The Empirical Case for Acquiescing to Intuition

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Abstract

Will people follow their intuition even when they explicitly recognize – in advance – that it is not rational to do so? Dual-process models of judgment and decision making often assume that the correction of errors necessarily follows the detection of errors. But this assumption may not always hold. People can explicitly recognize that their intuitive judgment is wrong, but nevertheless maintain it, a phenomenon known as acquiescence (Risen, 2016a; 2016b). Although anecdotes and experimental studies suggest that acquiescence occurs, the empirical case for acquiescence has not been definitively established. In three studies – using the ratio bias paradigm, a lottery exchange game, and blackjack – we test acquiescence using the criteria offered by Risen (2016a). We provide the first clear empirical support for acquiescence: People can 1) have a faulty intuitive belief about the world, 2) acknowledge the belief is irrational, but 3) follow their intuition nonetheless – even when doing so is costly.

Keywords: acquiescence, dual-process model, intuition, reason
The Empirical Case for Acquiescing to Intuition

Imagine that John is playing blackjack. He is dealt a 9 and 4 (13 total), and the dealer is showing a 4. Objectively, his chance of winning is better if he stands (39.6%) than if he hits (36.4%). But John has the intuition that 13 is not enough to win the hand and decides to take another card. Unfortunately, he gets a 10 – goes over 21 – and starts $10 in the hole.

Why might John have decided to hit despite the inferior odds of winning? One obvious answer is that John does not have an encyclopedic knowledge of blackjack probabilities. Indeed, you might assume that if John had only known that he had a better chance to win by standing, he would not have taken another card. However, as we will demonstrate in this paper, John’s decision to hit hinges on more than just his knowledge of objective probabilities. In blackjack, as in many other domains, people can recognize that one course of action is rationally superior yet choose to follow a different one. John may hit on 13 because of an intuitive belief that he is more likely to win by hitting – even if he recognizes the odds are against him. We suggest that he can maintain his intuitive belief while knowing that it is false, a phenomenon we have called acquiescence (Risen, 2016a; 2016b).

The notion that people would behave in a way that they explicitly recognize to be irrational is both intuitively puzzling and at odds with many models of judgment and reasoning. Thus, when scholars see apparent cases of acquiescence, they may be tempted to dismiss them. After all, if studies only measure people’s behavior, how can we be sure that faulty intuitions underlie their behavior? And, even if people are driven to make errors by faulty intuitions, do they really know it is an error at the time? Although we have previously laid out a case that we believe strongly suggests instances in which people acquiesce to powerful intuitions that they recognize to be incorrect (Risen, 2016b), to date there has been no definitive demonstration of
acquiescence. Thus, in the current studies, we test whether people’s behavior fulfill the three criteria required to meet the definition of acquiescence (Risen 2016a):

1) The individual has a faulty intuition that something is more likely to happen given a certain behavior or state of the world.

2) The individual is aware that the intuition is irrational.

3) The individual is guided by his or her intuition, knowing it is irrational.

For decades, psychologists have proposed various dual-process theories of judgment and decision making. Although the theories differ – in particular, for whether the two processes operate serially (e.g., Evans, 2008; Kahneman & Frederick, 2002; 2005; Stanovich, 1999) or in parallel (e.g., Epstein, 1994; Reyna & Brainerd, 1995; Sloman, 1996; 2014), they generally refer to the same two concepts (see De Neys, 2014; Handley & Trippas, 2015; Pennycook, Fugelsang, & Koehler, 2015 for recent “hybrid” accounts). One set of mental processes is based on intuition; functioning quickly and automatically (System 1). The other is based on reason; functioning slowly and deliberately (System 2).

Consider Kahneman and Frederick’s (2002) corrective dual process model. System 1 quickly proposes an intuitive judgment, which serves as a default. If System 2 determines the judgment is accurate (or is unable to determine it is inaccurate), it endorses System 1’s proposal. If System 2 detects an error, however, then it corrects the judgment. Returning to John’s ill-fated blackjack decision, we can think of his urge to hit on 13 as a System 1 intuitive judgment. Without knowing the objective probabilities, System 2 cannot detect an error, and John will follow his intuition to hit. But what if John learns that the probability of winning the hand is
higher if he stands? Based on their model, if System 2 detects a System 1 error, John will correct his intuition, thereby leading John to stand.

