The illusion of control: influencing factors and underlying psychological processes

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A thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy

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Declaration

This work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution to Anastasia Ejova and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

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* Ejova, A., Delfabbro, P. H, & Navarro, D. J. (2010). The illusion of control: structure, measurement and dependence on reinforcement frequency in the context of a laboratory gambling task. In W. Christensen, E. Schier, & J. Sutton (Eds). ASCS09: Proceedings of the 9th Conference of the Australasian Society for Cognitive Science (pp. 84–92). Sydney: Macquarie Centre for Cognitive Science.

Acknowledgements

Einstein said that “if you can’t explain something simply, you don’t understand it”. So many people contributed to this thesis becoming as simple as I could make it, but their selflessness in this is not something I can describe in a simple way or quite understand. I can only seek to emulate it in life’s various projects, and having these examples to work with is an even greater gift than a completed degree.

My supervisors, Paul Delfabbro and Dan Navarro, bring attention to detail, publishing considerations, and a sense of humour to all their work, this thesis notwithstanding. I feel very lucky to have witnessed these tools being applied consistently over such a long period of time to create a simplicity I never thought possible. Apart from my supervisors’ professionalism and humour, what stands out is their kindness. Paul gave me a great deal of conceptual freedom with this project and was then on hand with an arsenal of support for unexpected problems. Dan, meanwhile, was so generous with his time and head-space in lab-meeting discussions that we, his lab members, grew to love even topics not directly related to our theses.

In enumerating the many glorious aspects of the PhD experience that I cannot quite understand, I take the opportunity to acknowledge colleagues who answered calls for help in an unexpected level of detail. In particular, I would like to thank Magda Osman for being so prepared to bounce ideas across the equator; John Dunn for tuition in programming, maths, philosophy and what happens when they meet; David Lagnado and Tobi Gerstenberg for being the best lab visit hosts imaginable; Serguei Rassomakhine and Nancy Briggs for invaluable technical advice; Daniel King for working magic on the wording of some of my measures; Ted Nettelbeck for expert project management; and Alex Blaszczysnki and Keis Ohtsuka for, first, developing some very well-worded survey items and then helping me get access to them.

In the first year of candidature, a lovely friend presented me with a mug that bears inscriptions of Shakespeare’s most famous adages about love. Two things relating to this mug leave me baffled: (a) was Shakespeare actually writing about his university friends, and (b) how did the mug survive thousands upon thousands of tea-time conversations? Dragana Calic, Anna Olshansky, Victoria Gilliland, Dinis Gokaydin, Adam Kane, Belinda Bruza, Drew Hendrickson, Simon DeDeyne, Adella

Bhaskara, Margaret Prysak, Emma Stewart, Angela Kinnell, Joanne Collins, Annemarie Monck, Jeremy Goldring, Heidi Long, Peter Chamberlain, Christopher Bean, Emmi Teng, Pat Alvaro, Kathleen Wright, Kaitlin Harkess, Natalie Matthews – I definitely can't compare them "to a summer's day" because I have had no use for such days in an underground office surrounded by marvellous people. Other sources of unforgettable conversation and help have been our administrative staff and the members of the Computational Cognitive Science Lab.

My sister, Maria, and our closest friends make up an ever-studying, ever-dancing, ever-travelling unit. In retrospect, how we managed these activities all at the same time is a bit of a mystery. It was probably thanks to Maria's clever use of my office as an art-dealership and restaurant, and to my darling office mate's, Rachel Stephens', very forgiving and welcoming attitude to all things, from the office buzz to thesis woes. Talk of dancing and travel was 'very effectively' combined with study during office visits by Diana Pham and Suzie Cosh. With Fernando Marmolejo-Ramos, we managed this even more effectively, with me typing away while watching him talk. Ertimiss Eshkevari's descriptions of the tea and ballet selection at Covent Garden made London a stopping point for many of us. Feeding the study-dance-and-travel troika were also the calming words and wild samba moves of Sarah Williams, Tuscan alfresco evenings with Cheryl Goult, and similarly multi-dimensional outings with Christian Gelinek, Ladan Sahafi, Kim Pfitzner and Tamara Hunyadi. I also thank the friends who have dedicated precious Skype time to thesis-strategising: Maria Montanes Gassol and family, Roger Forcada, and Nyla Sarwar.

