Intuitive Confidence Reflects Speed of Initial Responses in Point Spread Predictions

by

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

Previous research has revealed that intuitive confidence is an important predictor of how people choose between intuitive and non-intuitive alternatives. Two studies were conducted to investigate the determinants of intuitive confidence. Across these studies participants predicted the outcomes of several National Basketball Association games, both with and without reference to a point spread. As predicted, after controlling for the variability associated with point spread magnitude, the faster participants were to predict the outright winner of a game (i.e., generate an intuition), the more likely participants were to predict the favourite against the point spread (i.e., endorse the intuition). Overall, my findings point to the speed of intuition generation as a determinant of intuitive confidence, and thus a predictor of choice in situations featuring intuitive and non-intuitive alternatives.

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Introduction

While many people hold their intuitions in high regard, there are times when our intuitions oppose the information presented to us. For example, a person may have a "good" feeling about an investment that is deemed unfavourable by their financial advisor or wish to go see a movie that has received negative reviews online. How do people decide between intuitive and non-intuitive alternatives when faced with information that conflicts with their intuitive choice? According to Simmons and Nelson (2006), people resolve such choice conflict situations by considering two factors: (1) The confidence they hold in their current intuition (i.e., intuitive confidence) and (2) the strength of information opposing this intuition. In a host of studies, Simmons and Nelson were able to demonstrate how participants were more likely to choose in accord with their intuition when choice situations produced confidently held intuitions and featured weak opposing information. Conversely, when intuitive confidence was low and the information undermining the intuitive choice strong, participants' preferences for intuitive choices disappeared.

Making Predictions Against Point Spreads

Simmons and Nelson (2006) investigated intuitive choice primarily in a sports betting domain. This domain is useful for such investigations as it commonly features an intuitive alternative (i.e., the superior team), a non-intuitive alternative (i.e., the inferior team), and a point spread designed to equate the validity of both choices. Therefore, the current study also utilizes a sports betting domain to study intuitive choice under conflict.

In the current study, participants were asked to predict the outcome of several National Basketball Association (NBA) games. Two types of predictions were asked of participants. First, participants were asked to predict the winners of games given a set of statistical cues that signified the quality of the two otherwise anonymous teams. These predictions (referred to as

WIN predictions) are simple in that a correct prediction entails the participant correctly identifying which team will have more points at the end of the game. Second, participants were asked to predict the winner of games against a point spread (referred to as ATS predictions). These predictions are more complex in nature as the correct prediction is not always one in favour of the winning team. Rather, the point spread serves to equate the likelihood of either team "winning" in the context of a bet and does so by subtracting points from the team deemed most likely to win the game (referred to as the favourite). For example, imagine you wish to place a bet on an NBA game featuring the dominant Cleveland Cavaliers and the lowly Philadelphia 76ers. Based on the quality of both teams, a bookkeeper decides that the Cleveland Cavaliers are an overwhelming favourite in this match-up and sets the point spread at 12 points. This means that a bet placed on the Cleveland Cavaliers pays out if the Cavaliers win this match-up by 13 or more points. However, if the Philadelphia 76ers win the game or the Cleveland Cavaliers win the game by 11 or less points a bet placed on the 76ers is declared a winner (if the Cavaliers win the game by exactly 12 points neither bet is declared a winner). Thus, what was once an easy decision (to bet on the Cleveland Cavaliers) due to the inequality of the two teams becomes difficult with the introduction of a point spread.

Explaining Choice Under Conflict in a Sports Betting Domain

Past research has shown that people prefer to predict favourites against the point spread, despite favourites failing to win against point spreads more often than underdogs (Paul & Weinbach, 2008; Simmons & Nelson, 2006). Simmons and Nelson demonstrated how this preference for favourites was dependent on how much confidence participants had in their intuitive choice. Specifically, when a vast majority of participants selected a "favourite" to defeat an "underdog" participants were more likely to choose the favourite against their own self-generated point spreads. Conversely, participants did not demonstrate this preference for games that lacked a clear favourite (as indicated by parity in participants' WIN predictions). The same pattern of results was observed when examining participants' self-reported confidence in their WIN predictions. When participant's confidence in a WIN prediction was high they were more likely to choose the team they deemed the favourite against their self-generated point spread, however, when participant's confidence in a WIN prediction was low no consistent preference for selecting favourites emerged. Lastly, the influence of point-spread magnitude on participants' ATS predictions was observed in a set of additional studies featuring authentic point spreads, with participants being less likely to choose favourites in ATS predictions as point spreads increased.