The assumption that people will correct errors when they detect them is reasonable much of the time. Despite its appeal, however, there are cases when this assumption doesn’t seem to hold. As Risen (2016b) explains, there are many examples, particularly in the realm of magical thinking, where individuals act on intuitions despite recognizing that they are rationally nonsensical (Keinan, 1994; Rozin & Nemeroff, 2002). For instance, in one study, participants refused to use sugar that was labeled as poison, even though they had put the poison label on the sugar themselves (Rozin et al., 1986).

There are also suggestive examples outside of magical thinking, even when there is a cost to following one’s intuition. For instance, in the ratio bias paradigm (Denes-Raj & Epstein, 1994; Kirkpatrick & Epstein, 1992; Pacini & Epstein, 1999), participants are given a choice between (a) a lottery with a greater number of winners, but a lower chance of winning and (b) a lottery with a higher chance of winning, but fewer winners. Many participants choose option (a) even though it is objectively inferior, presumably because it feels easier to win when there are more ways to win (see Reyna & Brainerd, 2008).

Although dual-process models often assume that error detection and correction are linked – with errors being attributed to a failure to detect the error (Kahneman & Frederick, 2002; 2005), the models might be improved by decoupling detection and correction (De Neys, 2014; Pennycook, et al., 2015; Risen, 2016a; 2016b). For example, recent research suggests that most people implicitly detect their errors in the ratio bias paradigm, suggesting that these errors are often due to a failure to correct (Bonner & Newell, 2000; Mevel et al., 2014). In one study, after being told the number of winners and losers in each lottery, participants reported how confident
they were that they correctly identified the lottery from which they were more likely to win. On average, participants were less confident when they were incorrect than correct, suggesting that they implicitly recognized when they made a mistake (Mevel et al., 2014). Indeed, a host of evidence has accumulated to suggest that people can implicitly detect their intuitive judgment errors even when they fail to explicitly detect them (De Neys, 2014; De Neys & Glumicic, 2008; De Neys, Moyens, & Vansteenhoven, 2010; De Neys, Rossi, & Houde, 2013).

Acquiescence differs from this work by suggesting that people may make intuitive judgment errors even when they explicitly recognize – in advance – that their judgments are wrong.

Overview of Studies

We test the criteria for acquiescence in three domains. Study 1 uses the ratio bias paradigm, as described above. In Study 2 participants guess which of three envelopes contains $5. Prior to opening their envelope, participants have the opportunity to exchange it for both of the other two envelopes. Past research finds that people believe it is bad luck to exchange a lottery ticket – i.e., they have the intuition that a ticket becomes more likely to win if they trade it away (Risen & Gilovich, 2007). Rationally, of course, participants are twice as likely to win with two envelopes than one. And in Study 3, participants play blackjack. In one trial, they are dealt the hand that John received in our opening example. While people intuitively feel they should hit, they have a better chance of winning if they stand. Critically, we provide participants with the objectively rational strategy for every hand they play.

The experimental condition in each study is designed to create conflict between an intuitive and a rational response (see Table 1). We also include a control condition for each study, which is matched in terms of the rational response, but lacks a competing intuition.
We measure three dependent variables, corresponding to the three criteria. We ask participants what they believe is most likely to happen based on their intuition (criterion 1) and which option is rationally superior (criterion 2). Lastly, participants make a decision (criterion 3). After examining decisions for all participants, we restrict our analyses to only those who accurately identify the rational response. This comparison is more conservative because it excludes participants who are unable to identify the rational response and therefore tests whether people acquiesce to beliefs that they explicitly recognize are irrational.

**Study 1: Ratio Bias**

**Methods**

Two hundred one participants (93 female; $M_{age} = 31.81$, $SD = 10.12$) completed the study for $0.25$ on Amazon Mechanical Turk. We predetermined a sample of 200 and got one extra hit before the study was taken down.$^1$ We recruited 100 per condition, which is larger than most ratio bias studies because participants only make one decision rather than several decisions.

