2009) do note that comorbidity of alexithymia and pathological poker gambling is likely to be mediated by the fact that pathological poker gamblers might be pathological gamblers in general. They just happen to play poker, too.

### 1.4.3 HEXACO personality inventory

HEXACO is similar to BIG-5 or Five-Factor-Model (FFM), in that it incorporates the same five personality dimensions found in them. These five or six factors of personality are generally considered to be irreducible and the most parsimonious way of measuring personality. In addition, these instruments are considered to incorporate the richness of the texture used to describe the concept of personality (e.g., DeVries, 2011).

Both HEXACO and FFM show high levels of test-retest validity along with high internal consistencies (Ashton, 2013, McRae & Costa, 2005). Furthermore, they show high levels of convergent and divergent validity with other related individual differences measures and they have both been extensively validated within the last 30 years, also cross-culturally (e.g., McRae & Costa, 2005 and Ashton, 2013).

The classical FFM consists of the following five factors: Extroversion, Neuroticism, Agreeableness, Conscientiousness and Openness to experience. The biggest difference between HEXACO and FFM is the H-factor, which stands for Honesty-Humility. Other less significant differences between FFM and HEXACO relate to how the sub-facets load on the main constructs. It has been argued that Honesty-Humility is often confounded within the five usual dimensions of FFM (Ashton & Lee, 2004; Lee & Ashton, 2007). According to these arguments, once Honesty-Humility is extracted or factored out of the data, it changes the contents of the other dimensions as well. Below, I present a summary of the differences between HEXACO and FFM (Ashton et al., 2004; Ashton & Lee, 2004; Lee & Ashton, 2007). The differences among the sub-facets are summarized, commented and presented in Table 1. The concepts used to describe the HEXACO dimensions below, are not directly observable from the names of the sub-facets listed in Table 1.

Extroversion in HEXACO is a measure of sociability and talkativeness, but it does not incorporate the concepts of bravery, toughness and independence, as is the case in some FFM models. In HEXACO, these sub-components seem to load more on Emotional stability (Neuroticism in FFM). HEXACO Agreeableness, which is a trait measure of gentleness, patience and tolerance is very similar to the FFM Agreeableness, but the two have some subtle differences. For instance, the Agreeableness sub-factor

labeled as Generosity loads under Honesty-Humility in the HEXACO model. Furthermore, irritability, which is usually found in Emotionality (Neuroticism), is found under Agreeableness in HEXACO.

Furthermore, HEXACO Conscientiousness is very similar to the FFM variations thereof. Conscientiousness is a measure of orderliness, punctuality and industriousness. Within HEXACO, the moral conscience sub-factor of Conscientiousness loads under Honesty-Humility. The Emotionality factor of HEXACO, as already stated, does not include the facet of irritability but includes some of the resilience sub-components that are not found within FFM Neuroticism. HEXACO Emotionality is mostly a measure of fearfulness, anxiousness and sentimentality, where according to Ashton et al., (2004, pp. 361), “the 'unemotional' pole [of this factor] emphasizes fearlessness, self-assurance, and toughness rather than the even temper that is traditionally included within an Emotional Stability factor”. Openness to experience in HEXACO is linked to concepts such as unconventionality, imaginativeness and intellectuality, appreciation of aesthetics and philosophy. HEXACO, unlike FFM strives to separate Openness from General intelligence (IQ) and from intellectual performance (Ashton, 2013).

The most defining feature of HEXACO is the H-factor (Honesty-Humility). This factor is associated with such features as low greed and high levels of integrity and helpfulness. Honesty-Humility correlates negatively with Machiavellian attitudes, lavish lifestyle choices and status striving (Lee & Ashton, 2004 ). People with low scores are prone to lie, flatter and break the rules to get what they want. People who have high levels of honesty-humility are also reliable and accountable and take responsibility for their actions and do not enjoy manipulating others. In Big-5, the helpfulness sub-facet is loaded under Agreeableness. Recently, a Dutch research team also noted that Honesty-Humility is important in explaining Sensation Seeking and Impulsivity (see de Vries, de Vries & Feij, 2009).

We chose HEXACO over the FFM model since, a) HEXACO rotation of the data is based on real factor analysis, where as FFM is based on principal components analysis and seems to have some issues with replication (Lee & Ashton, 2012), b) HEXACO nonetheless gives the same information theoretically as the FFM and finally

c) it has an added dimension which adds novelty value to our studies.

Table 1. Summarizing some of the differences between HEXACO and FFM (IPIP NEO PI-R)

	FFM (IPIP NEO PI-R)		HEXACO	
	Sub-facets	Notes	Sub-facets	Notes
Honesty-Humility	N/A	N/A	Sincerity Fairness Greed avoidance Modesty	
FFM : Neuroticism HEXACO : Emotionality	Anxiety Hostility Depression Self-consciousness Impulsiveness Vulnerability to stress	Concept of irritability in FFM is associated with high levels of Neuroticism. In HEXACO, it is associated with low levels of Agreeableness.	Fearfulness Anxiety Dependence Sentimentality	Concepts like Bravery, Toughness and Independence are associated with low levels of Emotionality under HEXACO, but with high levels of Extroversion in FFM
Extroversion	Warmth Gregariousness Assertiveness Activity Excitement Seeking Positive Emotion	Bravery, Toughness and Independence in FFM are concepts associated with high levels of Extroversion. In HEXACO, these are associated with low Emotionality.	Expressiveness Social Boldness Sociability Liveliness	
Agreeableness	Trust Straightforwardness Altruism Compliance Modesty Tendermindedness	Modesty and Tendermindedness are similar to HEXACO Modesty and Sincerity. The concept of generosity in FFM is associated with high levels of Agreeableness. In HEXACO it is associated with Honesty-Humility.	Forgiveness Gentleness Flexibility Patience	Patience is not found in NEO PI-R
Conscientiousness	Competence Order Dutifulness Achievement Striving Self-Discipline Deliberation		Organizational Diligence Perfectionism Prudence	
Openness to Experience	Fantasy Aesthetics Feelings Actions Ideas Values	Some items of “Values” sub-component might correlate with IQ (e.g. preference for puzzles )	Aesthetic Appreciation Inquisitiveness Creativity Unconventionality	



## 1.5. Aims of the thesis

The primary aim of the present thesis was to shed more light on those emotional processes that are related to poker and which are associated with bad decisions (as assessed from a mathematical perspective).

These components include personality, emotional health, situational and psycho-pathological factors. Study 1 concentrated on situational factors (e.g. being angry and/or being exposed to a social setting). Study 2 aimed to see whether personality factors act as predictors of expertise (i.e. whether certain types of traits are more associated with individual tendencies to persist playing online poker). In Study 3 we aimed to assess the whether the most common problem gambling screening instruments were applicable in online poker. PGSI and SOGS are commonly used in the area of gambling studies to categorizes the study participants into pathological and non-pathological, based on their gambling habits. In Study 3 we aimed to assess whether this approach is valid in a sample of poker players

### Study 1

Study 1 was a true experiment, that is, an experiment where participants are randomized into control and experimental groups. Its specific aims included the following:

- i)** to substantiate and validate previous qualitative findings by Palomäki et al., (2014), according to which anger or moral anger, specifically in the social context, would hinder the mathematical accuracy of our participants in poker decision making,
- ii)** to replicate the previous findings presented in Palomäki et al., (2013a), namely that more experienced poker players are more likely to make correct decisions in poker from a mathematical point of view,
- iii)** to separate between the social, emotional and skill factors that might contribute to the performance of the participants in their decision making situations.

For our experiment, we had the following two hypotheses:

*Hypothesis 1:* Feeling anger reduces the mathematical accuracy of players' poker decision making, and this effect is strengthened by feeling/experiencing a social

presence.

*Hypothesis 2:* Experienced poker players make mathematically more accurate poker decisions, as compared with inexperienced players.

These aims and hypotheses were selected for the following reasons:

- 1) We wanted to evaluate whether healthy people would tilt under specific situations, as suggested by our previous findings.
- 2) We wanted to evaluate whether it is just the emotional or the social aspect of poker (or both in combination) that is the principal factor motivating tilting.
- 3) Our previous qualitative analysis alone is not sufficient for making conclusions about emotional processes or the possible pathological aspects of gambling. We aimed to gain further support for our previous findings.

## **Study 2**

Study 2 was inspired by our previous findings (Palomäki et al., 2012a; 2012b; 2013), which showed that poker might function as a training ground for emotional maturity. It therefore had the following aims:

- i) to measure the HEXACO personality structure of the poker playing population, which to our knowledge has not been done previously.
- ii) to correlate the HEXACO Emotionality dimension (which corresponds to the BIG-5 Neuroticism dimension) with poker experience scale (PES). Furthermore, we investigated how individual items of PES correlated with emotionality.
- iii) to assess whether there are differences in preferences between online and live poker gaming for different personality dimensions.

For assessing the personality structure of internet poker players we had the following hypotheses:

*Hypothesis 1:* Emotionally stable poker players are more likely to have accumulated higher levels of poker experience

*Hypothesis 2:* Extroversion is positively associated with a preference for live poker play.

The aims and hypotheses were selected for the following reasons:

- 1) Since it is assumed, on theoretical basis, that personality is based on the genome of

the individual, it is also assumed that it is relatively stable throughout individuals life (see 1.4. above). Therefore, we conducted this study to gain more information regarding how poker playing skills are developed and whether they might influence the emotional maturity of any given individual. More specifically we wanted to check if HEXACO Emotionality correlates with poker experience. If, for instance, there is a negative correlation, this could be an indication that there is a self-selection mechanism involved (i.e. the individuals who can withstand the pressures of the poker playing environment, become more experienced in poker than those who cannot).

2) We wanted to investigate the differences between those who prefer to play poker in live settings as compared to those who prefer on-line environments, which has not been measured with HEXACO previously, as far as we are aware. This point has clinical relevance as well, since it could very well be that on-line poker attracts individuals with different psychopathological risk profiles as compared to those who prefer live poker. It could also be that individuals with different personality profiles make poker decisions differently, or prefer certain strategies rather than others.

### **Study 3**

Study 3 consisted of three smaller studies, which all aimed to investigate the relationship between emotional adjustment, emotional well-being, selfishness and accumulated poker experience.

The aims of the first sub-study (Study 3.1) were twofold.

- i)** To have an initial overview with respect to problem gambling, poker experience and emotional well-being. Our perspective was at the level of general life satisfaction and general emotion regulation abilities, on measures that chart psychological wellbeing. In study 3.3. We investigated sociological wellbeing. Our general purpose in Studies 3.1 – 3.3 was to asses wellbeing indicators of healthy people as widely as possible.
- ii)** To confirm the construct validity of the modified problem gambling scales we employed.

For the first sub-study we had the following hypotheses:

*Hypothesis 1:* Problematic gambling would correlate positively with detrimental

emotion regulation

*Hypothesis 2:* Problematic gambling would correlate positively with poker playing experience.

*Hypothesis 3:* Poker playing experience would correlate positively with measures of well-being and emotional intelligence.

These aims and hypotheses were chosen since we wanted to investigate the validity of the implicit background assumptions prevalent in the field of gambling studies, that regular gambling is pathological and thus detrimental for wellbeing.

The aim of the second sub-study (Study 3.2) was:

**i)** To investigate whether poker experience would be associated with more selfish, competitive or exploiting behaviors of others. This issue was raised since gambling disorders have been associated with anti-social personality disorders and poker is a competitive zero-sum-game, where gains for one mean losses for the other. It could therefore be argued that poker predisposes players to adopt dehumanizing views of other people more generally.

For the second sub-study we had the following hypothesis:

*Hypothesis 1:* there would be no link between poker experience and selfish/competitive behaviors, but that there could be a link between selfish behaviors and pathological gambling tendencies.

We chose this hypothesis and aim because:

- 1)** We wanted to see if the general pattern observed in the previously conducted study would be replicated with another gambling measure
- 2)** We wanted to see if the decision-making habits of poker portray the same pattern as the wellbeing measures. Social Value Orientation scale is basically a game-theoretical measure.

The aims of the third sub-study were (Study 3.3):

**i)** to assess the associations between poker experience and social well-being and adjustment to the general values of the society. This issue has been raised by Griffiths et al., (2010), who argued that poker players might be losing time and social opportunities

since playing poker often entails long marathon sessions, where players are seemingly isolated from social interaction, possibly leading to alienation and anomie.

**ii)** to assess whether the implications of our qualitative study could be substantiated.

One of the themes that rose from our previous study based on qualitative data suggested that poker might function as a training ground for developing self-control. We wanted to investigate this notion with quantitative tools and instruments in order to check its accuracy.