To explain this pattern of responding it is helpful to employ a dual-systems approach, which posits two distinct mental systems – System 1 and System 2 (Stanovich & West, 2000). According to a dual-systems approach, people often answer difficult questions by substituting in an easier but related question (Kahneman & Frederick, 2002). Thus, when faced with having to make a prediction against a point spread people may opt to make this prediction by first making a simpler prediction, that is, a prediction regarding which team will win the game. When making this easier prediction ("Who will win the game?") the favourite often springs to mind quickly and effortlessly. According to Simmons and Nelson (2006), the decision-maker will then consider the magnitude of the point spread along with the confidence they possess in their intuition in order to arrive at a decision. If confidence in the intuition is high and the point spread magnitude low, the decision-maker will likely choose the intuitive alternative and predict the favourite to win against the point spread. If however, intuitive confidence is low and the point spread magnitude high, the decision-maker is likely to favour the non-intuitive choice and predict the underdog to win against the point spread.

The Current Study

Simmons and Nelson (2006) were able to reliably demonstrate the important role intuitive confidence plays in resolving conflict between an intuitive alternative and information that opposes this intuition. Nevertheless, the determinants of intuitive confidence have yet to be examined. What causes an intuition to be confidently held and consequently favoured over an equally valid non-intuitive alternative? The primary goal of the current study is to advance Simmons and Nelson's account of intuitive choice under conflict by exploring this very question.

Prior to making an ATS prediction, participants in Simmons and Nelson's (2006) experiments were asked to provide a WIN prediction. Since favourites are selected a vast majority of the time in WIN predictions, it is possible that having people first predict the winner of a game increases confidence in favourites, thus leading to more favourite ATS predictions (i.e., for games featuring clear favourites). In Experiment 1, I investigate the potential influence of participants making WIN predictions immediately prior to ATS predictions by comparing the ATS predictions of participants who made (WIN/ATS Condition) and did not make (ATS Only Condition) WIN predictions. If making a WIN prediction immediately prior to an ATS prediction does bias participants to predict more favourites against the spread, one would expect favourite ATS predictions to be more frequent in the WIN/ATS Condition compared to the ATS Only Condition.

Previous studies have demonstrated a link between fast, fluent memory retrieval and confidence (Kelly & Lindsay, 1993; Morris, 1990; Nelson & Narens, 1980), with people reporting more confidence in answers they retrieved quickly. Additionally, other studies have demonstrated the impact of metacognitive experiences (such as disfluency) on peoples' choices in a variety of contexts (Alter, Oppenheimer, Epley & Eyre, 2007; Haddock, Rothman, Reber, &

Schwarz, 1999; Thompson, Turner, & Pennycook, 2011). Thus, one possible determinant of intuitive confidence is how quickly and easily an intuition springs to mind.

In Experiment 2, I investigate the relationship between the speed at which participants can arrive at an intuitive choice (i.e., make a WIN prediction) and participants' ATS predictions. I predict that the faster participants are able to predict the winner of a game the more likely they will be to predict the favourite against the point spread for that game. Overall, if fast intuition generation leads to confidently held intuitions, one would expect to observe this negative relationship between WIN prediction response times and favourite preferences in ATS predictions due to the previously demonstrated positive relationship between intuitive confidence and favourite bias in ATS predictions (Simmons & Nelson, 2006). Similarly, if fluent intuition generation leads one to experience high confidence in the intuitive choice (e.g., to predict the favourite) one would expect faster WIN predictions to correlate with the frequency of participants predicting the favourite to win the game. Consequently, I predict that games featuring a high proportion of favourite WIN predictions will be more likely to feature fast WIN predictions. Overall, if the above hypotheses are supported, it would suggest a relationship exists between how fast one can arrive at an intuitive response, how confident they are in this intuitive response, and how likely they are to choose in accord with this intuition in the face of opposing information (e.g., a point spread).