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$^1$ We report how we determined our sample size, all data exclusions (if any), all manipulations, and all measures in all studies.
Participants were randomly assigned to one of two conditions. In the experimental condition, participants were presented with a standard ratio bias paradigm. They were given a choice between a lottery with a lower chance of winning but a greater absolute number of winners, and a lottery with a higher chance of winning but a smaller absolute number of winners. More specifically, participants in the experimental condition were given the following two options:

<table>
<thead>
<tr>
<th>Tray A</th>
<th>Tray B</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 red marbles</td>
<td>1 red marble</td>
</tr>
<tr>
<td>90 white marbles</td>
<td>8 white marbles</td>
</tr>
<tr>
<td>10% chance of winning</td>
<td>11% chance of winning</td>
</tr>
</tbody>
</table>

Thus, the experimental condition was designed to create a conflict such that people would be intuitively drawn to the lottery with more winners (Tray A), even though they rationally knew the lottery with better odds was superior (Tray B). To maximize the chance that people would explicitly recognize Tray B as the rationally superior option, we included the percent chance of winning for each tray in addition to the number of winners and losers (previous research by Mevel et al., 2015 found that a substantial minority of participants failed to implicitly detect their error when the percentages were not calculated and displayed).

In the control condition, the lotteries matched those in the experimental condition rationally; that is, Tray A offered a 10% chance of winning, while Tray B offered an 11% chance of winning. However, the options in the control condition were designed to attenuate the intuitive appeal of Tray A, as each contained an equal number of winning marbles. Participants in the control condition were presented with the following two options:

<table>
<thead>
<tr>
<th>Tray A</th>
<th>Tray B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 red marble</td>
<td>1 red marble</td>
</tr>
<tr>
<td>9 white marbles</td>
<td>8 white marbles</td>
</tr>
<tr>
<td>10% chance of winning</td>
<td>11% chance of winning</td>
</tr>
</tbody>
</table>
In both conditions, the information in the table was accompanied by visual representations of the two trays (see Figure 1). In addition, we ensured participants that they would actually play whichever lottery they chose, and that they would receive an additional $3 bonus if they won their lottery.

Prior to choosing which tray they wanted to use for the lottery and before indicating which tray seemed better based on intuition and based on reason, participants read a description of decision making: “Some decisions are made mainly on the basis of ‘intuition,’ or by consulting the ‘gut’. Other decisions are made mainly on the basis of ‘reason,’ or through rational analysis. Sometimes your intuition and rational analysis might tell you the same thing, but sometimes they might disagree. Please look carefully at both trays and consider what it will be like to draw a marble from each of the trays.” The description was included so that participants would feel comfortable providing answers that were either the same or different from each other. Then they were asked two questions in a counterbalanced order. To test criterion 1 – that people would have the intuition that they would be more likely to win with Tray A in the experimental condition than in the control condition – they were asked, “Based only on your gut feeling (or your intuition), which tray feels like the one from which you are more likely
to draw a red winner?” To test criterion 2 – that people know it is rational to choose Tray B – they were asked, “Based only on reason (or rational analysis), which tray should you choose if you want to draw a red winner?” Finally they were asked to choose a tray and played the lottery.

**Results**

**Criterion 1.** When asked which tray felt more intuitively appealing, 44 out of 101 (43.6%) chose Tray A in the experimental condition, while only 11 out of 100 (11%) chose Tray A in the control condition, \( \chi^2 (1, N=201) = 26.81, p < .0001 \). This provides support for criterion 1.

**Criterion 2.** When asked which tray they should choose based on a rational analysis, 190 out of 201 participants (94.5%) accurately selected Tray B. In the experimental condition, 91 out of 101 participants (90.1%) answered correctly, and in the control condition, 99 out of 100 participants (99%) answered correctly. This provides support for criterion 2.

**Criterion 3.** We predicted that more people would choose Tray A in the experimental condition where the intuition was present even though there was an expected cost to choosing the normatively inferior lottery. As expected, when asked to choose a tray for their lottery, 17 out of 101 (16.8%) opted to draw from Tray A in the experimental condition, while only 7 out of 100 (7%) chose to draw from Tray A in the control condition, \( \chi^2 (1, N=201) = 4.62, p = .032 \). If we remove from the analysis those participants who did not accurately identify Tray B as the rational option, however, we find that 12 out of 91 participants (13.2%) in the experimental condition chose Tray A, and 7 out of 99 participants (7.1%) in the control condition chose Tray A, \( \chi^2 (1, N=190) = 1.97, p = .16 \). This does not provide statistically significant support for criterion 3.