The hypotheses for the third sub-study were:

*Hypothesis 1:* no association should be found between poker experience and social anomie or alienation,

*Hypothesis 2:* a negative association should exist between anomie/alienation with respect to self-control, social wellbeing and emotional intelligence measures

*Hypothesis 3:* positive associations should be observed between measures of social wellbeing, self-control and emotional intelligence.

We chose these aims and hypothesis for Study 3.3 since:

- 1) we wanted to investigate the sociological level of well-being, to supplement the measures of psychological well-being mentioned in Study 3.1.
- 2) we wanted to include another set of emotional intelligence scales in our analysis to replicate the previous zero correlations of another emotional intelligence measure (presented in Study 3.1)

To sum up, the general aim of Study 3 was to elucidate and clarify whether the implicit stereotypes about poker players in the field of gambling studies are accurate.

## 2. METHODS

### 2.1. Study designs and participants

Study 1 was a true experiment (i.e., participants were randomized into conditions and the experimenter was blind for the randomization), while all other studies were correlational. All data were gathered via the Internet. The data for Studies 1, 2 and 3.1 were collected simultaneously as a part of a single larger on-line experiment/questionnaire prepared with Qualtrics in English. This questionnaire was completed by 478 individuals (36 females; Mean Age = 29.9,  $SD = 9.35$ , range = 17–77). Participants had the option of participating in a draw of four separate \$50 gift coupons for Amazon.com.

For Study 1, we included only participants with one year or more of poker playing experience, since detailed understanding of poker was a requirement for the dependent variable tasks. The final sample size for Study 1 was 459 (33 females). The experiment had a 2 (emotional prime: anger vs. neutral)  $\times$  2 (social presence: eyes on the screen vs. black box on the screen) factorial design. The participants were automatically randomized into the experimental conditions. For Studies 2 and 3.1, the whole sample was included in the analyses. The sample size was decided *a priori* to be above 400, since this is classically considered to be a “big” sample in social statistics. We preferably wanted around 120 participants per cell (total of 480), since we were expecting a small effect sizes and we knew we would need to control for the level of poker experience of the individuals who would participate in our study. Furthermore, since our social presence manipulation randomly picked either female or male eyes, we needed to secure enough participants in each counterbalanced cell (see 2.2. further below).

The data for Studies 3.2 and 3.3 were collected in conjunction with another set of studies unrelated to the aims of the current ones (see Palomäki et al., 2014; 2013a). The variables (scale items) presented here were situated at the beginning of the

questionnaire to avoid extensive priming effects or other contaminating factors. The sample size for Study 3.2 was 417 (31 females; Mean age: 27.9, SD = 7.45, range: 16–66). The sample size for Study 3.3 was 354 (Mean age: 28.4, SD = 7.7, range: 17–62). Studies 3.2 and 3.3 were conducted in Finnish. For a summary of descriptions of samples and study designs, see Table 2.

There is probably some overlap between the samples listed in Table 2, since the method of data collection was similar in all studies. This could not be ethically avoided with the technology we had at our disposal without jeopardizing participant anonymity.

Table 2: Overview of the collected samples

	Study	N (women)	Age (SD)	Number of Scales / Focus	Design of the study
Sample 1	1	459 (33)*	29.9 (9.35)	2: DV + PES4 / Em. of Anger and Audience Effect	2×2 Experiment
	2	478 (36)		7: HEXACO+PES4 / Personality	Correlational
	3.1	478 (36)		7: Wellbeing scales + PES3 Emotional Wellbeing	Correlational
Sample 2	3.2	417 (31)	27.9 (7.45)	3: SVO+SOGS+PES3 Selfishness	Correlational
Sample 3	3.3	354 (23)	28.4 (7.7)	6: Wellbeing scales + PES4 Social wellbeing	Correlational

\* We excluded participants with less than one year of poker playing experience

In all studies, the participants were recruited through the social media and online poker forums. During the data collection for Studies 3.2 and 3.3 we also actively utilized the e-mail lists of Finnish university student associations. All studies were conducted by complying to the Finnish law regarding research ethics for social sciences. All participants were provided with informed consent forms and a debriefing. Participant anonymity was guaranteed and all identifying information was removed

from the data. Estimating whether the sample is representative of the poker playing population in general is challenging, since no normative sample has ever been collected to which we could compare our collected samples and make these judgments.

No pilot experiments were run, since the concept of the poker decision tasks had already been tested previously by Palomäki et al., (2013a). In these studies we noticed that experienced poker players with high self-reflection capacities were more likely to solve these tasks correctly (as compared to non-experienced and/or low self-reflecting individuals).

## **2.2 Procedures and Materials**

Data for Studies 1, 2 and 3.1 were collected with a single online questionnaire. Participants first filled in the HEXACO personality measures (Study 2), after which they continued to fill in measures on wellbeing, emotional intelligence and rumination (Study 3.1, see Table 3). Finally, the participants filled in the Poker Experience Scale (see below) and were randomized into one of the two experimental conditions: anger or neutral prime. Studies 3.2 and 3.3 were correlational questionnaire studies without any experimental manipulations.

### **2.2.1 Procedures and Materials for Study 1**


After filling in variables related to the other studies (2 and 3.1, see Tables 2 and 3) participants were randomized into one of the two experimental conditions. In the neutral condition, participants read a vignette in which an individual spends an ordinary evening with his/her partner. In both conditions the participants read a short story where they were told to take the position of the narrator. In the anger condition, participants read a short anger-eliciting vignette where the narrator finds his/her partner engaging in *flagrante delicto* — sexual infidelity — with their best friend. The stories have been previously validated as successful primes of aggression and non-aggression (Denzler et



al., 2009). We modified them slightly for the current purposes. The stories were adapted for both genders, and participant gender was taken into account when the stories were presented. After reading the stories the participants filled in the manipulation checks.

According to our manipulation check, participants randomized into the anger prime condition reported feeling significantly worse than participants randomized into the neutral prime condition (7-point bipolar scale item: “How negative or positive is the feeling evoked by the story”  $M_{\text{neutral}}: 1.99$  ( $SD = 1.26$ ) vs.  $M_{\text{anger}}: -1.86$  ( $SD = 1.19$ );  $t(456) = 33.64$ ,  $p < .001$ . According to Denzler et al., (2009), the priming effects should last for “some minutes” and they state that similar primes are effective to about 4–5 minutes. This was more than enough for for participants to fill in our poker decision making tasks (which were presented in random order).

Immediately after reading the story, participants completed five fictitious poker decision-making tasks. The tasks were presented in textual format (see Poker Decision Making Tasks in APPENDIX 1). Before participants saw the decision making scenarios, they were randomized again into one out of two experimental conditions. In the identity salience condition condition, a pair of moving human eyes was presented during the decision making tasks. The eyes were computer-animated from black and white photographs and located above the textual description of the task. The gaze of the eyes followed the mouse cursor. Participants were randomly presented with either female or male eyes. In the control condition, a black box was presented. The black box reacted to the mouse movements by tilting either to left or right, depending on the location of the mouse cursor. The dimensions and the location of the control prime matched that of the identity salience condition). The eyes and the box were coded with JavaScript and were embedded into the Qualtrics questionnaire. Experimenters were blind to the randomization process. A demonstration of the moving eyes manipulation can be seen at: <http://kaktus.cc/michael/> (see Figure 1 for a screen shot) Finally, participants filled in their demographics and were debriefed.



You are holding: **Ah, 3h**  
(ace of hearts, three of hearts)

The flop is: **3d, 4d, 5d**  
(three of diamonds, four of diamonds, five of diamonds)  
--  
--

In the beginning of the hand, both you and your opponent had **200 bb**. Currently, on the flop, the size of the pot is **20 bb**, and both you and your opponent have **190 bb** in your stacks. Your opponent bets all-in.

--  
--

You know **for a fact** that your opponent can have **anything**. In other words, you know **for a fact** that your opponent's range of possible hands is **any two cards (or "random")**.

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Fold  Call

Figure 1. Screen shot from a decision making task similar to the one used in Study1.

## 2.2.2 Descriptions of scales

### 2.2.2.1. Dependent variable of Study 1

Based on rational choice theory, we constructed five poker decision making tasks where participants were facing a decision to either *fold* or *call*, in a hypothetical game situation. We postulated that this way of constructing the tasks would engage the System 2 -type processing suggested by the dual processing theory (see further below).

The tasks involved a common poker variant called, *No Limit Texas Hold'em* (NLHE). In each task, the game was *heads-up* (i.e., one versus one), and either folding (i.e., "not investing") or calling (i.e., matching the bet made by the opponent/"investing") was designed to be the mathematically correct solution, based on the expected value of the decision (coded "1 = mathematically correct decision", "0 = mathematically incorrect decision"). For each respondent, the number of correct choices was summed and then averaged, resulting in a "decision score" (minimum score = 0 points, maximum score = 1 point).

Every decision task was presented in a similar setting (see *Figure 1*). Participants were told, in writing, what NLHE starting hand they had (e.g., 7 of hearts, and 6 of clubs). They were also told which community cards were on the table (e.g., Queen of spades, 8 of hearts, 5 of diamonds). They were also told i) the amount of money they had at the beginning of the current round and ii) the amount of money that was currently in the pot (total of what had been played so far), and iii) the amount of money they had currently.

After this, the respondents were described what their opponent did (e.g., "*The opponent bets all-in*"). As a last piece of information the participants were given specifics that were related to the situation (e.g., "*You know for a fact that your opponent can have anything. In other words, you know for a fact that your opponent's range of possible hands is any two cards*"). This information enables a mathematical calculation of equity for both calling and folding. Therefore, either folding or calling was always the mathematically correct choice. See the Appendix 1 for a full technical description of expected value evaluations for the tasks.

### 2.2.2.2 Poker Experience Scale in Studies 1 – 3

A listing of all the variables that were used in the studies can be found from Table 3, along with all the relevant statistics. In the published versions of Studies 1, 3.1, 3.2 and 3.3, we used the original three-item version of our previously validated Poker Experience Scale (see Palomäki et al.,2013a; 2013b). This scale consists of the following 10-point Likert items: "How many years have you played poker?" (1 = "Less than 1"; 10 = "More than 15" ); "At what level of stakes do you usually play?" (1 = "Freerolls, NL2-5, PLO2-5, SNG1-5, MTT1-5 "; 10 = "Above NL600, PLO600, SNG500, MTT500") and "What is the rough estimate of how many poker hands you have played during your life?" (1 = "0-50 000"; 10 = "more than 5 million"). See Table 3 for descriptives.

In Study 2, we used an extended 4-item version of the scale, which has subsequently been used successfully in another study (see Palomäki et al.,in preparation). This additional item, which was also used in reanalysis of Study 1 and analysis of Study 2, is: "Do you consider yourself to be a professional poker player?" This question was anchored from 1 = "definitely not a [full time] professional poker player" to 10 = "definitely a [full time] professional poker player". Higher scores indicate higher poker experience. The complete coding and related abbreviations mentioned above are presented in Palomäki et al.,(2013a).

### 2.2.2.3 Scales of Study 2

In Study 2, we used the English version of HEXACO-PI-R (HEXACO-60; Ashton & Lee, 2009) to assess personality. HEXACO is a six dimensional instrument with very good psychometric properties (Lee & Ashton, 2004; Ashton & Lee, 2007). It is highly similar to BIG-5/FFM but has an additional dimension labeled "Honesty-Humility", which measures the individual lack of interest in manipulating others for personal gain, and disinterest in status symbols and/or luxurious life style. Emotionality in HEXACO corresponds to Neuroticism in the FFM. The other dimensions of HEXACO are

Emotionality, the tendency to experience fear, anxiety, and need of assurance;  
eXtroversion, the tendency to experience positive feelings of enthusiasm and energy;  
Agreeableness, the tendency to be forgiving, lenient, flexible and patient;  
Conscientiousness, the tendency to stay organized, control one's impulses and aspire for perfection; and Openness to Experience, the tendency to be creative, curious, imaginative and appreciative of aesthetics. For a detailed description of HEXACO see 1.4.2 above. For Cronbach's alphas, means and standard deviations see Table 3. All items were anchored from 1 ("Strongly disagree") to 7 ("Strongly agree").

#### 2.2.2.4 Scales of Study 3.1

In Study 3.1, in addition to PES we used the following measures: Sensitivity to Losses scale, The Hope Scale, Satisfaction in Life Scale, Reading the Mind in the Eyes Task (RMET), Problem Gambling Severity Index (PGSI), Self-rumination and Self-reflection scales.