Another thing impossible to describe simply is the support provided by my partner, Matt. Whatever is the equivalent of suspending all plans for two years to leave just a lot of gentleness and good sense for your partner to bask in – I owe him that in kisses.

Thanks also go to our families, who have always added the certainty of excitable conversation to our otherwise uncertain plans. My grandmother Nina in Russia has managed to do this from a great distance, while my grandmother Svetlana has complemented conversations with weekly gifts of strawberries because apparently they're good for the brain. I would like to dedicate this thesis to Vladimir Ejov and Julia Ejelovitch, my parents. I thank them, first and foremost, for having so many

discussions about movies, books and human emotions, that my sister and I developed quite an obsession with well-turned arguments. When I turned this obsession into a potential career, my parents softened the initial failures that come with any career move by buying me thinking time and many pleasant distractions. The distractions included time at the family dinner table, which, thanks to them, is the most wonderful and surprising of destinations.

Statements of authorship

Paper 1: The illusion of control: structure, measurement and dependence on reinforcement frequency in the context of a laboratory gambling task

Published: Proceedings of the 9th Conference of the Australasian Society for Cognitive Science (2010)

Anastasia Ejova (Candidate)

The paper presents a subset of data collected as part of a larger study into influences on, and measurement of, the illusion of control. While my co-authors were involved in the design of the broader study, I was responsible for data collection and decisions on what data and arguments to present in this paper. I wrote a complete first draft and my co-authors subsequently assisted me with shortening the paper so that it met the publication's strict length requirements. I was later the corresponding author responsible for revisions to the paper based on the reviewer's comments.

Signed: ..... Date: 03/04/13

Paul H. Delfabbro (Co-author)

I was the primary supervisor for the research programme that led to this paper, so was involved extensively in the design of the study described in the paper and discussions of results. Ms. Ejova was responsible for writing the paper, for which I then provided editorial comments and advice on making changes following review. I hereby give my permission for this paper to be included in Ms. Ejova's submission for the degree of PhD at the University of Adelaide.

Signed: ..... Date: 03/04/13

Daniel J. Navarro (Co-author)

As the co-supervisor of Ms. Ejova's PhD research programme, I was involved in discussions of the results and suggested that she write up some portion of them as a submission to this conference. Ms. Ejova was responsible for writing the paper, and I then explained in detail how some sections could be written more concisely to meet the requirements of shorter publications of this kind. I also offered advice on how to respond to reviews, in terms of both revising the paper's content and composing a response letter. I hereby give my permission for this paper to be included in Ms. Ejova's submission for the degree of PhD at the University of Adelaide.

Signed: ..... Date: 04/04/13

Paper 2: Success-slope effects on the illusion of control and on remembered success-frequency

Submitted for publication

Anastasia Ejova (Candidate)

I was responsible for study design, data collection and analysis, and the development of the article's ideas through conference presentations and discussions with my co-authors. I also wrote the paper, with each section being carefully edited by my co-authors. I have revised the paper twice in response to reviews and have, with help from Dr. Navarro, conducted correspondence regarding both sets of revisions.

Signed: ..... Date: 03/04/13

Daniel J. Navarro (Co-author)

The paper is targeted at a journal specialising in judgement and decision-making, and, given my experience in publishing in this field, I offered extensive guidance to Ms. Ejova about how to structure and shorten sections of the paper. Prior to the second submission, I also edited the paper as a whole and helped Ms. Ejova draft letters to the action editor. I have also made comments on data analysis changes recommended by

reviewers. Ms. Ejova was responsible for writing the paper and I hereby give my permission for this paper to be included in Ms. Ejova's submission for the degree of PhD at the University of Adelaide.

Signed: .... Date: 04/04/13

Paul H. Delfabbro (Co-author)

I was involved in discussions of study design and results, and edited numerous drafts of the paper. I focused, in particular, on the structure of the Introduction, and the presentation of results. Ms. Ejova was responsible for writing the paper and I hereby give my permission for this paper to be included in Ms. Ejova's submission for the degree of PhD at the University of Adelaide.

Signed: ..... Date: 03/04/13.