**Discussion**
Study 1 meets criterion 1. Significantly more participants had an intuitive preference for Tray A in the experimental condition than in the control condition. Nonetheless, only 43.6% of participants in the experimental condition had this intuition. This study also meets criterion 2, as the overwhelming majority of participants accurately identified Tray B as rationally superior. We did not find evidence for criterion 3, however. While significantly more participants chose Tray A in the experimental than control condition, this difference was not significant for participants who accurately identified Tray B as rational. Therefore, although people are following an intuition that most people know is irrational, we cannot conclude that people explicitly recognize that choosing the intuitive option is irrational when they do so.

**Study 2: Envelopes**

Study 2 tested the same criteria, but with a paradigm that was meant to create a more powerful intuition shared by more participants.

**Methods**

One hundred fifty participants (61 female) completed the study in a lab located in downtown Chicago. We predetermined a sample of 75 participants per condition because we anticipated that the intuition would be stronger than in the ratio bias paradigm and because our lab could support 150 participants in a reasonable time frame. Participants received $1, with an opportunity to earn an additional $5. Participants were seated at a table across from the experimenter. Prior to the study, we placed three slips of paper on the table labeled “1”, “2”, and “3”. Upon sitting down at the table participants were handed three envelopes, and were asked to arrange them on the table in any order in front of the three labels. Participants were then told that one of three envelopes contained a $5 bill, while the other two were empty. As in Study 1, participants were assigned to either the experimental or control condition.
In the experimental condition, participants had the opportunity to guess which envelope had the money, and were told that they would be allowed to keep the money if they chose correctly. Participants then wrote their name on the envelope they selected. Before revealing whether or not they chose the winning envelope, participants were given an opportunity to trade their envelope for the other two envelopes. To clarify, if a participant accepted the exchange, she would win the money if it was located in either of the other two envelopes, but not if the money was located in her original envelope. This situation draws on research showing that people hold an intuitive belief that it is bad to exchange a lottery ticket (Risen & Gilovich, 2007). We hypothesized that participants would intuitively believe that their original envelope would be more likely to contain the money if they exchanged it.

In the control condition, participants did not choose an envelope. Instead, after discovering that one of the three envelopes contained $5, they were asked whether they wanted one specific envelope (randomly determined for each participant), or the other two envelopes. For instance, a participant might be asked whether she would prefer to have Envelope 1, or both Envelope 2 and Envelope 3. As in Study 1, the control condition was designed to reduce the intuitive appeal of the single envelope, but match the experimental condition in terms of rationality. In other words, although selecting the two-envelope option is the rational strategy for participants in both conditions because it doubles the chance of winning, the intuition that it is bad to exchange a ticket (Risen & Gilovich, 2007) only conflicts with the rational strategy in the experimental condition where participants start by choosing an envelope.

Prior to deciding whether they wanted the single envelope or the other two envelopes, all participants heard an explanation about intuitive- and reason-based decision-making, like the description from Study 1. Then they were asked two questions. First, to test criterion 1, they
were asked about their intuition. Participants in the experimental condition were asked, “Imagine that you exchange your envelope. The experimenter is about to open the envelopes. Based on your gut feeling (or your intuition), where do you feel the money is most likely to be located?” They could respond by selecting “Your original envelope” or “Either of the other two envelopes”. Participants in the control condition were asked, “Imagine that you choose Envelopes 2 and 3. The experimenter is about to open the envelopes. Based on your gut feeling (or your intuition), where do you feel the money is most likely to be located?” They could respond by selecting “Envelope 1” or “Either of the other two envelopes (Envelope 2 or Envelope 3)”.

Then, to test criterion 2, all participants were asked about rational analysis. They were asked, “Based on rational analysis, with which envelope(s) are you most likely to win?” Participants in the experimental condition responded by selecting “Your envelope” or “Both of the other two envelopes together”, and participants in the control condition selected either “Envelope 1” or “Envelope 2 and Envelope 3 together”. Finally participants were asked to decide which envelope(s) they wanted.

**Results**

**Criterion 1.** When asked where they felt the money was most likely to be located based on intuition, 42 out of 75 participants (56%) chose the single envelope in the experimental condition, while only 20 out of 75 (26.7%) chose the single envelope in the control condition, $\chi^2 (1, N=150) = 13.31, p = .0002$. This provides support for criterion 1.