Sensitivity to Losses scale was introduced in Palomäki et al.,(2014) and it consists of 11 items. It measures the extent to which players experience negative emotions (feelings of unfairness, anger and frustration) elicited by poker losses and has been shown to effectively predict the reported severity of *tilting* behavior. In essence, tilting in poker refers to losing control due to negative emotions and the resulting detrimental level of decision making. The scale has such items as: "I feel losing is unfair." and "Losing is part of the game." (reverse coded). The items were anchored from 1 ("Strongly disagree") to 7 ("Strongly agree"). Higher scores indicate a higher tendency to experience negative emotions elicited by losses, or in other words, higher scores indicate a higher sensitivity to losses (see Palomäki et al., 2014, for further details). We included this scale to better assess the validity of our previous findings (Palomäki et al., 2014) and to further evaluate whether sensitivity to losses shows comorbidity with problematic gambling in general.

The Hope Scale was developed by Snyder et al.,(1991; see also Snyder 1994; 2002). It consists of 12 items (including 4 filler items). Snyder (2002) defines hope as

“the perceived capability to derive pathways to desired goals, and motivate oneself via agency thinking to use those pathways”. The scale has such items as: “I energetically pursue my goals” and “I can think of many ways to get the things in life that are important to me”. All items were anchored from 1 (“Definitely false”) to 8 (“Definitely true”). Higher scores indicate a higher tendency for goal-oriented behavior via feelings of agency.

The Satisfaction in Life Scale was developed by Diener et al.,(1985) and is a robust measure of personal satisfaction in life on a very general level. The scale consists of five items such as: “I am satisfied with life” and “In most ways my life is close to my ideal”. All items were anchored from 1 (“Strongly disagree”) to 7 (“Strongly agree”). Higher scores indicate higher satisfaction in one's life, higher general emotional stability and a reduced likelihood of depression (for a review, see Pavot & Diener, 1993). In other words we included this scale in our study to asses the general level of individuals mental well-being.

Reading the Mind in the Eyes Task (RMET) was developed by Baron-Cohen et al.,(2001). RMET is used to measure an individual's empathetic behavior and general ability to “be in another person's shoes”. The task consists of 36 close-up pictures of human eyes expressing an emotion. Participants are given four options to choose from, only one of which corresponds to the emotional tone of the eyes. Higher scores indicate higher levels of performance in the sub-facet of emotional intelligence measuring accuracy in perceiving the emotional states of others. See Figure 2 for an example.

4. Which word best describes what the person in the picture is thinking or feeling?


	joking	insisting	amused	relaxed
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 2. An example item from Reading the Mind in The Eyes Task (see Baron-Cohen et al 2001)

The Problem Gambling Severity Index (PGSI) was developed by Ferris and Wynne (2001) and is among the best documented and validated measures of problematic gambling behavior (Orford et al., 2010). The scale has nine items such as: "In the past 12 months, how often have you needed to gamble with larger amounts of money to get the same excitement?" and "In the past 12 months, how often have you felt guilty about the way you gamble or what happens when you gamble?". All items were anchored from 1 ("Never") to 4 ("Almost always"). Higher scores indicate higher levels of problematic gambling behavior. The scale was scored by averaging the items.

Self-rumination and self-reflection scales are components of the private self-consciousness scale presented in Fenigstein et al.,(1975). Self-rumination is the tendency to dwell on negative past experiences. Thus, the scale measures the inability to withdraw from constantly thinking about the negative consequences of one's past decisions. Self-reflection is an alternative type of self-inspection, namely a positive form of curiosity concerning one's emotions and cogitations. Fundamentally, self-reflection refers to beneficial and thoughtful self-contemplation that is associated with mature coping mechanisms (Trapnell & Campbell 1999; Elliott & Coker 2008).

The Self-rumination scale consists of 10 items such as: "I often reflect on unfavorable outcomes in my life" and "It is easy for me to put unwanted thoughts out of mind" (reverse coded). The Self-reflection scale consists of 12 items such as: "Knowing myself is very important to me" and "Contemplating myself is something I don't do very often" (reverse coded). Both scales were anchored from 1 ("Strongly disagree") to 7 ("Strongly agree"). Higher scores in the self-rumination scale indicate higher tendency to dwell on past negative events, while higher scores on the self-reflection scale indicate an ability for a "philosophical and detached" analysis of one's situation, decisions and emotions (see Elliott & Coker 2008).

In Study 3.1, we included both the Satisfaction in Life and Hope scales due to their psychometric qualities and well-documented performance in assessing general mental stability. With the aid of these scales it is possible to identify potential mental health problems on a general level (e.g. Pavot & Diener, 1993). These scales were included to assess the construct validity of our previously developed Sensitivity to Losses scale. Since the link between PES and PGSI has not been previously assessed,

we included these scales to strengthen our convergence/divergence validity assessment. In our previous studies we showed that reflection and rumination predict mathematically correct decision making in poker and that sensitivity to losses predicts tilting severity (Palomäki et al., 2013a, 2013b). By including rumination, reflection and losing sensitivity measures to this study as well, we were building on our previous studies. Including these two scales also makes it possible for us to estimate the robustness of our previous and present findings

#### 2.2.2.5 Scales of Study 3.2

In Study 3.2 we used the following scales: PES, Social Value Orientation and the South Oaks Gambling Screen. Social Value Orientation (SVO) originated in game theory research and its use in studying individual differences in behaviour has been well-documented and validated (Van Lange et al., 1997). SVO is utilized as a method for profiling people into one of three categories: *Pro-social*, *individualistic*, and *competitive* (Messick & McClintock, 1968; Van Lange et al., 1997). SVO is based on the assumption that the values people have influence profoundly the strategies they use in various economic games. SVO includes nine items, where people are asked to allocate points between themselves and another imaginary player (“the other”). The choices are presented in the form of decomposed game matrices. These matrices are deduced from 2 x 2 prisoner's dilemma game matrices through a formal logical analysis. An example game matrix item is: “Please choose the option you prefer, for any reason, from the following ones: A) You get 480 points and the other gets 80, B) You get 540 points and the other gets 280, C) You both get 480 points”. In the example above, the choices correspond to the following social value orientation tendencies: A) Competitive – maximum relative difference between the self and the other, B) Individualistic – maximum absolute gain for the self, and C) Pro-social – equal and maximized joint gain between the self and the other. We coded the item into a continuous measure by calculating the difference in allocated resources between the self and the other. This resulted in a bi-polar scale. Composing the scale in this way makes it possible to



differentiate between pro-social (i.e., non-selfish) and pro-self (i.e., selfish) behavior. See Figure 3 for a listing of these items.

	A	B	C
1 You get	480	540	480
Other gets	80	280	480
	A	B	C
2 You get	560	500	500
Other gets	300	500	100
	A	B	C
3 You get	520	520	580
Other gets	520	120	320
	A	B	C
4 You get	500	560	490
Other gets	100	300	490
	A	B	C
5 You get	560	500	490
Other gets	300	500	90
	A	B	C
6 You get	500	500	570
Other gets	500	500	300
	A	B	C
7 You get	510	560	510
Other gets	510	300	110
	A	B	C
8 You get	550	500	500
Other gets	300	100	500
	A	B	C
9 You get	480	490	540
Other gets	100	490	300

Figure 3. Listing of SVO items

The South Oaks Gambling Screen (SOGS) is a diagnostic tool used in clinical settings to detect individuals with gambling related disorders (Lesieur & Blume, 1987). It is usually scored with dichotomous yes-no questions and it has several filler or mock items. The maximum score is 20 and usually 5 is used as a cut-off point for diagnosing someone with a gambling problem. For the purposes of our study, we used a modified version of SOGS. We omitted the items that are not scored and transformed the

remaining 13 items into 7-point Likert scales anchored from 1 (“Never”) to 7 (“Very often”). Higher scores indicate higher levels of problematic gambling behavior.

We modified the scale to increase transparency between SOGS and the standard questionnaire instruments that are more typically utilized in the domain of social and personality psychology. In social and personality psychology, there is an increasing trend to move away from categorical instruments. In the light of accumulating data, theories of personality have come to suggest that personality disorders should not be viewed as particular categories. Rather, they should be viewed as rare personality trait constellations that nonetheless are within the boundaries of normal variation (Matthews & Deary, 1998). Similar arguments can be made regarding the categorical diagnostics used to screen pathological gambling; it is only a matter of administrative convention to define someone as a problematic (or disordered) gambler based on whether his/her score on SOGS is above a specific cut-off point. Furthermore, Likert-scoring on a scale from 1 to 7 per item – as opposed to the conventional method of calculating a score based on dichotomous yes/no questions – results in higher resolution (i.e., higher variance in absolute terms). This makes it possible to calculate more accurate correlations between SOGS and other social psychological variables.

#### 2.2.2.6 Scales of Study 3.3

In Study 3.3, we employed the following scales: Srole's Anomia Scale, Marginalization of Society (MOS) Alienation Scale, Social Well-being scale, Emotional Intelligence scale and the Self-Control Scale. All the relevant metrics of the scales are portrayed in Table 3.

It has been claimed that Srole's Anomia scale (Srole, 1956) is among the most commonly used sociological and/or psychometric instruments in social sciences (Caruana, Ramaseshan, & Ewing, 2000; see Seeman, 1991 for validity assessment). The scale measures the extent to which an individual feels he/she is integrated to his/her society and its values. Anomie is usually negatively correlated with happiness and life satisfaction (Keyes, 1998). We implemented a six-item version of the scale, which we

obtained from the annual General Social Survey of the US National Opinion Research Center. The Srole anomie scale has been part of this survey since 1973. An example item is: "You sometimes can't help wondering whether anything is worthwhile anymore". All the items were anchored from 1 ("Strongly disagree") to 7 ("Strongly agree"). Higher scores indicate higher levels of anomie – i.e., the experience of detachment from one's society and its values.

Marginalization of Society Alienation Scale (MOS) is an alternative measure of social alienation (Travis, 1993). It was developed in response to the criticism of Srole's scale described above. According to Travis (1993), Srole's scale is unable to accurately distinguish alienation in subcultures and small-scale communities, so we supplemented our study with another anomie/alienation measure as well. We obtained a six-item version of the MOS scale from the annual General Social Survey of the US National Opinion Research Center. An example item is: "The people running the country don't really care what happens to you." All the items were anchored from 1 ("Strongly disagree") to 7 ("Strongly agree"). Higher scores indicate higher level of alienation from society.

The Social well-being scale was developed by Keyes (1995; 1998; Keyes & Shapiro 2004) and includes 14 items. It measures a person's sense of involvement with other people and with his/her community. This scale includes such items as: "People do not care about other people's problems", "Society isn't improving for people like me", and "I believe that people are kind" (reverse coded). The questions were anchored from 1 ("Strongly disagree") to 7 ("Strongly agree"). Higher scores indicate higher levels of social well-being.

The Emotional Intelligence scale is a self-report instrument developed by Schutte et al.,(1998) and it consists of 33 items. The scale differentiates accurately between therapists and their clients, with therapists scoring higher on the scale. In addition, high scoring individuals display lower levels of pessimism and impulsivity (Schutte et al., 1998). Example items are: "I am aware of my emotions as I experience them", and "It is difficult for me to understand why people feel the way they do" (reverse coded). All the items were anchored from 1 ("Strongly disagree") to 7 ("Strongly agree"). Higher scores indicate higher levels of emotional intelligence.

The self-control scale was developed by Tangney, Baumeister and Boone (2004), and it consists of 36 items. We used a short 13-item version of the scale. The Self-Control is negatively associated with psychological pathologies and social deviance, and positively associated with the quality of social and familial ties. Furthermore, it is positively associated with abilities in perspective-taking and negatively associated with a ruminative tendency to "wallow" in various negative aspects of life (Tangney et al., 2004). Self-control is further positively associated with proficient anger management and motivation to forgo binge eating and binge drinking (Tangney et al., 2004). Example items are: "Getting up in the morning is hard for me" and "People would say I have iron self-discipline". All the items were anchored from 1 ("Not at all like me") to 7 ("Very much like me"). Higher scores indicate higher levels of self-control.

All anomie/alienation and wellbeing scales (MOS, Srole's anomia scale and Social well-being scale) were included to assess the possible sociological (rather than just psychological) consequences of poker playing. The self-control scale was included in this study, since it has been shown to correlate with working memory capacity and "mature" decisions and it seems to be a general protective buffer against mental illness in general. The Emotional intelligence scale was included to see if self-reported emotional intelligence has a different effect on poker experience than the actual performance measure (RMET, see above).