Paper 3: Erroneous gambling-related beliefs as illusions of primary and secondary control: a confirmatory factor analysis

Submitted for publication

Anastasia Ejova (Candidate)

I conceived of the study design in consultation with my co-authors and collected the data. Data analysis involved fitting a model, the qualitative details of which I also discussed at length with my co-authors. My co-authors also offered advice on common practices for fitting models through confirmatory factor analysis. I wrote a full draft of the paper before Dr. Delfabbro and I engaged in a series of edits and discussions in order to make the qualitative details of the model understandable to gambling researchers – the readership of the journal where the paper is currently under review.

Signed: ..... Date: 03/04/13

Paul H. Delfabbro (Co-author)

As the study was being designed, I offered extensive advice on what items should be included in the survey analysed in this paper. With respect to data collection, I advised Ms. Ejova on best practices in conducting survey studies in the general community. With my experience in confirmatory factor analysis, I also provided technical support during data analysis. After the analyses were written up in a draft of the paper, I provided extensive editorial comments on what additional gambling-related literature needed to be mentioned to justify the modelling decisions. Ms. Ejova was responsible for writing the paper and I hereby give my permission for this paper to be included in Ms. Ejova's submission for the degree of PhD at the University of Adelaide.

Signed: ..... Date: 03/04/13

Daniel J. Navarro (Co-author)

I was involved in early discussions of study design and, like Dr. Delfabbro, answered numerous technical questions regarding confirmatory factor analysis. I also offered suggestions about how to structure the paper's Introduction before Ms. Ejova began writing the paper. Ms. Ejova was responsible for writing the paper and I hereby give my permission for this paper to be included in Ms. Ejova's submission for the degree of PhD at the University of Adelaide.

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Abstract

The illusion of control refers to the overestimation of the probability of a win following a personal action in a gambling game. This thesis identifies gaps in the body of literature on factors influencing the illusion, uses a theoretically motivated methodology to address them, and tests the theory underlying the methodology.

The thesis consists of a literature review and three papers. The review focuses on factors found to influence the illusion – factors such as the number of response options available in the gambling task, the degree of need for money, the average frequency of successes/wins in a sequence of rounds, and success-slope (i.e., whether wins are concentrated at the beginning or end of the sequence). The review draws attention to problems with the way the illusion of control has been measured in studies of success-frequency and success-slope. This observation, in turn, raises questions as to whether success-frequency and success-slope are, indeed, factors that influence the illusion.

The review goes on to discuss the psychological processes underlying the effects of various influencing factors. Two relatively unexplored arguments are advanced. The first is that people in gambling tasks engage in problem-solving. Problem-solving involves searching for actions that bring about the desired outcome, which, in gambling settings, is a substantial monetary win. The greater the number of available response options and the need for money, the more likely the player is to still be searching for effective actions at the time that her perceived control is measured. Such a player is, in turn, less likely to report having 'no control' over the task. A second and related argument is that the actions people consider during problem-solving are influenced by their beliefs about the task at hand. In gambling, beliefs in the gambler's fallacy (Oskarsson et al., 2009) and beliefs about supernatural agents such as luck and God (Atran & Norenzayan, 2004) are particularly relevant. In line with terminology used by Rothbaum, Weisz and Snyder (1982), it is proposed that the illusion of control has two variants, primary and secondary, influenced by the gambler's fallacy and beliefs in supernatural agents respectively.

The first two papers describe re-examinations of the effects of success-frequency (N = 97) and success-slope (N = 334) using a methodology consistent with

the above explanation. Like most studies of these two factors, the experiments involved a gambling session under a particular success-frequency or success-slope condition, followed by a post-experimental questionnaire about the degree of perceived control over task outcomes. The novel aspects of the methodology included, for example, the separate measurement of the illusion's two variants. Success-frequency was found not to influence the illusion of control when it was measured in this way, while the influence of success-slope was confirmed, in that an 'ascending slope' (a concentration of wins at the end of the sequence) was found to be associated with higher illusory primary control. The finding regarding success-slopes suggests that people expected to learn the correct way of playing through trial-and-error, which is consistent with the above argument that people engage in problem-solving when gambling.

The third paper describes a confirmatory factor analysis of a survey about erroneous gambling-related beliefs (N = 329). Items were based on interviews with people who gamble regularly, and, therefore, represented illusions of control – problem-solving solutions based on some playing experience. Consistently with the second argument presented above, the factor analysis showed that the items could be described in terms of two latent factors reflecting the gambler's fallacy and beliefs about supernatural agents, respectively.