Experiment 1

The primary goal of Experiment 1 was to investigate the influence of having participants make WIN predictions immediately prior to ATS predictions. Participants were randomly assigned to one of two conditions. Those in the WIN/ATS Condition made both WIN and ATS predictions for each presented NBA game. Meanwhile, those in the ATS Only Condition only provided ATS predictions. The comparison of these two groups ATS predictions served as the focus of Experiment 1.

Method

*Participants***.** A sample of 413 participants was recruited from Amazon Mechanical Turk to complete an online questionnaire. Participants were recruited under the condition that they be U.S. residents and possess a Mechanical Turk HIT approval rate greater than or equal to 95%. The present experiment took approximately 10 minutes to complete and participants were compensated $0.50 for their participation. All reported experiments received prior approval by the University of Waterloo, Office of Research Ethics.

Materials and Procedure. Participants completed an online questionnaire that had them predict the outcome of 24 NBA games played in the 2014-15 NBA season. Games were included on the basis that they were played between February 19, 2015 and February 22, 2015. This date range was selected as it ensured that each team had played a minimum of 50 games during the current NBA season and thus that their quality could be reliably demonstrated through various statistics (e.g., win-loss record). Artificial point spreads were then calculated via a regression analysis. Authentic point spreads retrieved for each game through a sports betting website (www.donsbest.com) were employed as my dependent variable. Next, three independent variables were calculated and included in my regression analysis. These three independent variables were as follows: Win percentage difference (Home team win percentage - Visiting team win percentage), points scored difference (Home team points scored per game - Visiting team points scored per game) and points allowed difference (Home team points allowed per game - Visiting points allowed per game). These independent variables were related to three of the four statistical cues presented to participants prior to them making their predictions in Experiment 1. An independent variable based on the Home/Away record cue was not included in my regression analysis due to the fact that this cue did not lend itself to a fair comparison between home and visiting teams (i.e., one would expect home win-loss records to be better than visiting win-loss records). Finally, unstandardized predicted values were obtained from this regression analysis and used as point spreads in Experiment 1. By using these artificial point spreads, I ensured that only the data presented to participants would influence a game's point spread. Some games played in between this date range output a point spread lower than 1.5 and thus were not included in Experiment 1 due to the fact that they lacked a clear favourite. Following the removal of such games, I arrived at a set of 24 NBA games, which were featured in Experiment 1 (see Appendix A for the full list of stimuli).

Prior to making any predictions, participants completed a point spread tutorial that informed them how point spreads operate in a sports betting domain. To ensure that each participant understood this knowledge, two questions were administered following the point spread tutorial. Each question required that participants correctly select the winner of a bet made against a point spread. Only the 300 participants who correctly answered both questions were able to proceed in this experiment.

Participants in Experiment 1 were randomly assigned to one of two conditions. In the WIN/ATS Condition (N = 144) participants were asked to make both WIN ("Which team do you believe will win the game?") and ATS ("Which team do you believe will win against the spread?") predictions. In the ATS Only Condition (N = 156), participants only made ATS predictions. Four statistical cues were presented in a table format, each helping to highlight the overall quality of the otherwise anonymous teams (see Figure 1). The presented cues were as follows: 1) Record 2) Home/Away Record 3) Points Scored Per Game and 4) Points Allowed Per Game. These cues informed participants of the frequency of wins and losses for an anonymous team (Record), the frequency of wins and losses specific to when a team was the Home or Away team (Home/Away Record), the quality of a team's offense (Points Scored Per Game) as well as the quality of a team's defense (Points Allowed Per Game). Following each prediction, participants rated how confident they were in their prediction(s) on a 9-point scale, ranging from 1 (*not at all*) to 9 (*extremely*). These confidence data are not included in the following analyses.[1]