Table 3: Listing of all the variables and relevant statistics used in Studies 1–3.

Scale	M	SD	Items	Range	Cronbach's $\alpha$
<b>Study 1</b>					
PES4 (Same scale in Study 2)	4.62	2.00	4	1.0 – 9.5	0.75
Poker Decision Tasks	0.66	0.21	5	0.00 – 1	N/A
<b>Study 2</b>					
PES4	4.62	2.00	4	1.0 – 9.5	0.75
HEXACO:					
Honesty-Humility	4.23	1.04	6	1.3 – 7.0	0.75
Emotionality	3.45	0.93	6	1.2 – 6.1	0.73
Extroversion	4.20	1.03	6	1.0 – 7.0	0.81
Agreeableness	4.20	0.91	6	1.3 – 6.9	0.74
Conscientiousness	4.53	0.90	6	2.4 – 6.6	0.74
Openness to Experience	4.75	1.01	6	1.5 – 6.7	0.76
<b>Study 3.1</b>					
PES3	4.97	1.98	3	1.0–9.66	0.69
Sensitivity to Losses	3.31	0.96	11	1.0–5.9	0.81
Hope scale	5.09	0.94	12	2.0–7.5	0.78
Self-Reflection	4.87	1.01	12	1.5–7.0	0.88
Self-Rumination	4.24	1.17	10	2.08–7.0	0.90
RMET	24	4.12	32	6.0 – 33	N/A
PGSI	1.41	0.45	9	1 – 4	0.85
<b>Study 3.2</b>					
PES3	4.68	1.92	3	1.00 – 9.33	0.74
Social Value Orientation	N/A	N/A	9	N/A	N/A
Modified SOGS	2.22	0.93	13	1.00 – 6.92	0.84
<b>Study 3.3</b>					
PES3	4.79	2.19	3	1.00 – 9.67	0.80
Srole's Anomie Scale	3.2	1.07	6	1.00 – 7.00	0.69
MOS Alienation Scale	3.93	1.03	6	1.00 – 7.00	0.70
Social Well-being Scale	3.16	0.76	11	1.21 – 5.85	0.79
Emotional Intelligence Scale	4.88	0.71	33	1.54 – 6.60	0.91
Self-control Scale	4.11	0.76	13	1.69 – 6.53	0.78

Abbreviations: PES: Poker Experience Scale; RMET: Reading the Mind in the Eyes Task; PGSI: Problem Gambling Severity Index; SOGS: South Oaks Gambling Screen

## 2.3 Data analysis

All data were analyzed with SPSS and with custom Python scripts using the Statsmodels 5.0 statistics library. Python Statsmodels was used because it is an open source alternative for statistical analyses and freely available. We have intentions to make our anonymized data and its analysis publicly available to increase transparency in science.

In analyzing the data for Study 1, we used a two-way ANOVA with simple contrast codings with Type III Sum of Squares for significance testing. In the following analyses the updated version of Poker Experience Scale (PES4) was used. In other words, the analyses of the published Study 1 were redone for transparency (i.e. confirmed with a newer version of PES). The results are slightly stronger with our four item version of PES (PES4). All the other analyses were normal bivariate Pearson correlations.

Additional analyses for more technically oriented readers have been presented in the Appendix 2. These analyses were conducted with R and with R lavaan package (freely available from online). As a general note, the structural equation models, covariance path analyses and multiple regression analyses presented in the Appendix 2 do not add anything to the results presented in the main text. The results and the interpretations stay exactly the same.

## 3. RESULTS

### 3.1 Study 1

Hypotheses 1 and 2 (*H1* and *H2*) were tested by employing a full factorial PES4 adjusted ANOVA with the average score calculated from the decision making tasks as the the dependent variable (DV, see APPENDIX 1). Social identity salience manipulation (SIS; i.e., eyes on the screen vs. black box on the screen), Anger prime (AP; i.e., anger prime vs. neutral prime) and Gender were entered into the model as categorical variables. The PES4 adjustment was statistically significant ( $B = 0.026$ ,  $F(1, 450) = 23.29$ ,  $p < .001$ ). This supported *H2*, indicating that experienced poker players make mathematically more accurate decisions than inexperienced ones. Also the main effect of Anger prime ( $B = 0.08$ ,  $F(1,450) = 3.77$ ,  $p < .05$ , supporting *H1*) and the interaction effect between SIS and AP were statistically significant ( $F(1, 450) = 3.70$ ,  $p < .05$ ; supporting *H1*). This indicates that anger, especially in a social context, is detrimental for poker decision making accuracy. The interaction effect with 95% CIs is plotted in Figure 4. Full statistics of the model presented above are shown in Table 4.

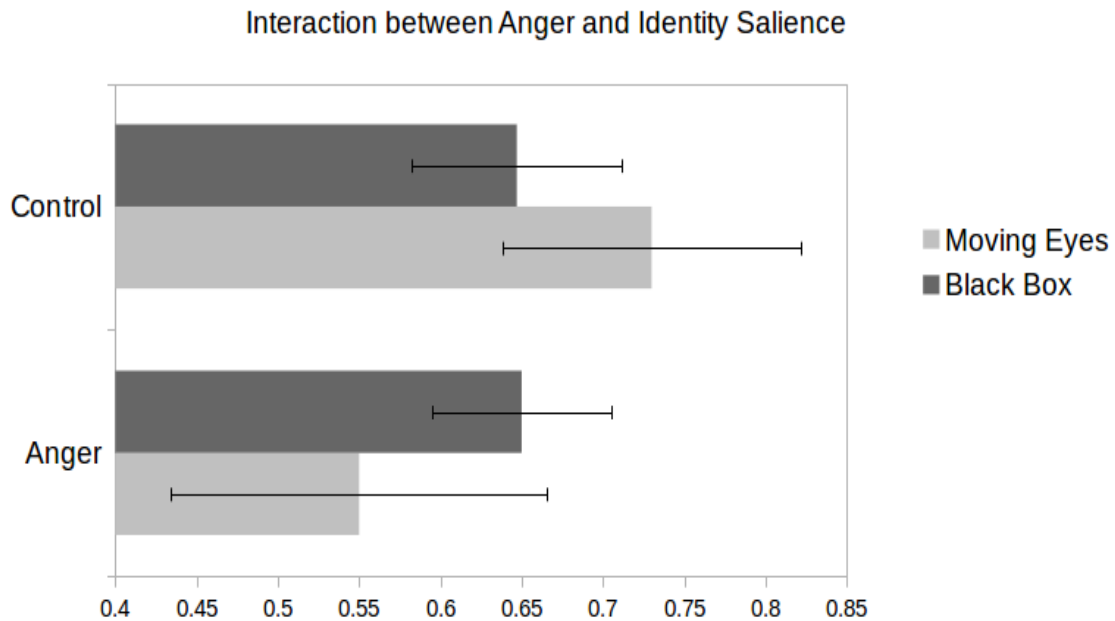


Figure 4. Interaction effect between the emotion saliency manipulation and identity saliency manipulation. The interaction effect is driven by the slope between the identity saliency manipulation in the control condition and in the anger prime condition. ( $B = 0.18$ ,  $F(1,450) = 5.73$ ,  $p = .02$ ). The results are controlled for PES4. Error Bars are 95% CIs

The simple slopes of the interaction in Figure 4 were assessed for significance with a planned contrast analysis. This revealed that the differences between the Anger- and Neutral prime condition means were significant *only* during the “eyes on the screen” SIS -manipulation ( $M_{\text{anger}} = 0.55$ ,  $SD_{\text{anger}} = 0.61$  vs.  $M_{\text{control}} = 0.73$ ,  $SD_{\text{control}} = 0.46$ ;  $B = 0.18$ ,  $F(1,450) = 5.73$ ,  $p = .02$  partial  $\eta^2 = .009$ ). This difference was not observed during the “black moving box on the screen” condition ( $F < 1$ ,  $p = \text{n.s.}$ ). Thus, in accordance with *H1*, anger in a social context is detrimental for poker decision making accuracy.



Table 4. Full factorial ANOVA statistics. Average number of correct responses to the five poker decision tasks is the dependent variable. The model is controlled for Gender and Poker Experience Scale.

Factor	B	<i>t</i>	<i>p</i>	par.η <sup>2</sup>
Anger Prime (Hypothesis 1)	0.022	2.04	.04	.009
Moving Eyes on Screen	0.140	1.06	n.s.	<.001
Anger Prime × Moving Eyes (Hypothesis 1)	0.343	2.04	.03	.0085
Gender	0.080	1.13	n.s.	.003
Gender × Anger Prime	0.024	1.69	n.s.	.007
Gender × Moving Eyes	0.079	1.01	n.s.	.002
Gender × Moving Eyes × Anger	0.317	1.82	n.s.	.007
Poker Experience Scale (Hypothesis 2)	0.032	6.31	< .001	.08

Note: Model statistics:  $F(8, 450) = 7.71$ , adj.  $R^2=0.11$ ; B-values are calculated from estimated marginal means. A significant interaction effect was observed between the anger prime and the identity salience manipulation (moving eyes on screen). Hypothesis 1 was supported as the main effect of anger prime was significant. For the interaction plot, see Figure 4. Hypothesis 2 was fully supported. Hypothesis relevant cells have been highlighted

### 3.2 Study 2

We analyzed the Pearson correlations between PES4, Engagement in Live Play, and all HEXACO dimensions (see Table 5). PES was moderately negatively correlated with Emotionality ( $r(478) = -.18, p < .001$ ). Engagement in Live Play was weakly positively correlated with Extroversion, Conscientiousness and Openness to Experience. PES had a weak negative correlation with Engagement in Live Play, indicating that experience might be best gained by not limiting oneself to playing merely live poker, where it is more difficult to get to play a large number of hands (i.e. rounds of play) due to the relatively slow pace of the game. We also correlated the individual items of PES with the HEXACO dimensions. All PES items were negatively correlated with Emotionality, and the PES item “Number of Years Played” was positively correlated with Extroversion (see Table 6). We thus found support for both of our hypotheses in Study

2, namely that emotionally stable poker players are more likely to have accumulated higher levels of poker experience and that extroversion is positively associated with a preference for live poker play. – We also ran a multiple regression analysis (controlling for age) and a covariance path analysis for the analysis presented in Table 5. The results and their interpretations stay exactly the same (See APPENDIX 2)

Table 5. Correlations between Poker Experience Scale (PES), Preference for Live Play and HEXACO-60 personality inventory dimensions

Scale or Measure	1.	2.	3.	4.	5.	6.	7.	8.
1. PES	1	-.02	-.18***	.01	-.01	-.01	-.07	-.11*
2. Honesty-humility		1	.00	-.08	.21***	.13**	.09*	.02
3. Emotionality			1	-.14**	.03	-.03	.06	-.00
4. Extroversion				1	.1	.10*	.15**	.11*
5. Agreeableness					1	.06	.02	-.04
6. Conscientiousness						1	.06	.10*
7. Openness to Experience							1	.10*
8. Do You Play Live?								1

Notes: \* :  $p < .05$ ; \*\* :  $p < .01$ ; \*\*\* $p < .001$ ; a:  $p < .1$ . Hypothesis relevant cells have been highlighted

Table 6. Individual Poker Experience Scale (PES) item correlations with HEXACO-60 dimensions

PES Items	HEXACO Dimension					
	H	E	X	A	C	O
1. Number of Years Played	.02	-.07 <sup>a</sup>	.12**	.02	.05	-.01
2. Number of Hands Played	-.03	-.12**	.02	.02	-.03	-.07 <sup>a</sup>
3. Level of Stakes Played At	-.04	-.23***	-.02	-.03	.04	-.08 <sup>a</sup>
4. Do you consider yourself professional?	.02	-.11*	-.05	.02	-.03	-.03

Notes: \* :  $p < .05$ ; \*\* :  $p < .01$ ; \*\*\* $p < .001$ ; a:  $p < .1$ . relevant cells have been highlighted

### 3.3. Study 3

#### 3.3.1 Study 3.1

A bivariate correlation matrix was calculated between all the variables (see Table 7). PGSI was negatively correlated with the measures of well-being and empathizing abilities, and positively correlated with self-rumination and sensitivity to losses (in line with *H1*). PGSI was also significantly positively correlated with PES3 ( $r(478) = 0.2, p < .001$ , as predicted by *H2*), suggesting that experience in poker players is likely to be expressed as symptomatic problematic gambling behavior. However, there were no significant correlations between PES and the measures of well-being, or between PES and empathizing abilities, whereas there were significant *negative* correlations between PES and self-rumination, and between PES and sensitivity to losses (lending partial support for *H3*: See Table 7). We also ran a covariance path analysis for the data. Interpretation stays almost the same, with the exception that Poker experience is weakly positively related to the Hope scale, indicating that gaining experience in poker could be related to optimism or positive mental health (see Appendix 2). However this does not tell us which way the causation flows.