**Criterion 2.** When asked which envelope(s) offered the best chance to win based on rational analysis, 118 out of 150 participants (78.7%) accurately selected the two envelopes. In the experimental condition, 53 out of 75 participants (70.7%) answered correctly, while in the
control condition, 65 out of 75 participants (86.7%) answered correctly. This provides support (albeit weaker than in Study 1) for criterion 2.

**Criterion 3.** Finally, when participants in the experimental condition were asked whether or not they wanted to exchange their envelope for the other two, 32 out of 75 participants (42.7%) refused the exchange, opting instead to keep their single envelope. In the control condition, only 11 out of 75 (14.7%) chose the single envelope over the other two, $\chi^2 (1, N=150) = 14.38, p = .0001$. Next, as in Study 1, we restrict the comparison to only those participants who accurately identified that the two-envelope option was the rational option. Here we find that 13 out of 53 participants (24.5%) chose to keep their single envelope in the experimental condition, while only 7 out of 65 (9.2%) chose the single envelope in the control condition, $\chi^2 (1, N=118) = 5.06, p = .025$, providing support for criterion 3.

**Discussion**

Study 2 meets all three criteria for acquiescence. More than half of participants in the experimental condition (and significantly more than those in the control condition) held the faulty intuitive belief that the money was more likely to be located in their original envelope than in the other two envelopes combined (criterion 1). Additionally, the majority of participants accurately identified that, based on rational analysis, they were more likely to win with two envelopes than with one (criterion 2). Finally, significantly more participants chose the single envelope in the experimental condition than in the control condition. This was true even among participants who correctly identified the rational option (criterion 3). Thus, participants who knew it was irrational to keep their original envelope still did so, even though they were half as likely to win when acquiescing to their intuition.

**Study 3: Blackjack**
In Study 3, we test acquiescence in a real-world domain—blackjack. Given any starting hand (player’s two cards and dealer’s up-card), there is an optimal strategy that offers a player the best odds of winning. These strategies are commonly depicted in a table (Figure 2), and are known as “basic strategy”.

![Blackjack basic strategy table]

*Figure 2: Blackjack basic strategy. Green “H” means hit, and red “S” means stand.*

Participants played ten rounds of blackjack, in which the starting hands were pre-selected. We confirmed in a pretest (detailed below) that for one of these hands, players’ intuitive strategy diverges from basic strategy—that is, players believe they should hit, while the optimal strategy is to stand. We refer to this as the experimental hand.

We hypothesized that when presented with the experimental hand, some proportion of participants would acquiesce to their intuitive beliefs and hit, despite knowing that the optimal

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2 Participants were told that they could only hit or stand, and that the game would not include other strategies (e.g. split, double down, etc.). Therefore, the basic strategy table with which they were provided only depicts these two possibilities.
strategy is to stand. However, this proportion in isolation is not particularly meaningful. Therefore, as in Studies 1 and 2, we included a control condition, in which intuition and rational analysis would lead to the same decision. We used the pretest to find a matched control hand for which the objective difference between hitting and standing was equal to that of our experimental hand, but players’ intuition would match – rather than conflict – with optimal strategy.

**Pretest Methods and Results**

To determine people’s intuitions for different starting hands, we conducted a pretest with 101 participants on Amazon Mechanical Turk (29 female; $M_{age} = 32.18$, $SD = 9.58$). Participants saw nine different blackjack starting hands. For each hand, they were asked to indicate on two separate slider scales how likely they felt they were to win or lose the hand if they hit, and how likely they felt they were to win or lose the hand if they stood. These slider scales ranged from 0 (very likely to lose) to 100 (very likely to win). Then all participants were asked whether they would choose to hit or stand. Participants did not have the chance to play any of these hands.

We hypothesized that participants’ intuitions would be egocentric, meaning that their beliefs would be driven by their own cards, without much consideration for the dealer’s up-card. For instance, we included our eventual experimental hand (player: 13, dealer: 4), because 13 is a relatively low starting hand for the player. If the dealer does not bust (that is, go over 21), the player cannot win with 13. We included our eventual control hand (player: soft 18, dealer: 8), because 18 is a relatively high starting hand for the player (unlike the experimental hand, it is possible for the player to win with 18 even if the dealer does not bust). The results of the pretest can be found in Table 3. Although, objectively, the chances of winning the two hands are improved by nearly the exact same amount (~3%) by standing rather than hitting, participants
had the faulty intuition that they would be more likely to win by hitting on the experimental hand.