[1] **Analyses featuring participants' self-reported confidence data did not appear in the present thesis due to these analyses not being relevant to the primary focus of Experiment 1. However, participants' self-reported confidence data was analyzed and a number of Simmons and Nelson's (2006) findings were replicated. First, I observed a strong positive relationship between participants' WIN prediction confidence and the frequency of favourite WIN predictions ($r(21) = .799$, $p < .001$). Second, WIN prediction confidence was shown to be a significant predictor of participants' ATS predictions ($b = 25.65$, $t(20) = 10.30$, $p < .001$), with favourites being more likely to be predicted as WIN prediction confidence increased. Lastly, participants demonstrated more confidence when predicting the favourite ($M = 5.86$) compared to the underdog ($M = 5.47$) while making ATS predictions ($t(297) = 8.20$, $p < .001$).**

	Home Team		Visiting Team	
Record	30-23		20-33	Record
Home Record	15-10		8-19	Away Record
Points Scored Per Game	99.2		100.7	Points Scored Per Game
Points Allowed Per Game	97.2		104.1	Points Allowed Per Game

Figure 1. Presentation of Cues in Experiment 1. Cue table presented to participants in Experiment 1 outlining a match-up between two anonymous teams. Values in table represent the cues provided for one game in Experiment 1.

*Data Analysis***.** Prior to analyzing the data, I set out to remove any games from the analyses in which the underdog was perceived as the superior team by a majority of participants. Such games are problematic as for more than half of participants, the presented point spread only serves to bolster a prediction on what is already perceived as the stronger team. Consequently, I removed one game from the final analyses as, for this game, 82% of participants predicted the underdog to defeat the favourite. Following the removal of this game, the final analyses consisted of predictions made to 23 NBA games.

Results & Discussion

The primary goal of Experiment 1 was to investigate the influence of having participants make WIN predictions immediately prior to ATS predictions. To this end, I was unable to find any evidence that having participants first predict the winner of a game biased a future prediction made against a point spread. That is, participants' point spread predictions did not significantly differ between conditions ($t(44) = -.785$, $p = .437$). Specifically, 59.8% of point-spread predictions in the WIN/ATS Condition were for the favourite compared to 63.9% in the ATS

Only Condition. Furthermore, participants in Experiment 1 displayed a preference for predicting favourites against the point spread, as they did so 61.9% of the time. This percentage was significantly greater than the chance expectation of 50% ($t(45) = 4.49$, $p < .001$). Overall, favourites were predicted by the majority of participants against the spread for 18 out of 23 games in the WIN/ATS Condition and 19 out of 23 games in the ATS Only Condition.

Experiment 2

The primary goal of Experiment 2 was to investigate the relationship between the speed at which participants are able to generate an intuitive choice (i.e., make a WIN prediction) and participants' choices for WIN and ATS predictions. Participants were once again randomly assigned to one of two conditions. Those in the WIN Condition exclusively made WIN predictions while those in the ATS Condition only made ATS predictions. Participants' response times in the WIN Condition were aggregated and a median response time for each game was calculated. Furthermore, the proportion of participants selecting the favourite in the WIN Condition and the ATS Condition was also calculated on a per game basis. First, I hypothesized a negative relationship between WIN prediction response times and the proportion of favourites being selected in WIN predictions, such that games featuring fast responses will be associated with a high number of predictions for the favourite. Second, I hypothesized a negative relationship between WIN prediction response times and the extent of favourite bias in participants' ATS predictions such that the faster participants can generate an intuitive response (i.e., make a WIN prediction) the more strongly favourites will be preferred against a point spread.

Method

Participants. A sample of 418 participants was recruited from Amazon Mechanical Turk and was rewarded with 50 cents upon completion of an eight-minute online questionnaire. All participants were recruited under the condition that they be U.S. residents and keep a 95% (or greater) HIT approval rate on Mechanical Turk.

*Materials and Procedure***.** Participants in Experiment 2 were asked to predict the outcomes of 20 NBA games. These 20 games were randomly selected for each participant out of a pool of 44 NBA games that were played between February 19, 2015 and February 25, 2015.

Artificial point spreads were calculated in an identical manner to Experiment 1. Games that generated a point spread less than 1.5 were not included in Experiment 2 due to these games lacking a decisive favourite. Following the removal of such games, I arrived at a set of 44 NBA games, which were featured in Experiment 2 (see Appendix B for the full list of stimuli).