Table 7. Correlation Matrix For Study 3.1

Variables	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. PGSI	1	.20***	-.15***	-.15***	-.22***	.24***	-.02 <sup>n.s.</sup>	.15***	-.1*
2. Poker experience		1	-.02 <sup>n.s.</sup>	-.06 <sup>n.s.</sup>	-.03 <sup>n.s.</sup>	-.19***	-.02 <sup>n.s.</sup>	-.11*	-.03 <sup>n.s.</sup>
3. Satisfaction in life			1	.55***	.12**	-.08*	-.01 <sup>n.s.</sup>	-.33***	.14**
4. Hope				1	.10*	-.11*	.29***	-.20***	.14**
5. RMET					1	-.01 <sup>n.s.</sup>	.15**	-.01 <sup>n.s.</sup>	.11*
6. Sensitivity to losses						1	-.03 <sup>n.s.</sup>	.27***	-.01 <sup>n.s.</sup>
7. Self-reflection							1	.30***	-.02 <sup>n.s.</sup>
8. Self-rumination								1	-.08 <sup>a</sup>
9. Level of education									1

Note. n.s. = not significant; a  $p < .1$ ; \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ . PGSI = Problem Gambling Severity Index. RMET = Reading the mind in the eyes -task.

### 3.3.2 Study 3.2

A bivariate correlation matrix was calculated between all the variables (see Table 8). There was no correlation between the continuous SVO scale and PES ( $r(417) = 0.03, p = \text{n.s.}$ ). SOGS and SVO were weakly positively correlated ( $r(417) = 0.08, p < .1.$ ). SOGS and PES were significantly positively correlated ( $r(417) = 0.29, p < .001$ ). These results appear to indicate that experience in poker is associated with behavior that is classified by SOGS as problematic and that poker experience is not associated with a tendency to act selfishly. For Study 3.2, we hypothesized that there would be no link between poker experience and selfish/competitive behaviors, but that there could be a link between selfish behaviors and pathological gambling tendencies, which is what we found.

Table 8. Correlation Matrix for Study 2

Variables	1.	2.	3.
1. Poker experience	1	.29***	.03 <sup>n.s.</sup>
2. SOGS		1	.08 <sup>a</sup>
3. SVO			1

Note. n.s. = not significant; a  $p < .1$ ; \*\*\* $p < .001$ . SOGS = South Oaks Gambling Screen. SVO = Social Value Orientation (scale).

### 3.3.3 Study 3.3

A bivariate correlation matrix was calculated between all the variables (see Table 9). Unsurprisingly, social well-being was negatively correlated with anomie, social (MOS) alienation, and positively correlated with self-control and emotional intelligence (supporting *H2*). Self-control and emotional intelligence were also positively correlated (supporting *H3*). Anomie was positively correlated with social alienation, and both were negatively correlated with self-control and emotional intelligence. Poker experience was marginally negatively correlated with MOS alienation, meaning that participants with more poker experience reported – albeit marginally – lower levels of social alienation

(supporting *H1*, see discussion). No other correlations between PES and other variables were found. These results imply that poker experience is not strongly related to social well-being, alienation, emotional intelligence (or emotional disorders) or impulsivity. See Table 9 for full statistics. However we also ran a covariance path analysis for the correlation table presented below, where we found that poker experience might actually buffer against alienation when all the other measures of the model are kept controlled for (see Appendix 2)

Table 9. Correlation Matrix For Study 3

Scales	1.	2.	3.	4.	5.	6.
1. Poker experience	1	-.01 <sup>n.s.</sup>	-.04 <sup>n.s.</sup>	-.1 <sup>a</sup>	-.02 <sup>n.s.</sup>	-.03 <sup>n.s.</sup>
2. Social well-being		1	-.48***	-.53***	.23***	.49**
3. Srole's anomia			1	.54***	-.19**	-.18***
4. MOS alienation				1	-.23***	-.16**
5. Self-control					1	.20***
6. Emotional intelligence						1

Note. n.s. = not significant; a  $p < .1$ ; \*\* $p < .01$ ; \*\*\*  $p < .001$ . Relevant cells have been highlighted

## 4. DISCUSSION

### 4.1 Results with respect to the hypotheses

In Study 1, we confirmed experimentally the implications of our previous qualitative and correlational studies (Palomäki et al., 2013a; 2013b; 2014). We also confirmed both our current Hypotheses. With respect to *H1*, we found that the emotion of *anger* together with the *social context* of the task environment are likely precedents for mathematically inaccurate decisions in a poker task. With respect to *H2*, we confirmed that PES4 accurately predicts mathematically accurate decisions in poker.

The results of Study 2 clarify the question whether playing poker helps to increase emotional stability, or whether some individuals manage to become thriving poker players *due* to their pre-existing emotional stability. The answer seems to be that those who are naturally emotionally stable are more likely to develop expertise in poker. We also found support for our hypothesis regarding the personality traits of the players that prefer live playing (as opposed to preferring playing online): extroverted individuals, and individuals who are open to experiences prefer to play in live settings.

Naturally correlation does not imply causation, however, correlation is a prerequisite for causation. Furthermore, given that the present interpretation of personality as something that has a strong hereditary (or genetic) component, it is possible that emotional stability has some causal influence on ones success as a poker player. Most likely the genetic components of personality are already present in the person when he/she starts playing poker (see 4.2 for further discussion).

In Study 3.1, we hypothesized that *H1*) problematic gambling would correlate positively with lower emotion-regulation abilities, *H2*) problematic gambling would correlate positively with poker playing experience and *H3*) poker playing experience would correlate positively with measures of wellbeing and emotional intelligence. *H1* and *H2* were fully supported, indicating that, on the face of it, poker experience is predictive of pathological gambling habits. This, however, is arguably not the case, since poker experience was uncorrelated with any negative effects related to wellbeing.

In fact, *H3* received partial support, since we found that the ability to withstand poker losses correlates with poker experience relatively strongly (however, no correlations with RMET scores or other wellbeing scores were observed). This implies that poker is not a training ground for general skills related to emotional intelligence, and that the ability to withstand losses could be a context dependent (i.e. a poker related) trait measure.

In Study 3.2 we found full support for our hypothesis. We predicted that there would be no link between poker experience and selfish or competitive behaviors. Furthermore, we predicted that there could be a link between selfish behaviors and pathological gambling tendencies (i.e., that there could be a marginally significant association between SVO and SOGS). This seems to imply that poker experience is probably not linked with sociopathy or Machiavellian tendencies (see discussion below).

Our hypotheses for Study 3.3 were the following: *H1*) no association should be found between poker experience and social anomie or alienation, *H2*) negative association should exist between anomie/alienation with respect to self-control, social wellbeing and emotional intelligence measures *H3*) positive associations should be observed between measures of social wellbeing, self-control and emotional intelligence. All these hypotheses were supported, albeit *H1* received stronger support than expected (slight negative correlation).

To summarize the results of Studies 3.1 through 3.3, we obtained evidence suggesting that extensive poker experience is not linked to social isolation, anomie, selfishness, self-control issues or proximate markers of alexithymia (i.e. pathologically low levels of intrapersonal emotional intelligence), but, at the same time, these participants still seemed to exhibit gambling problems [!]. Studies 3.1 through 3.3 thus seem to imply that both SOGS and PGSI might be too sensitive in diagnosing internet poker players with a psychological illness, although these players in fact are seemingly healthy and well adjusted. The results even allude to marginal health benefits associated with poker (see further below). This is highly relevant since SOGS and PGSI, even in their modified Likert forms, had exactly the construct validity we expected them to have (for limitations see below).

## 4.2 Implications

The results of Study 1 imply that the negative consequences of gambling in poker players (i.e. bad investment decisions) are not in themselves necessarily a marker of psychopathology. Taken together with our previous research, the findings imply that detrimental decisions made in anger happen to normal healthy people. It also seems that anger could play a role in the processes that lead to irrational decisions in poker, especially if the situation is social. The results of Study 2 seem to support this conclusion, since they imply that there is a selection effect involved in developing poker expertise: people who are naturally emotionally stable are capable of standing the pressures of the game. It is well known that Emotionality (or Neuroticism in the FFM) is consistently associated with development of psychopathologies (e.g. Ormel, Rosmalen & Farmer, 2004; Widiger & Trull, 1992; Widiger, 2011). However, the results of Study 2 imply that emotionally unstable people are likely to steer clear from playing poker. This then, could even further attenuate the false positive effects associated with SOGS and PGSI (e.g. Goodie et al, 2013; Kincaid et al, 2013).

Studies 3.1–3.3 further support the aforesaid conclusion. Based on the evidence it seems that playing poker is not something that exposes people to the risk of developing problematic gambling habits. Whatever the factor that predisposes people to develop pathological behaviors in gambling, it seems unlikely that it would be the gambling games themselves, or online poker specifically.

Taken together, the results from Studies 1–3 have wider implications not only for gambling research, but also for decision-making sciences in general. We have provided early evidence showing that, scientifically speaking, there is a need for a perspective shift in how we view poker players in online environments. Moreover, there needs to be a shift in how we perceive the mental states of poker players and their ability to successfully make correct decisions in a complicated settings, which are demanding in emotional and mathematical/cognitive terms. Up to now, the literature in the field of gambling studies has mostly focused on the clinical aspects of poker playing (e.g. Laplante et al., 2009; Mitrovic & Brown, 2009; Tryggvesson, 2006; Jiménez-Murcia et al., 2011) and has consequently overlooked some essential sides of it. These



include psychological phenomena such as identity processes, social support networks, friendships, emotions and decision-making processes. These are all conceivably connected to the game of poker and its sub-cultures and also to their likely effects on wellbeing. In addition, the subject matter of gambling should be of interest for a wider range of decision-making sciences. The results presented here imply that the actual decisions that are made in gambling games can be studied from an interdisciplinary angle, whereby the antecedents of particular decisions can be understood.

Furthermore, if the results of Studies 1–3 are taken as a whole, we can understand the large influence that emotions and emotional stability have on decisions made in poker. Despite the fact that emotional stability is correlated with poker playing experience, emotionally engaging vignettes can disrupt rational decision-making – when the level of poker experience is held constant – especially if the context implies the presence of others. Furthermore, experience gained in playing poker seems to be reliably linked to the ability to withstand losses (see Study 3.1 and Palomäki et al., 2014).

In a clinical framework, the results are illuminating too. The results are especially relevant for parties working with gambling-related harm prevention, such as counselors, therapists, addiction centers and psychiatric professionals of different stripes. Understanding the dual process dynamics of human emotions and rationality seems to offer ways for educating healthy gamblers on how to avoid making bad decisions (and lose money). Public awareness campaigns that urge people not to drink and drive are well-known and effective in many ways. Similarly, campaigns that educate gamblers about their emotions could save some families from disasters (“Feeling grumpy? Then play tomorrow. Studies show that negative moods make you less rational”). Gambling problems are of high importance to modern societies and therefore there are possible benefits to be gained from understanding the emotional/cognitive processes and individual differences that predispose some individuals to develop *ludomania* (i.e. pathological gambling habits). It also seems that the instruments used to diagnose pathological gambling need to be revised to accommodate the special features of internet based poker playing to avoid treating those who are not (mentally) ill. – This detail is already taken into consideration in the clinical

practice where the diagnosis of the gambling problem is supplemented with an interview.

Study 1 together with an increasing number of similar studies have also some methodological implications (Seale & Phelan 2009; Liley & Rakow 2009). It seems that the paradigm introduced in Study 1 enables for investigating the social, emotional, mathematical and experiential components of decision-making. This implies that poker could be a relevant addition into the tool-kit of micro-economists, economic and social psychologists, and other experts of decision-making sciences. Study 1 provides further validation of Palomäki et al.,(2013a), where poker experience was linked to better mathematical decision-making in poker. For Study 1, we created another five fictional decision-making scenarios in which poker experience was reliably linked to better performance, implying that the method of creating rational decision-making scenarios like we have, is feasible.