<table>
<thead>
<tr>
<th>Hand (player vs. dealer)</th>
<th>Subjective Likelihood Rating: Hit</th>
<th>Subjective Likelihood Rating: Stand</th>
<th>% Choosing Hit</th>
<th>Objective Win Probability Hit</th>
<th>Objective Win Probability Stand</th>
<th>Objective Win Probability Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exp. 13 vs. 4</td>
<td>60.14</td>
<td>29.13</td>
<td>67.3%</td>
<td>36.4%</td>
<td>39.55%</td>
<td>3.15%</td>
</tr>
<tr>
<td>Cont. Soft 18 vs. 8</td>
<td>47.33</td>
<td>58.26</td>
<td>13.9%</td>
<td>52.5%</td>
<td>55.40%</td>
<td>2.90%</td>
</tr>
</tbody>
</table>

Table 3: Blackjack Pretest Results

Methods

One hundred ninety seven participants (62 female; $M_{age} = 33.62$, $SD = 10.88$) completed the study on Amazon Mechanical Turk. We predetermined a sample of 200 to match the MTurk sample from Study 1. Three participants initiated the hit, but failed to complete the study, which we suspect may have been due to using a non-recommended browser. Participants earned a base payment of $0.55, and had an opportunity to earn an additional $0.50 in the blackjack game. The study consisted of two rounds. Round 1 was designed to elicit participants’ intuitions for both the experimental and control hands. Using the same likelihood scales as the pretest, participants were asked how likely they felt they were to win or lose if they hit, and how likely they felt they were to win or lose if they stood, for the two critical hands and three additional hands. The order of these five starting hands was randomly determined. As in the pretest, participants did not have an opportunity to play out the hands in this round.

After Round 1, participants were told that in Round 2, they would need to use the basic strategy table. Participants saw the table, and received the following description:

“In Round 2, you will need to use the table on the right. This table is adapted from what is called "blackjack basic strategy." Given any starting hand (the player's two cards and the dealer's upcard), the table displays the optimal strategy based
on calculated probabilities. The player's total is labeled along the left side of the table, while the dealer's upcard is labeled along the top of the table. Therefore, every possible starting hand is represented by a single cell in the table. A red box with an "S" means that a player should stand, while a green box with an "H" means that a player should hit. The table was created by running computer simulations of millions of blackjack hands. Therefore, a player using reason and rational analysis would follow the table’s advice on every hand if he or she wanted to maximize the chance of winning the hand. Importantly, a player will not win every hand by following the table's advice. Nonetheless, for any given hand, following the table offers the best possible chance of winning.”

All participants were then given a short quiz, in order to confirm that they understood how to use the basic strategy table.

In Round 2, participants were given ten blackjack hands, including the two critical hands. The order of these ten hands was randomized. For each hand, participants were asked to:

1. Click the cell in the table that corresponds with their starting hand and the dealer’s upcard.
2. Respond to the following question: “Based only on reason (or rational analysis), what should you do if you want to maximize your chance of winning this hand?”
3. Play out the hand on the following page.

While the ten starting hands (the players’ two cards and the dealer’s upcard) were pre-selected, all other cards in the game were completely randomized. Participants were told that they would earn an additional $0.05 for each hand that they won, giving real financial stakes to their
decisions. Before starting Round 2, participants read about intuitive and rational decision-making, just as participants did in Studies 1 and 2.

Results

Criterion 1. Judgments in Round 1 replicated the pretest. For the experimental hand, participants felt that they were significantly more likely to win if they hit than if they stood, $t(196) = 6.95$, $p < .0001$. This provides support for criterion 1, as participants demonstrated a faulty intuitive belief. For the control hand, participants felt that they were significantly more likely to win if they stood than if they hit, $t(196) = 4.14$, $p < .0001$.

Criterion 2. In Round 2, when asked to indicate which decision offered the best chance to win based on rational analysis, participants accurately selected “stand” on 373 out of 394 trials (94.7%). For the experimental hand, 187 out of 197 participants (94.9%) answered correctly, and for the control hand, 186 out of 197 participants (94.4%) answered correctly. This provides support for criterion 2.