As in Experiment 1, participants were administered a point spread tutorial followed by two questions that required knowledge of point spreads. Only the 339 participants who correctly answered both questions were able to proceed in this experiment.

Participants in Experiment 2 were randomly assigned to one of two conditions. In the WIN Condition (N = 162) participants were asked to predict the winners of each presented game ("Which team do you believe will win the game?"). In contrast, participants assigned to the ATS Condition (N = 177) made all of their predictions against a provided point spread ("Which team do you believe will win against the spread?"). Immediately following each prediction, these participants were asked to rate their confidence in their prediction on a 9-point scale ranging from 1 (*not at all*) to 9 (*extremely*). However, participants self-reported confidence data are not included in the subsequent analyses.[2] Three statistical cues informed participants' predictions, as these cues highlighted the overall quality of the otherwise anonymous teams (see Figure 2). These cues were identical to those used in Experiment 1, with the exception that the Home/Away Record cue was removed in order to simplify the presentation of cues for participants. Nevertheless, the three statistical cues used in Experiment 2 informed participants of the frequency of wins, as opposed to losses, for an anonymous team (Record), the quality of a team's

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[2] **Replicating the results of Simmons and Nelson (2006) and Exp. 1, participants' self-reported more confidence when predicting the favourite (*M* = 6.00) compared to the underdog (*M* = 5.44) when making ATS predictions ($t(172) = 7.37$, $p < .001$). Once again, this analysis was not reported in the present thesis due to this analysis not being relevant to the primary focus of Experiment 2.**

offense (Points Scored Per Game) as well as the quality of a team's defense (Points Allowed Per Game).

	Home Team		**Visiting Team**	
Record	30-23		20-33	Record
Points Scored Per Game	99.2		100.7	Points Scored Per Game
Points Allowed Per Game	97.2		104.1	Points Allowed Per Game

Figure 2. *Presentation of Cues in Experiment 2*. Cue table presented to participants in Experiment 2 outlining a match-up between two anonymous teams. Values in table represent cues provided for one game in Experiment 2.

*Data Analysis***.** As in Experiment 1, I set out to remove games in which the underdog was perceived as the superior team by a majority of participants. In Experiment 2, one game fit this criterion and thus was removed from all further analyses. Therefore, my final analyses included predictions made to 43 NBA games.

Results & Discussion

As in Experiment 1, participants in Experiment 2 demonstrated a preference for predicting favourites against the point spread, doing so 62.9% of the time. This percentage was significantly greater than the chance expectation of 50% ($t(42) = 5.18$, $p < .001$). Furthermore, this preference resulted in favourites being predicted against the spread by the majority of participants for 31 out of 43 games.

Two additional hypotheses were investigated in Experiment 2. First, I hypothesized a negative relationship between WIN prediction response times and the frequency of favourite WIN predictions, such that games featuring fast WIN predictions would be more likely to feature a greater proportion of favourite WIN predictions. In order to measure the speed of participants' WIN predictions, I analyzed the median response times for each game in the WIN Condition. This was done on a per game basis by amassing all WIN prediction response times for a particular game and then calculating a median response time. Thus, a median response time was calculated for all 43 games analyzed in Experiment 2. Similarly, I assessed the proportion of participants who selected the favourite in WIN predictions for each game in the WIN Condition. It is important to note that, for all analyses presented below, games were used as the unit of analysis (as opposed to subjects). As predicted, WIN prediction response times shared a significant negative relationship with participants' favourite preferences in WIN predictions (r = -.423, $p < .01$), with games featuring high proportions of favourite WIN predictions being more likely to possess a fast WIN prediction median response time (compared to games featuring fewer favourite WIN predictions). Second, I sought to examine the relationship between the speed at which WIN predictions were made and participants' ATS predictions. I hypothesized that the faster participants made a WIN prediction in the WIN Condition, the more likely participants in the ATS Condition would be to predict the favourite for that game against the spread. I regressed the proportion of favourite ATS predictions for each game on (a) point spread magnitude and (b) WIN prediction median response times. As shown in Table 1, my hypothesis was supported. That is, after controlling for the variability associated with point spread magnitude, the faster WIN predictions were made in the WIN Condition the more likely participants were to predict favourites against the spread in the ATS Condition. Additionally, point spread magnitude was shown to share a strong negative relationship with participants ATS predictions. That is, after controlling for WIN prediction response times, people were less likely to predict the favourite against the spread as point spreads increased in magnitude.