During the last years, the field of judgment and decision-making research has accumulated evidence showing that understanding emotions is important in a decision-making context. For instance, witnessing unfair offers in ultimatum game is correlated with disgust-related brain activity (Sanfey et al., 2003), and induced disgust increases the likelihood of rejecting unfair offers in the Ultimatum game (Moretti & Di Pellegrino, 2011). Furthermore, Fehr & Gächter (2002; see Fehr & Fischbacher, 2004) have reported that decisions to engage in costly punishment behavior are associated with self-reported feelings of anger. Additionally, extensive research employing the Iowa Gambling Task (Brevers, Bechara, Cleeremans & Noël, 2013) implies that the value of money is at least partially scaffolded on the brain responses in areas related to emotional processing, without which decisions to switch from bad investment decisions to better ones seem to be compromised (for a review, see Brevers, Bechara, Cleeremans & Noël, 2013).

Studies in evolutionary psychology and microeconomics also show that humans exhibit a natural tendency for punishing others for unfair offers and selfish behaviors (e.g., Fehr & Gächter, 2002; Fehr & Fischbacher, 2004). Arguably, by doing so they reduce the likelihood of selfish behaviors occurring in the future and signal unwillingness to tolerate exploitation. However, this behavior is not displayed when

people play the ultimatum game against computer opponents (Sanfey et al., 2003). Punishing computers for selfish behavior would be pointless since there are no intuitive (or implicit) reasons to assume that computers would change their behaviour (i.e., programming). Expressed with the language of dual processing models, System 1 level mechanisms — such as the emotion of anger — are context-sensitive and capable of making conceptual distinctions between living and non-living entities (for a review of intuitive ontology, see Boyer and Barrett 2005). We can therefore embed the findings of Study 1 within the context of decision-making sciences and the dual processing model more generally.

Normatively rational decision-making, especially in the context of economics, is generally presumed to be reached through System 2-type deliberation (Kahneman, 2011). However, System 1 level processes regarding emotional and social information are unavoidably incorporated into this process. In the context of poker, this seems to be detrimental to the subjective assessment of successful investment decisions (i.e. whether to fold or call). It seems to be relatively straightforward to conclude then that experimental poker studies, such as this one, contribute in a fruitful way to the ongoing discussion on how emotions and social situations hinder or enhance performance in game theoretical settings. Normative rationality and its violations in highly experienced participants can be studied using poker. More importantly, in our study the social context and emotional processes were clearly disruptive of normative decisions. In real life, playing in the state of anger could translate to excess financial losses, since internet poker requires constant conscious deliberation and rapid assessment of relative hand strengths with a relatively fast pace. Possibly the effects observed in Study 1 could be stronger, if the participants played for real money.

Taking a microscopic view of the results of Study 2, it seems that the individuals who are most likely to develop proficient System 2 level processing abilities in a poker context are those who are naturally emotionally stable. There is some evidence suggesting that introverts are naturally more prone to develop their skills in poker, because they prefer playing online (e.g., Brown & Mitchell, 2010), where the number of decision per minute is much higher than in a live game, as people can play at several tables simultaneously. Also, we found that the preference for live poker was

negatively associated with levels of poker experience. We assume that this negative correlation is due to similar reasons as the correlation between introversion and poker experience. Namely, online poker is more easily available and is more fast paced than regular poker.

When we analyzed the correlations between individual PES4 items and HEXACO dimensions, we found that all of the individual items correlated with emotional stability. However, the item which was most strongly correlated with emotional stability was the one measuring the level of stakes played at. This suggests that one of the most important factors in developing poker skill is the ability to cope with emotional pressure emanating from the risk of losing monetary investments. Lower levels of emotionality were thus associated with a smaller number of hands played and with less self-reported professionalism in poker. Given that the number of years played was only marginally correlated with emotionality, we conjectured that there might exist a minority group of recreational players who have played consistently for years, but who have not climbed up the stakes. The individuals who fit this profile would probably not gain as much from emotional stability as other sub-populations.

Given that success in poker seems to be related to natural emotion regulation aptitudes and that acute emotional states are predictive of detrimental decision-making, the results of Studies 3.1–3.3 become more pronounced. The main results of Studies 3.1–3.3 imply that accumulated poker experience is probably unrelated to psychosocial-wellbeing. More importantly, it seems that normal healthy individuals can play online poker without major risks of becoming psychologically ill, selfish, alexithymic or socially alienated. Careful examination of the results implies that there might be some mild health benefits associated with online poker playing. We found a negative marginal relationship between poker experience and the Mos Alienation scale ( $p < .1$ , Study 3.3) and we further found significant negative associations between PES and sensitivity to losses (Study 3.1) and between PES and ruminative tendencies (Study 3.1). Paradoxically, however, there were significant correlations between accumulated poker experience and problem gambling measures (namely SOGS and PGSI), *without* significant correlations between problem gambling measures and wellbeing, emotional intelligence or selfishness measures. This effect is attenuated by the problem gambling

measures showing good convergence validities. This means that the present instruments are probably not suited for diagnosing pathological aspects of internet poker playing and should not be used in the way they have been until now, since it renders the findings less reliable.

### **4.3 Limitations**

The limitations of these studies are the standard limitations facing any internet-based questionnaires, which include (among others) different forms of demand characteristics or experimenter effects. Another general limitation of questionnaire studies using self-report measures is the likelihood that some participants give false information or try to guess the study hypotheses. This can lead either to intentional mock replies or overly “polished” responses to please the researchers.

Moreover, Studies 1, 2 and 3.1 could have selected for individuals who were more patient than the average poker player, since the average time to complete the questionnaire was 40 minutes, albeit this is not unusually long for an internet study. Nowadays taking part in internet surveys is relatively common and these usually last at least 30 minutes. A limitation in Study 2 could be that the sample was possibly more curious than the population average, since openness to experience scores deviated from the scale mid-point by 0.7 (in other words, poker players could be more open to experiences than the population average). Going further, because our samples were collected from online poker-playing communities, we assume that most participants had at least some poker playing experience. Therefore, we cannot compare poker players with non-poker-players. Comparing poker players with poker naïve population with respect to these dimensions is a topic for a future research .

In addition to the standard set of questionnaire limitations of self-selection, experimenter effects and demand characteristics, there are limitations that apply to each of the individual studies. In Study 1, the use of new stimulus material could be a possible limitation. We used pairs of moving human eyes as a proxy/cue for social presence, which was a step up from previous research where pictures of static eyes have

been used (e.g., Bateson, Nettle & Roberts, 2006). It could be argued that the moving eyes stimulus would need to be set up against another set of controls, where the possible disruption of working memory, attentional blinking and other more basic cognitive functions are taken into consideration in more detail. Moving eyes, however, are more ecologically valid than static eyes and any disruptions of working memory or attentional focus would be exactly due to the fact that they are human eyes. Humans have special brain areas for detecting faces and humans have automatic tendencies for "joint attention"; in other words, we care about what other people care about, and what others care about grabs our attention (e.g., Bruinsma, Koegel & Koegel 2004).

It is possible that similar disruptions on decision-making could be achieved by other means as well (e.g. loud syncopated atonal music or holding a number series in your mind while doing the tasks). However, this would not mean that the moving eyes are not an effective experimental manipulation in their own right (due to the specific effect human eyes and faces have on other humans), separate from working memory disruptions etc. Furthermore, previous experiments that elicited the audience effect used only pictures of static eyes. Proper controlling, testing and validation of the stimulus should take this into consideration as well. In previous research, where static eyes have been used as a stimulus, pictures of flowers have been used as controls. For future research, also these types of controls (e.g., pictures of flowers) should be incorporated in to the proper validation tests of the moving eyes stimuli.

Furthermore, the dependent variables in Study 1 were hypothetical decision-making scenarios. It can be argued that these decision-making scenarios lack ecological validity. These scenarios were textual descriptions of poker game situations and different from the graphically rich online virtual environments or live poker tables. These descriptions were in a sense minimal representations of the poker environments, portraying only the bare essentials needed for assessing the expected values of folding (not investing) and calling (investing; See Figure 1). However, if the results were obtained with such materials, the benefit is that there were no other confounds due to colorful graphics or associations related to casino environments. Study 1 was the second study to employ this method of assessing mathematical accuracy of poker players in an online questionnaire, and the results seem to be convergent, lending credence to the

method. The final limitation for Study 1 is that we did not have a control condition for any other negative emotion (see 4.4. for further Discussion).

Limitations in Study 3 include the following: a) we used Likert-adapted versions of established clinical instruments (PGSI & SOGS) and b) we did not include both PGSI and SOGS in all of our studies, therefore we cannot know if the results would converge between the scales. These instruments (PGSI & SOGS) are traditionally used to classify respondents into discrete categories based on individual scoring (i.e. non-problematic gambler, problem gambler, pathological gambler), while our continuous Likert-scored measures are not directly comparable to the traditional scoring system. However, the Likert -adapted PGSI had exactly the right convergent and divergent validity with performance measures of emotional intelligence, life satisfaction, hope, level of education etc (see Results for Study 3.1). Using a continuous Likert scoring of the clinical instrument seems to expose its weaknesses and increases the statistical power of the analysis in comparison to median splits or other data categorization methods that are often used.

Finally, as already stated in 2.1, due to technical and ethical limitations there could be some overlap between the study populations, since the method of data collection was similar in all studies. Furthermore, as far as we are aware of, there is no up-to-date normative sample that has been collected from the Finnish or international gambling population and this makes it difficult to estimate, with absolute certainty, to which extent our samples are representative of the poker playing or gambling community as a whole. However, since our studies aimed at studying the population of healthy poker players, this does not seem to be such a critical issue (i.e. we are not developing clinical instruments *per se*). Furthermore, as a more technical note, in our Appendix 2 we have presented Maximum Likelihood estimated structural models from our data. Since these analyses have converged and their  $X^2$  -tests have a p-value of  $>.05$ , they do satisfy the prerequisites of being multinormally distributed (See Byrne, 2012). What this implies, in the end, is that our data is most likely representable/ generalizable and was collected appropriately.

## 4.4 Future directions

Future studies could take several directions. Future research building up on Study 1 will benefit from simulating actual frustration or anger induced by the poker situations themselves, rather than using anger inducing vignettes not-related to the context. More research is also needed in order to ascertain whether it is negative emotions in general, or (moral) anger specifically, that is detrimental to poker decision-making. In addition, Study 1 should be replicated in laboratory conditions to consolidate the poker decision-making paradigm used. Antonio Damasio (2003; see Stich and Mallon, 2000), among others, has suggested that human emotions could be divided into two broad categories: primary and secondary (social) emotions. The results of Study 1 were confirmed through an interaction effect between the social identity salience manipulation (i.e. eyes on the screen) and anger manipulation. This implies that basic and social emotions could possibly exert separate effects on System 2 type of processing. Since social emotions need to take into consideration the nuances of social situations, it is possible that they also need the analytical capabilities of System 2. Social emotions are highly context sensitive and hence their rationality depends more or less on explicit strategic understanding of the surrounding situations. It is therefore possible that social or moral anger takes more resources from System 2, which would otherwise be used in the processing of rational economic calculations. Basic emotions (fear, disgust, anger), which are related to immediate survival on the other hand would simply override any System 2 -level processes completely. For instance, if there was an earthquake while a person was playing a poker game, his fear would force him to run out of the building, not really caring whether it was the right decision from the perspective of poker. Also, to further validate the role of (moral) anger specifically in the context of poker we would need to conduct studies that have other negative emotion inductions as control conditions. This is a standard practice in social psychology that is usually required step before we could conclude with more certainty that it is anger and not just any negative emotion that has this disruptive effect on System 2 level decision making.

Study 2 implies that future studies in gambling and gambling pathologies would



benefit from taking into consideration the personality profiles of healthy normal individuals. Future studies should assess which types of personality profiles are more susceptible to psycho-pathologies. In a recent study by Van Gelder & De Vries (2014), HEXACO was utilized in conjunction with a dual processing model in order to measure criminal decision-making. In addition, HEXACO could be further utilized in assessing decision-making processes in the field of gambling studies and economic psychology as well.

Finally, Studies 3.1–3.3 provide numerous implications, directions and suggestions for future research. For instance, the SVO measure used in Study 3.2 stems from the mathematical tradition in game theory and micro-economics. Furthermore, SVO has been extensively validated in empirical contexts. Social Value Orientation had no association with PES, implying that the exploitative strategies encouraged by the logic of poker are not activated outside the game. Or, stated in other ways, manipulative character does not benefit in acquiring poker experience. As far as we are aware, there are no studies assessing whether poker expertise is domain specific, or whether it has domain general effects. In other words, it is unknown if experience in poker is related to specific gaming strategies / behaviors in general, or whether the skills that are developed in poker are only specific to poker (e.g. it has been shown, that chess expertise does not influence IQ). To answer these and other similar questions, poker experience and poker decision-making behavior should be studied in relation to the most common game theoretical measures, like the Ultimatum game, Trust Game or Public Goods Game.