Criterion 3. Finally, when playing the experimental hand, 77 out of 197 participants (39.1%) chose to hit, thereby going against the optimal strategy. On the control hand, only 30 out of 197 (15.2%) chose to hit. This difference is highly significant, $\chi^2 (1, N=197) = 28.34$, $p < .0001$. Again, we also analyze the decisions of only those participants who accurately identified the optimal strategy. For those participants who responded correctly on the experimental hand, we find that 63 out of 182 participants (34.6%) chose to hit on the experimental hand. For those participants who responded correctly on the control hand, only 22 out of 186 participants (11.2%) chose to hit on the control hand, $\chi^2 (1, 190) = 26.9$, $p < .0001$. This provides strong support for criterion 3.
Because we have a continuous measure of intuition in Study 3, we can test the extent to which participants’ intuitions predicted their decisions. We first calculated an intuitive score for each participant for each hand by subtracting their Round 1 ratings of their likelihood to win if they hit from their Round 1 ratings of their likelihood to win if they stood. We then regressed their decision in Round 2 (hit or stand) on this intuitive score using a binomial logistic regression. For the experimental hand, participants’ intuitions significantly predicted their decisions, \( b = -0.014, z(195) = -3.24, p = .001 \). This result holds if we only include those participants who accurately identified the optimal strategy, \( b = -0.013, z(180) = -2.90, p = .004 \). Thus, the stronger participants’ intuition was that they would win by hitting on 13, the more likely they were to hit, despite having just correctly identified the optimal strategy as standing. Participants’ intuitions did not significantly predict their decisions for the control hand.

**Discussion**

Study 3 provides the clearest evidence of acquiescence. Participants had a faulty intuition, acknowledged that this intuition was incorrect, but acquiesced to this intuition nonetheless. This study extends Studies 1 and 2 as it demonstrates acquiescence in a real-world domain, and offers direct evidence that participants’ intuitions are driving their decisions.

**General Discussion**

Across three studies, we provide the first clear empirical support for acquiescence. Study 1 provides suggestive evidence (fulfilling criteria 1 and 2), while Studies 2 and 3 demonstrate acquiescence by fulfilling all three criteria. Dual-process models of cognition often assume that the correction of errors necessarily follows the detection of errors. The present studies, however, demonstrate that a person can have a faulty intuitive belief about the world, explicitly acknowledge that the belief is in error, but follow the intuition nonetheless. Moreover, in each
study there was an expected cost to following one’s intuition, which means that acquiescence is more than just a “tie-breaker” – people deviated from what they knew was rational even though it incurred a cost.

We found support for the existence of acquiescence by comparing responses in the experimental and control conditions. Can we say something about how common acquiescence is? The data cannot speak to its frequency in everyday life, of course. But, we can ask how often people follow their intuition when it conflicts with what they know to be true. For each study, we restricted our sample to those who experienced the intuitive-deliberative conflict that we tried to create in the experimental condition. Among those who experienced the conflict – they had the faulty intuition and recognized that it was irrational, acquiescence rates ranged from one-third to one-half of participants (see Figure 3). Thus, more than providing evidence for its existence, these data suggest that acquiescence is a fairly typical response when people recognize a conflict between their intuition and rational knowledge.

We see it as a strength that participants made real decisions with real consequences. But, because their choices were likely to be infused with emotion, one might wonder whether emotion is necessary. In a follow-up to Study 2, we had participants imagine that John was playing the envelope game (see Supplementary Materials). Again, we found support for all three criteria. Participants had a faulty intuitive belief about what would happen if John traded his envelope, knew the intuition was faulty, but relied on it in the experimental condition when deciding what John should do. The fact that acquiescence emerged in third-person judgment suggests we are capturing intuitive beliefs about how the world works rather than expressions of emotion (see Risen, 2016a).
Figure 3: Summary of results from the experimental condition
We are currently investigating factors that might influence the likelihood of acquiescence. We have initial evidence from Study 3 that the strength of participants’ intuitive beliefs significantly affects their decision to acquiesce. We hope to unpack the properties that make intuitive beliefs stronger to investigate this further. In addition to the forces that encourage acquiescence, future research should examine factors that allow people to put aside what they know to be true. For instance, we predict that individuals are more likely to acquiesce if it is easy to rationalize a decision, if the costs of ignoring rationality are low, and if they are feeling epistemological modesty for what can be known with certainty.