Table 1.

Effect of Independent Variables for ATS Predictions in Experiment 2

Predictor Variable	*B*	*SE*	*Beta* (Standardized)	*p* <
WIN prediction RT	-.059	.029	-.307	.05
Point Spread Magnitude	-.034	.008	-.608	.001

Note. Data represents the output of a regression analysis conducted featuring games as the unit of analysis. The percentage of favourite ATS predictions for each game was used as the dependent variable and was predicted by the median WIN prediction response times for each game in the WIN Condition (WIN prediction RT) along with point spread magnitude.

General Discussion

The current study investigated intuitive choice under conflict in a sports betting domain, with a primary focus on examining the relationship between the speed of intuition generation and peoples' preferences for intuitive versus non-intuitive alternatives. Replicating the findings of previous research (Paul & Weinbach, 2008; Simmons & Nelson, 2006), participants demonstrated a clear preference for predicting favourites against the spread in both Experiments 1 and 2. Nevertheless, as demonstrated in Experiment 1, the magnitude of this preference was not influenced by whether participants first made WIN predictions. Thus, it appears that having people first select the winner of a game does not enhance their preference for favourites against the point spread. It is possible that people implicitly predict the winner of a game, regardless of whether this prediction is explicitly asked for, in order to simplify the complex question they are tasked with (making an ATS prediction). This is an open question, but nevertheless, is a claim that fits well within a dual-process framework (Kahneman & Frederick, 2002).

In Experiment 2, I investigated the relationship between WIN prediction response times and participants' WIN predictions. I predicted that a significant negative relationship would exist such that games featuring fast WIN predictions would be associated with a greater proportion of predictions for the favourite to win the game. This hypothesis was supported in Experiment 2, with the predicted negative relationship being observed. Furthermore, I tested the hypothesis that the faster participants made a WIN prediction in the WIN Condition, the more likely participants in the ATS Condition would be to predict the favourite for that game against the spread. This hypothesis was also supported in Experiment 2 with WIN prediction response times sharing a significant negative relationship with the frequency of favourite ATS predictions when the variability associated with point spread magnitude was controlled for.

Overall, these findings suggest an important relationship between the speed at which an intuition comes to mind, the confidence that an intuition is held with, and how a conflict between an intuitive and non-intuitive choice is resolved. These results are consistent with the claim that intuitions that are generated fluently may be held more confidently and thus be more likely to be endorsed in choice conflict situations. However, further studies need to be done in order to validate this claim. For example, studies in which the fluency of intuition generation is directly manipulated can be undertaken to investigate the casual effects of intuition fluency on intuition confidence and choices under conflict. Such an investigation would be meaningful as there are many factors in the everyday world that serve to disrupt fluency while simultaneously keeping the nature and strength of information for and against an intuitive alternative unchanged. For example, a poorly written or hard-to-read opinion piece may elicit less preference for intuitive responding from a decision-maker compared to an opinion piece that is well written or easy-to-read, yet is identical in content. Similarly, choices involving abstract or complex components, such as choosing a stock to invest in, may also produce less intuitive responses due to a lack of intuitive fluency and consequently intuitive confidence. The answers to these questions are dependent on future empirical study.

Conclusion

The current study expanded on the findings of Simmons and Nelson (2006) by investigating two potential determinants of intuitive confidence. First, Experiment 1 demonstrated that having participants explicitly predict the winner of a game does not bias them to make the same selection against a point spread. That is, participants who made WIN predictions prior to ATS predictions were no more likely to predict the favourite against the spread compared to participants who made only ATS predictions. Additionally, in Experiment 2, I was able to provide evidence of a relationship between the speed at which an intuition comes to mind and how conflict between an intuitive and non-intuitive choice is resolved. Specifically, the speed of participants' intuitive responding in the WIN Condition was shown to be a significant predictor of participants' choices under conflict in the ATS Condition. Overall, the data collected suggests that the speed of intuition generation may act as a determinant of intuitive confidence and thus play an important role in how people resolve conflict between intuitive and non-intuitive alternatives.