The reason for studying the economic games in conjunction with poker are numerous. One of the reasons is that at the moment it is not quite clear whether the strategies employed in poker are analogous with other types of “selfishness” decisions made in for example in Trust game or the Ultimatum game. As an example In the ultimatum game Player A divides, say 10 coins, between himself and Player B. Player B can then decide whether to accept the number of coins offered to him by player A. If B accepts, both get to keep their coins. If B rejects, neither of the participants gets anything. It can be ascertained, that experienced poker players in the role of B, are more likely to accept offers that non-poker players find unfair (offers from 1 to 3 coins), since

they should be more sensitive to rational decision making in contexts that involve money. If on the other hand skills and thinking patterns developed in the context of poker are extremely context dependent (i.e., *domain specific*), then we should not expect to see any correlation between strategies individuals choose in economic games and their poker playing experience. At the moment we have no clue whether skills developed in poker are relevant in other contexts as well.

Studies 3.1 and 3.3 could be further extended by trying to replicate them with a full battery of problem gambling measures, and possibly with more sophisticated path model-based analyses to gain more insight into the underlying mechanisms of poker. A more complex analysis could take into consideration that zero correlations are sometimes artifacts stemming from latent clusters that produce opposite effects. For instance, it is possible that experienced poker players are divided into two sub-groups: a sub-group of non-pathological players who experience positive benefits from poker and a sub-group of problematic players who actually have only negative effects from the game. Just by looking at correlations however, such latent cluster or interaction effects would remain unobservable.

Nonetheless, results that are replicated three times over and that systematically suggest that there are no ill-effects associated with gaining high levels of experience in poker, need to be taken seriously by the gambling studies community. Especially since there is an increasing number of studies which do consistently find strong evidence suggesting that the common diagnostic tools for detecting problem gambling need to be revised (Stinchfield, 2002, Ladoucer et al., 2000; Orford et al., 2010; Kincaid et al., 2013; Stone et al., 2014; Goodie et al., 2013) and there have been other studies that point to this direction as well, in the context of poker (e.g. Palomäki et al., 2013a)

We still have a lot to learn about the relationship of healthy rational decision-making and how it gets disrupted and snowballs into something which is defined as an addiction. It also seems that the rise of new technologies, like the internet, forces us to rethink what addiction or problematic behavior is (for extensive discussion, see: Widyanto & Griffiths, 2006).

## 5. Conclusions

This thesis succeeded in aims set up in 1.5. Studies 1–3 offer clarifications to the origins of tilting, mathematically inaccurate decision-making, development of expertise and questions related to poker and well-being. Furthermore, we successfully succeeded in adjusting the focus of the field of gambling studies by extending the domain from clinical populations to include healthy individuals as well.

The studies presented here imply that there are benefits in revising our perspective on poker gambling and poker players. The extensive clinical concentration on poker and poker playing communities has obscured other interesting scientific perspectives and possible findings. By concentrating more on the decision-making aspects and aspects related to expertise development we can gain a deeper understanding on human decision-making in general and tie the field of gambling studies more closely to cognitive sciences and social and personality psychology as well.

Further discussion of the results implies that the financial losses that are associated with online poker gambling is a concern to anyone who decides to actively play the game. However, this seems to be a matter of both situational (state) and trait factors (i.e. personality), and if psychopathology plays a role, then its magnitude needs to be assessed in relation to these other findings as well (i.e. level of poker experience, personality, sensitivity to losses, emotional and social situational factors). Problematic gambling and pathological behaviors surely exist, but the magnitude of the problem and the frequency of really problematic behavior among poker players needs to be assessed in the context of what is normal. If losing your nerves and feeling angry due to losing money is normal human behavior and if going back to the poker table after a losing streak is something that is comparable to going to work after a bad day – for the professional – , then classifying these behaviors as pathological or problematic is questionable from a more scientific perspective.

It seems that many of the key components related to accumulating poker skills and avoiding bad decisions leading to monetary losses are related to emotional self-regulation, which stems from either extensive training or natural aptitude or both.

Keeping this in mind when investigating gamblers and gambling related behaviors will greatly benefit the basic decision-making sciences and will add to our understanding on how such things as addictions actually develop. It is not enough to classify people as mentally ill, if we want to prevent people from becoming mentally ill.

To sum up, the thesis successfully showed that: 1) making investment decisions in poker while angry leads to detrimental decisions, 2) emotional stability is important in developing poker expertise and 3) developing poker expertise is not associated with emotional or social problems, selfishness or hopelessness. This warrants further studies conducted on healthy and normal decision-makers in the field of gambling studies.

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## APPENDIX 1

### Explicit Presentation of the Poker Decision Making Tasks (Dependent Variable)

Detailed descriptions of the five Texas no limit hold 'em (NLHE) poker decision making tasks/scenarios are presented here. The scenarios involved NLHE, since it is currently very likely the most popular and recognized poker game variant. In both scenarios, participants could choose one of two options, fold or call, in accordance to the rules of NLHE.

Poker Terminology Abbreviations and Explanations:

To fold = To give up your hand

To call = To match a bet made by an opponent

To bet all-in = To bet all the money/chips one currently has in play

bb = big blind

h = hearts, s = spades, c = clubs, d = diamonds

As Kh Qc Jd Ts = Ace of spades, King of hearts, Queen of clubs, Jack of diamonds, Ten of spades

Knowing *for a fact* an opponent's range of possible hands for a given action, one's own hand, and the amount of money/chips invested in the pot, enables a mathematical calculation of *equity*. Here, equity corresponds to the likelihood of a given hand (the hand held by the participant in a given scenario) winning against a specified hand range. The expected value of folding is always exactly zero. Thus, calling is mathematically correct if and only if its equity is above zero. Correspondingly, folding is mathematically correct if and only if the equity of calling is below zero. PokerStrategy.com Equilator (version 1.8) was used to calculate the distribution of equity between the participants' hand and the opponent's hand range.

The monetary values are depicted as *big blinds*, which, in general, correspond to the *minimum bet* allowed in any given game. Typically, in a NLHE game with a maximum buy in of \$100, the big blind will be \$1. Correspondingly, in a NLHE game with a maximum buy in of \$5000, the big blind will be \$50.

## Scenario 1

You are holding: **5s, 4s** (five of spades, four of spades).

The flop is: **Kh, 9s, 6s** (king of hearts, nine of spades, six of spades)

In the beginning of the hand, both you and your opponent had **100 bb**. Currently, on the flop, the size of the pot is **6 bb**, and both you and your opponent have **97 bb** in your stacks. Your opponent bets all-in.

You know **for a fact** that your opponent can have **anything**. In other words, you know **for a fact** that your opponent's range of possible hands is **any two cards (or “random”)**.

**What do you do: Call / Fold?**

Table 2. Scenario 1 mathematical evaluation.

Player	Hand range	Equity ("range strength") (%)	Money
Subject	[5s, 4s]	46.67	97 bb
Opponent	[random / "any two cards"]	53.33	has bet all-in
Size of the pot (after opponent bets all-in)	103 bb		

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Calling yields an expected value of  $0.4667 \times 103 - (1 - 0.4667) \times 97 = -3.66$



## Scenario 2

You are holding: **2c, 2s** (deuce of clubs, deuce of spades)

The flop is: **3s, 4s, 5s** (three of spades, four of spades, five of spades)

In the beginning of the hand, both you and your opponent had **150 bb**. Currently, on the flop, the size of the pot is **2 bb**, and both you and your opponent have **149 bb** in your stacks. Your opponent bets all-in.

You know **for a fact** that your opponent can have **anything**. In other words, you know **for a fact** that your opponent's range of possible hands is **any two cards (or “random”)**.

**What do you do: Call / Fold?**

Table 3. Scenario 2 mathematical evaluation.

Player	Hand range	Equity ("range strength") (%)	Money
Subject	[2c, 2s]	59.02	49 bb
Opponent	[random / "any two cards"]	40.98	has bet all-in
Size of the pot (after opponent bets all-in)	151 bb		

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Calling yields an expected value of  $0.5902 \times 151 - (1 - 0.5902) \times 149 = 28.06$

### Scenario 3

You are holding: **Ts, 8s** (ten of spades, eight of spades)

The flop is: **Qs, As, 9h** (queen of spades, ace of spades, nine of hearts)

In the beginning of the hand, both you and your opponent had **100 bb**. Currently, on the flop, the size of the pot is **8 bb**, and both you and your opponent have **96 bb** in your stacks. Your opponent bets all-in.

You know **for a fact** that your opponent has **two “picture cards”** (here, “picture cards” refer to Jacks, Queens and Kings – i.e., cards that have “pictures of people” in them) in his/her hand – but you do not know anything else. In other words, you know **for a fact** that your opponent's range of possible hands is **any two “picture cards”** (either two of the same picture card, or two different picture cards, regardless of the suits)

#### **What do you do: Call / Fold?**

Table 4. Scenario 3 mathematical evaluation.

Player	Hand range	Equity (“range strength”) (%)	Money
Subject	[Ts, 8s]	44.64	96 bb
Opponent	[any two “picture cards”]	53.36	has bet all-in
Size of the pot (after opponent bets all-in)	104 bb		

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Calling yields an expected value of  $0.4464 \times 104 - (1 - 0.4464) \times 96 = -6.72$

### Scenario 4

You are holding: **Jh, Th** (jack of hearts, ten of hearts)

The flop is: **3c, 7h, 8h** (three of clubs, seven of hearts, eight of hearts)

In the beginning of the hand, both you and your opponent had **100 bb**. Currently, on the flop, the size of the pot is **2bb**, and both you and your opponent have **99 bb** in your stacks. Your opponent bets all-in.

You know **for a fact** that your opponent has **Tc, Td** (ten of clubs, ten of diamonds) in his/her hand.

**What do you do: Call / Fold?**

Table 5. Scenario 4 mathematical evaluation.

Player	Hand range	Equity ("range strength") (%)	Money
Subject	[Jh, Th]	55	99 bb
Opponent	[Tc, Td]	45	has bet all-in
Size of the pot (after opponent bets all-in)	101 bb		

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Calling yields an expected value of  $0.55 \times 101 - (1 - 0.55) \times 99 = 11$

## Scenario 5

You are holding: **9h, 8s** (nine of hearts, eight of spades)

The flop is: **6h, 7h, 8c** (six of hearts, seven of hearts, eight of clubs)

In the beginning of the hand, both you and your opponent had **100 bb**. Currently, on the flop, the size of the pot is **2bb**, and both you and your opponent have **99 bb** in your stacks. Your opponent bets all-in.

You know **for a fact** that your opponent has **Qh, Jh** (queen of hearts, jack of hearts) in his/her hand.

### **What do you do: Call / Fold?**

Table 6. Scenario 5 mathematical evaluation.

Player	Hand range	Equity ("range strength") (%)	Money
Subject	[9h, 8s]	52.88	99 bb
Opponent	[Qh, Jh]	47.12	has bet all-in
Size of the pot (after opponent bets all-in)	101 bb		

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Calling yields an expected value of  $0.5288 \times 101 - (1 - 0.5288) \times 99 = 6.76$

## APPENDIX 2

Additional statistical analyses to supplement the analyses presented in the main text.

### Study 1

We ran several interaction and moderated regression analyses on the data from Study 1 to investigate whether Poker Experience would behave differently with different emotional manipulations. We did not find anything.

### Study 2

We first ran a multiple regression analysis by entering the PES4 as the dependent variable and all the HEXACO dimensions as independent variables. We also added the respondents age into the model. The results of the analysis are presented in Table A2 below. In this analysis only age and Emotional stability were significant predictors. This analysis conforms exactly with the analysis presented in the main text.