Recognizing acquiescence might also help guide interventions to improve decision-making. It may seem that the obvious way to avoid irrationality is to teach decision makers the objectively correct answer. However, if a person is already aware that a decision is irrational, then simply teaching him what is rational would be futile. A blackjack player who knows that he is statistically more likely to win by standing but wants to hit nonetheless is unlikely to be swayed by statistical information. We plan to investigate interventions that might be most effective in these situations. One strategy that might be useful, for example, is setting a policy for future decisions rather than making decisions as they arise. We predict that this would both minimize the opportunity to rationalize a decision, and reduce the strength of the intuitive preference. If people follow intuitive beliefs that they explicitly recognize are irrational – as we find in the current studies – then changing beliefs and behavior will require interventions that go beyond helping people detect their errors.
References


Supplemental Material

**Study 2 Follow-up: Envelopes – Self and Other**

**Methods**

Four hundred five participants (176 female; $M_{\text{age}} = 34.27, SD = 10.87$) completed the study for $0.25$ on Amazon Mechanical Turk. We predetermined a sample size of 100 per condition to match Study 1 and received 5 extra hits before the study was taken down. We used a 2 (Condition: experimental vs. control) x 2 (Target: self vs. other) between-subjects design. Participants read a hypothetical scenario that described the envelopes paradigm used in Study 2, and were assigned to either the experimental or control condition. Participants were either asked to imagine that they were playing the game themselves (self condition), or that they were watching someone else – John – play the game (other condition). Participants were asked the same questions about their intuition and rational analysis as those in Study 2. Lastly, participants in the Self condition were asked which envelope they should choose, while participants in the Other condition were asked which envelope John should choose.

**Results**

**Criterion 1.** When participants in the Self condition were asked where they felt the money was most likely to be located based on intuition, 56 out of 100 participants (56%) chose the single envelope in the experimental condition, while only 25 out of 98 (25.5%) chose the single envelope in the control condition, $\chi^2 (1, N=198) = 19.03, p < 0001$. This difference provides support for criterion 1 in the Self condition. Participants had the faulty intuition that trading their envelope would make them more likely to lose.

Did participants who were imagining watching another person play the game share this faulty intuition? In the Other condition, 37 out of 102 participants (36.3%) chose the single
envelope in the experimental condition, while only 21 out of 103 participants (20.4%) chose the single envelope in the control condition, $\chi^2 (1, N=205) = 6.38, p = .012$. This difference provides support for criterion 1 in the Other condition. Participants also had the faulty intuition that if someone else traded his envelope, he would be more likely to lose.

**Criterion 2.** When asked which envelope(s) offered the best chance to win based on rational analysis, 342 out of 405 participants (84.4%) accurately selected the two envelopes. The percentage of participants who responded accurately in each condition can be found in Table 2. Across conditions, we see support for criterion 2 with the majority of people recognizing that the two-envelope option was rationally superior.

<table>
<thead>
<tr>
<th></th>
<th>Self</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Control</strong></td>
<td>85/100 (85%)</td>
<td>96/103 (93.2%)</td>
</tr>
<tr>
<td><strong>Experimental</strong></td>
<td>82/100 (82%)</td>
<td>79/102 (77.5%)</td>
</tr>
</tbody>
</table>

Table 2: Percentage of participants who accurately identified the rational option

**Criterion 3.** Lastly, when participants in the Self condition were asked to make a choice, 41 out of 101 participants (40.6%) chose to keep the single envelope in the experimental condition, while only 19 out of 100 (19%) chose the single envelope in the control condition, $\chi^2 (1, N=201) = 11.19, p = .0008$. For those who accurately identified the rational option, 22 out of 82 participants (26.8%) chose the single envelope in the experimental condition, while only 6 out of 85 participants (7.1%) chose the single envelope in the control condition, $\chi^2 (1, N=167) = 11.69, p = .0006$. This provides support for criterion 3 in the Self condition.

In the Other condition, 35 out of 101 participants (34.7%) chose the single envelope in the experimental condition, while only 9 out of 103 participants (8.7%) chose the single envelope in the control condition, $\chi^2 (1, N=204) = 20.25, p < .0001$. For those who accurately identified
the rational option, 16 out of 79 participants (20.3%) chose the single envelope in the experimental condition, while only 6 out of 96 (6.3%) chose the single envelope in the control condition, $X^2(1, N=175) = 7.73, p = .005$. This provides support for criterion 3 in the Other condition. Participants were more likely to report that John should choose the single envelope in the experimental condition than in the control condition, even though they knew it was not the rational course of action.