References

Alter, A. L., Oppenheimer, D. M., Epley, N., & Eyre, R. N. (2007). Overcoming intuition: Metacognitive difficulty activates analytic reasoning. *Journal of Experimental Psychology: General*, *136*(4), 569-576. doi:10.1037/0096-3445.136.4.569

Haddock, G., Rothman, A. J., Reber, R., & Schwarz, N. (1999). Forming judgments of attitude certainty, intensity, and importance: The role of subjective experiences. *Personality and Social Psychology Bulletin*, *25*(7), 771-782.

Kahneman, D., & Frederick, S. (2002). Representativeness revisited: Attribute substitution in intuitive judgment. In T. Gilovich, D. Griffin, & D. Kahneman (Eds.), *Heuristics and biases: The psychology of intuitive judgment* (pp. 49-81). Cambridge, United Kingdom: Cambridge University Press.

Kelley, C. M., & Lindsay, D. S. (1993). Remembering mistaken for knowing: Ease of retrieval as a basis for confidence in answers to general knowledge questions. *Journal of Memory and Language*, *32*, 1-24.

Morris, C. C. (1990). Retrieval processes underlying confidence in comprehension judgments. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *16*(2), 223-232. http://dx.doi.org/10.1037/0278-7393.16.2.223

Nelson, T. O., & Narens, L. (1980). Norms of 300 general-information questions: Accuracy of recall, latency of recall, and feeling-of-knowing ratings. *Journal of verbal learning and verbal behavior*, *19*(3), 338-368.

Paul, R. J., & Weinbach, A. P. (2008). Price setting in the NBA gambling market: Tests of the Levitt model of sportsbook behavior. *International Journal of Sport Finance*, 3, 137-145.

Simmons, J. P., & Nelson, L. D. (2006). Intuitive confidence: Choosing between intuitive and nonintuitive alternatives. *Journal of Experimental Psychology. General*, *135*(3), 409-428. http://doi.org/10.1037/0096-3445.135.3.409

Stanovich, K. E., & West, R. F. (2000). Individual differences in reasoning: Implications for the rationality debate? *Behavioural and Brain Sciences*, *23*, 645-726.

Thompson, V. A., Turner, J. A. P., & Pennycook, G. (2011). Intuition, reason, and metacognition. *Cognitive Psychology*, *63*, 107-140. doi:10.1016/j.cogpsych.2011.06.001

Appendix A: Experiment 1 Stimuli

Home Team					Visiting Team				
Record	Home Record	Points Scored Per Game	Points Allowed Per Game	Point Spread	Record	Away Record	Points Scored Per Game	Points Allowed Per Game	Point Spread
17-39	7-18	95.7	101.7		27-26	10-16	99.8	99.7	-4
12-41	7-19	89.8	100.5		21-33	10-19	95.8	97.2	-5
43-11	25-3	103.4	96.8	-6	36-17	15-8	105.6	100.7	
10-43	7-19	92.5	100.2		22-30	13-15	92.8	96.6	-3.5
33-21	20-8	99.7	97.3	-1.5	33-22	12-13	102.2	99.3	
11-42	6-21	97.5	106.1		29-25	13-14	105.9	104.7	-6.5
30-23	15-10	99.2	97.2	-10	20-33	8-19	100.7	104.1	
36-20	17-9	106	101	-3	36-17	18-9	103.1	99.8	
19-34	10-15	95.7	98.2		36-17	13-12	102.6	97.3	-7
13-40	7-18	99.1	106.2		21-31	11-16	95.5	99.5	-3
42-9	23-2	110.6	99.6	-5.5	34-20	14-13	100.9	97.1	
22-30	13-15	94.3	96.9		29-25	12-17	100.7	98.6	-1.5
23-30	9-15	93.1	96.4	-1.5	27-27	10-17	99.6	99.6	
34-21	15-11	102	99.1	-7.5	29-26	13-15	106	104.9	
36-18	18-8	103.1	100	-2	37-17	16-8	105.6	100.4	
36-19	22-7	107	101	-11	19-34	7-17	100.2	104.2	
10-44	7-20	92.4	100.4		34-22	13-13	102.6	99.1	-10
31-23	16-10	99	96.9		43-12	18-8	103	97	-3
22-33	11-18	98.3	99.6		33-22	13-13	99.5	97.9	-2
18-39	8-18	95.6	101.4	-6.5	12-42	5-22	89.9	100.6	
22-33	11-14	96	97.2		43-9	19-7	110.6	99.6	-8.5
30-25	17-8	102.1	97.2	-9.5	20-34	8-20	100.3	103.8	
37-20	18-9	106.1	101	-7.5	22-31	9-15	94.5	97.1	
13-41	7-19	99.2	106.3		20-32	8-17	100.8	102.4	-3.5