Table A2. Regression analysis of HEXACO personality traits and age as predictors of PES4

Coefficients:	Parameter estimates			
	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	6.47	0.9	7.16	< 0.001
Honesty-Humility	-0.08	0.09	-0.83	n.s.
Emotionality	-0.39	0.1	-4.01	< 0.001
Extraversion	-0.02	0.09	-0.26	n.s.
Agreeableness	0.01	0.1	0.14	n.s.
Conscientiousness	-0.07	0.1	-0.71	n.s.
Openness	-0.11	0.09	-1.26	n.s.
Age	0.02	0.01	2.44	< 0.05

Notes:  $R^2 = 0.05$ ,  $F(7, 469) = 3.71$ ,  $p < .01$

After this we prepared a covariance path analysis with R lavaan. Where we let all the covariances between the HEXACO dimensions and PES4 to be freely estimated. We used a robust MLM algorithm for our model estimation. After analyzing the baseline model, we removed all the non-significant covariances from our model and this resulted in a restricted covariance path model which had an excellent fit with the data ( $X^2(14) = 0.41$ ; CFI = 0.99; TLI = 0.99; RMSEA < 0.01, 90% CI [0.00 – 0.04], SRMR

= 0.03). See the final model in Figure A2 below.

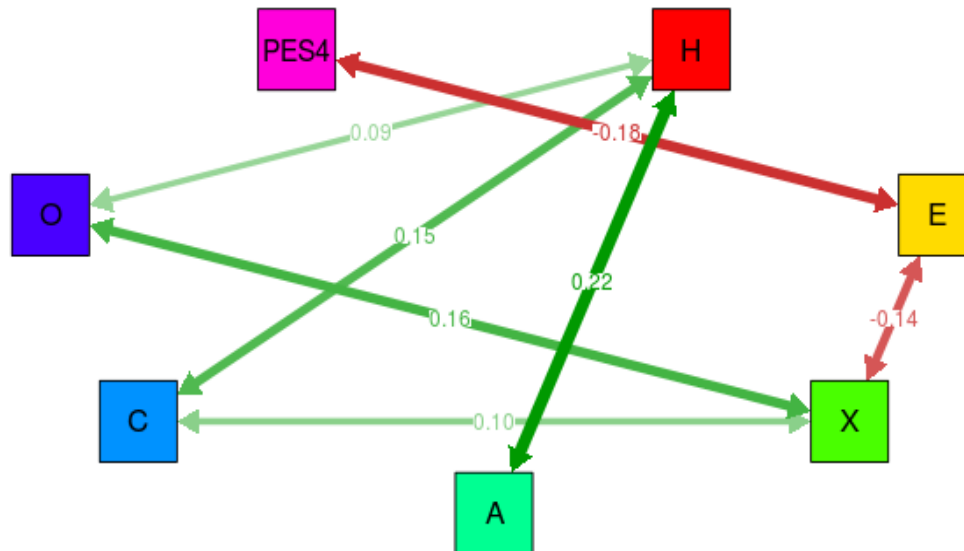


Figure A2. Results of the covariance path analysis of the data presented in Study 2 Table 5 in the main text. The model presented in this figure has a very good fit with the data,  $X^2(14) = 14.44$ ,  $p = 0.41$ ; CFI = 0.99; TLI = 0.99; RMSEA < 0.01, 90% CI [0.00 – 0.04], SRMR = 0.03). For simplification the error terms have been left out. All numbers represent strengths of covariances. Red arrows represent negative associations and green arrows represent positive associations.

As a last extra analysis for Study 2 we ran a Path model, where we set each PES4 item as an independent variable and we regressed all the HEXACO dimensions on each of the PES4 items. Our a priori model is presented below in Figure A3. After we ran the analysis for our a priori model, we removed all the non significant associations from the model, which resulted in the final model presented in Figure A4. This model had a very good fit with the data as well ( $X^2(4) = 6.313$ ,  $p = 0.17$ ; CFI = 0.99; TLI = 0.98; RMSEA = 0.03, 90% CI: [0.00, 0.01]; SRMR = 0.02). For all practical purposes the interpretation of these analyses are exactly the same as the analysis that has already been presented in the main text.

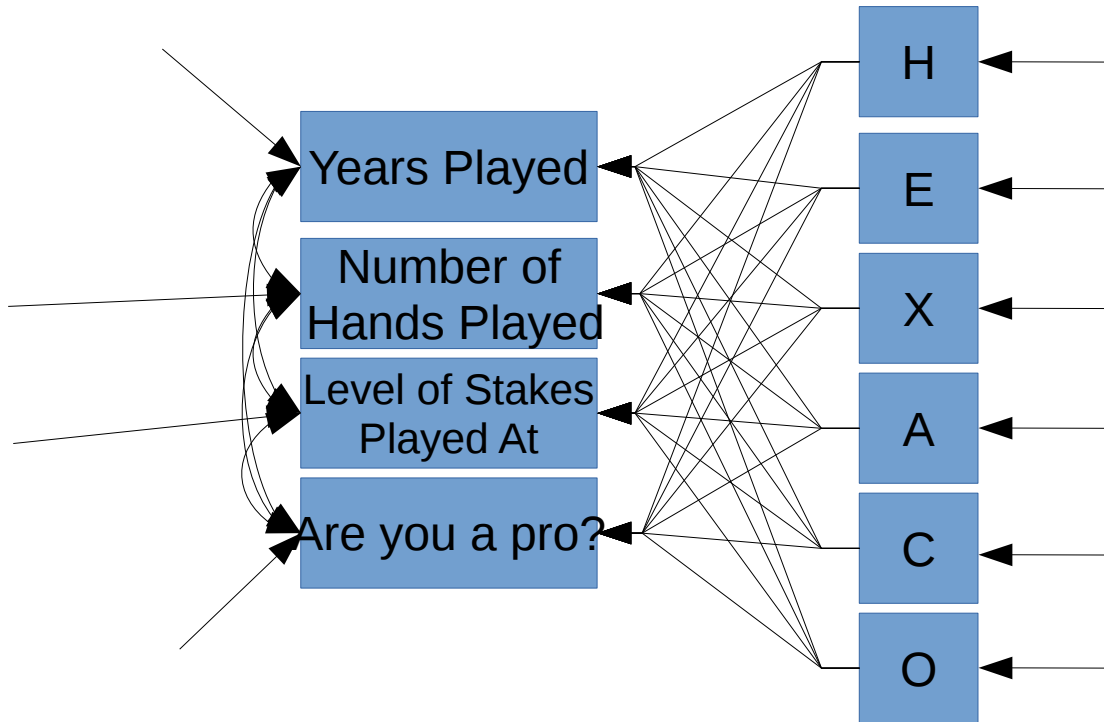


Figure A3. A priori structural equation model/path analysis for the second analysis of Study 2 (see Table 6 in the main text). Single headed arrows going from one squared box to another represent regression paths. Single headed arrows pointing to boxes without being connected to another box represent measurement errors. Curved double headed arrows represent covariances.

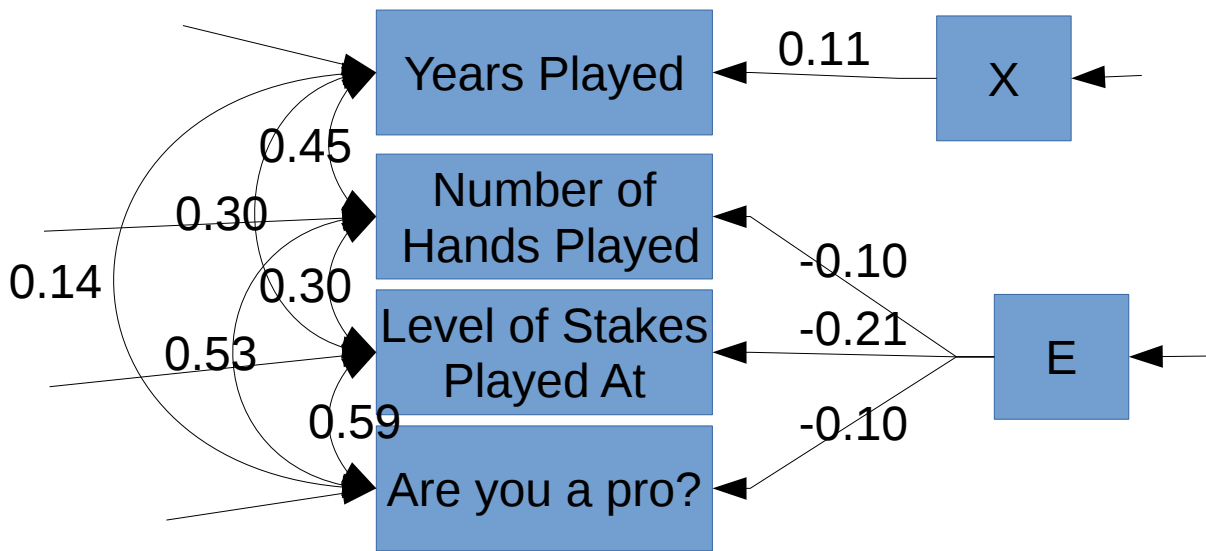


Figure A4. Path analysis / structural equation model showing only the significant connections between HEXACO dimensions of Exrtversion (X) and Emotionality (E) and each individual item of PES4 scale. The model had a good fit with the data ( $X^2(4) = 6.313$ ,  $p = 0.17$ ; CFI = 0.99; TLI = 0.98; RMSEA = 0.03, 90% CI: [0.00, 0.01]; SRMR = 0.02)

### Study 3.1

We ran a covariance path analysis for the data presented in the main text under Study 3.1 (see Table 7). Again, after removing the statistically non-significant paths, the model had an extremely good fit with the data ( $X^2(7) = 3.48$ ,  $p = 0.83$ ; CFI = 0.99; TLI = 1.04; RMSEA < 0.01, 90% CI: [0.00, 0.03]; SRMR = 0.01). Final covariance path model is presented below in Figure A5.

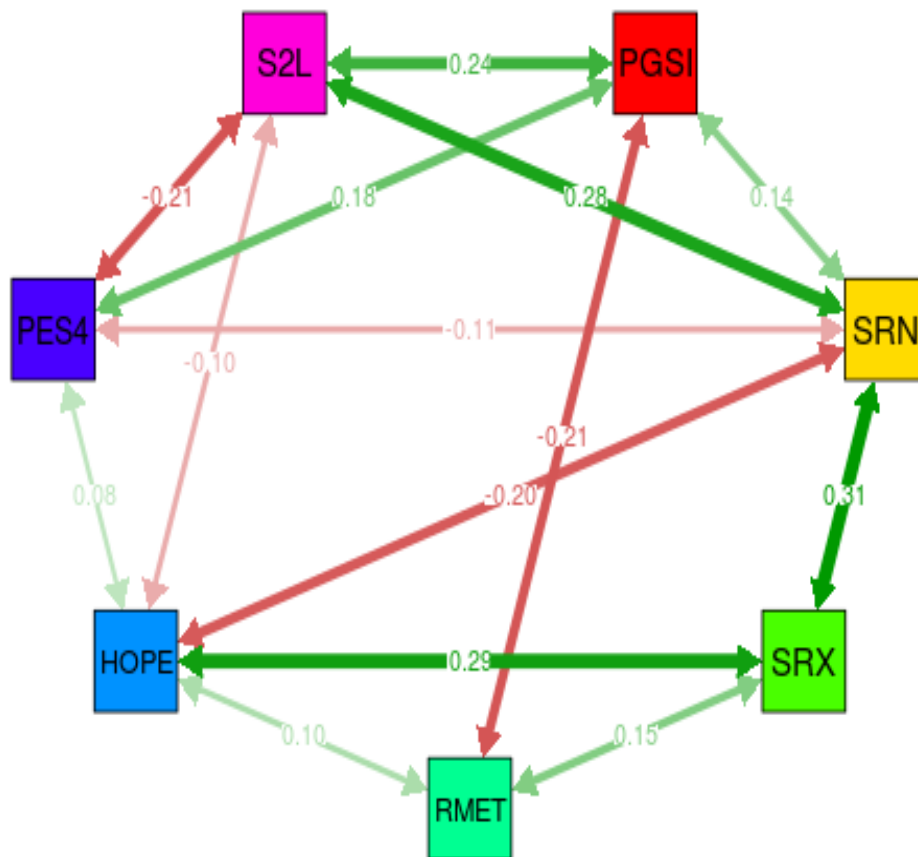


Figure A5 Covariance path model for Study 3.1. All double headed arrows represent standardized covariances between variables. This model had a very good fit with the data ( $X^2(7) = 3.48$ ,  $p = 0.83$ ; CFI = 0.99; TLI = 0.99; RMSEA < 0.01, 90% CI: [0.00, 0.03]; SRMR = 0.01). PGSI = problem gambling severity index, PES4 = Poker Experience Scale, RMET = Reading the mind in the eyes task, SRN = self rumination, SRX = self reflection, HOPE = Hope Scale, S2L = Sensitivity to Losses. For simplification, the error markers have been left out.