Appendix B: Experiment 2 Stimuli

Home Team				Visiting Team			
Record	Points Scored Per Game	Points Allowed Per Game	Point Spread	Record	Points Scored Per Game	Points Allowed Per Game	Point Spread
17-39	95.7	101.7		27-26	99.8	99.7	-3.5
12-41	89.8	100.5		21-33	95.8	97.2	-3.5
43-11	103.4	96.8	-5	36-17	105.6	100.7	
10-43	92.5	100.2		22-30	92.8	96.6	-3
33-21	99.7	97.3	-2.5	33-22	102.2	99.3	
11-42	97.5	106.1		29-25	105.9	104.7	-6.5
30-23	99.2	97.2	-7.5	20-33	100.7	104.1	
36-20	106	101	-2	36-17	103.1	99.8	
19-34	95.7	98.2		36-17	102.6	97.3	-6
13-40	99.1	106.2		21-31	95.5	99.5	-1.5
42-9	110.6	99.6	-7.5	34-20	100.9	97.1	
33-23	99.3	98		43-10	110.3	99.7	-4.5
34-21	102	99.1	-4.5	29-26	106	104.9	
35-19	106.7	100.7	-2.5	34-19	100.7	96.7	
36-19	107	101	-10.5	19-34	100.2	104.2	
10-44	92.4	100.4		34-22	102.6	99.1	-8.5
31-23	99	96.9		43-12	103	97	-2.5
22-33	98.3	99.6		33-22	99.5	97.9	-2.5
18-39	95.6	101.4	-5.5	12-42	89.9	100.6	
22-33	96	97.2		43-9	110.6	99.6	-9
30-25	102.1	97.2	-8	20-34	100.3	103.8	
37-20	106.1	101	-8.5	22-31	94.5	97.1	
13-41	99.2	106.3		20-32	100.8	102.4	-2
21-33	98.3	99.8		34-20	102.2	99.1	-3.5
23-31	93.1	96.6	-8	12-43	90.1	100.7	
28-27	99.7	99.5		37-18	105.1	100.3	-2

35-21	102.1	99.2	-3.5	31-24	98.8	96.9	
37-18	103	99.6	-14	12-42	97.8	106.2	
20-34	95.7	97.7		34-21	100.9	97.4	-4
29-27	106	105	-5.5	20-33	101	102.7	
23-33	98.4	99.4		35-22	102.6	98.8	-3
31-25	101.2	98.6	-5.5	23-33	96.2	97.2	
38-20	105.9	100.7	-2.5	37-19	104.9	100.3	
44-12	102.9	96.8	-4.5	39-20	105.8	100.5	
21-33	101.3	102.9	-7.5	10-45	92.3	100.5	
36-21	101.9	98.7	-7.5	22-32	94.2	97	
38-18	103.2	99.6	-2	37-20	106.9	100.7	
31-25	98.3	96.7	-12	12-44	90.4	101	
12-43	97.9	106.3		33-24	99.4	98.3	-7.5
29-27	99.7	99.4	-5	23-31	96.1	99.3	
20-36	99.9	104.2		29-28	106.1	105.2	-2
21-34	95.6	97.4	-6.5	14-41	99.5	106.4	
19-35	100.2	104.6		41-14	100.3	95.5	-8
36-19	101.9	97.2	-3.5	34-22	100.5	97.3	