The Role of Mechanism in Expectations About the Future: Luck and Skill

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Abstract

Two experiments on decision making explored the role of the mechanism perceived to be generating events. In Experiment 1 participants were told about two identical basketball players who varied in terms of motivation in separate games. Both experienced the same streaks of shot success or failure, and participants predicted the motivated player was more likely to continue the streak in either direction. Predictions of success were related to participants' ratings of which player's shot was more influenced by skill, and perhaps luck. In Experiment 2 we tried to manipulate perceptions of skill and luck by giving participants success at a task over which they either had some or no control. There was evidence that inductions of luck transferred to a new task, but follow-up is needed. Overall our results support the claim that perception of mechanism plays a role in decision making, and the role of skill and luck is a promising domain in which to explore this.

Keywords: Decision making, streaks, induction, luck

Introduction

It is the nature of decision making under uncertainty that people will fill in that uncertainty in different ways, so despite having the same information different people will come to different decisions. Some of this variance is explained by the heuristics and biases that have been identified as influencing decision making (Tversky & Kahneman, 1974), but they leave a large amount of the variance unexplained. An important source of this variance is likely to be how people represent situations, framing effects being a well know illustration of this. Also likely to be an important source of variance are the inductions people make about the mechanisms generating events; and an area of decision making research in which this has become a focus is that into how people respond to streaks (Alter & Oppenheimer, 2006; Ayton & Fischer, 2004; Burns & Corpus, 2004). In this paper we further explore the role of perceptions of mechanism in decision making, and in particular the role of beliefs in luck and skill as sources of individual variation in responses.

Factors affecting streak responses

When a streak occurs within a sequence of independent events people have shown both the gambler's fallacy (Laplace, 1814/1951), and the hot hand (Gillovich, Vallone & Tversky, 1985). Recent research on streaks (Ayton & Fischer, 2004; Burns & Corpus, 2004; Caruso & Epley, 2004) has focused on what conditions or factors determine when people will tend to go with streaks (hot hand, or positive recency) and when they will go against them (gambler's fallacy, or negative recency). Ayton and Fischer suggest that what determines which bias will arise is the absence or presence of human agency in the generating mechanism, for example lottery numbers are said to be the results of inanimate generating mechanisms. Thus basketball shots are the result of human performance leading to positive recency in predictions. Burns and Corpus suggest that people will display the gambler's fallacy when events are perceived to be randomly generated whereas they will follow streaks (i.e., display positive recency) when there is a generating mechanism perceived as non-random. Burns and Corpus (2004) gave participants scenarios which varied in how random outcomes were perceived (participants' ratings of randomness confirmed the pattern), and as hypothesized, scenarios rated as most random by participants led to negative recency in response to streaks whereas scenarios rated as the least random led participants responded with positive recency. However their scenarios rated as most random would be classified as generated by inanimate mechanisms by Ayton and Fischer, but scenarios rated as least random would be classified as examples of human performance. So random and animate may have been confounded.

There are two possible criticisms of Burns and Corpus (2004): 1) they confounded randomness and animacy, and thus cannot distinguish their explanation and Ayton and Fischer's (2004); 2) the scenarios employed are quite different and thus some factor other than randomness may account for the results. Experiment 1 tried to address these criticisms by contrasting two generating mechanisms that were both human, and by using a manipulation that involved a minimal change. This was done by presenting two basketball players who differed only in motivation, which should alter the level of perceived causality behind their actions while holding everything else constant. We predicted that the more motivated player would be expected to be more likely to follow both positive and negative streaks.

Luck and skill as mechanisms

The Beijing Olympics will start at precisely 8:08:08 pm on 8/8/08, because to the Chinese 8 is a lucky number. On 7/7/07 four times the normal number of marriage licences were issued in Las Vegas than normal ("Couples hit Vegas for 7-7-07 weddings," 2007), although how many marriages were diverted to this date rather than encouraged by it is

hard to know (as is how many survived 7 days). Beliefs in luck may be dismissed as mere vestiges of superstition, but these two dates illustrate that they still has the power to affect decisions of both global and personal significance. Luck however should not be confused with chance, these dates and lottery numbers choices (Halpern & Devereaux, 1989) show that lucky numbers are anything but random. In this way luck acts like a causal mechanism, something that might be both used to explain events and to predict future outcomes. Pritchard and Smith (2004) review the limited literature on luck, but their focus is on defining luck, in particular that it involves counterfactual thinking (cf. Teigen, 1995, 1997, 1998). There is little empirical research into how luck influences future decisions.

Cox and Burns (2008) found evidence that beliefs in luck could influence participant's responses to streaks. In their first experiment participants were told that they had had either a streaks of wins or losses on a roulette wheel. Participants were then asked how confident they were that they would win the next spin and asked if they would return (after getting a drink) to the same or a different wheel. To measure their general belief in luck we gave them the BIGL scale of Darke and Freedman (1997a,b). Participants tended to go against the streak in that they were more confident of winning after a streak of losses than of wins, and they were more likely to switch wheels after wins. BIGL scores had no relationship to confidence, but they did with the decision to switch wheels. The effect of streak direction on switching wheels was only present for participants expressing medium to high belief in luck.

In Cox and Burns's (2008) second experiment participants made sequential choices on a simulated roulette wheel and outcomes were manipulated so that they experienced either a streak of four wins or four losses. Participants were again given the BIGL scale which asks about luck in general, however what may matter more is how much luck is perceived as playing a role in a particular task. So we followed Wagenaar and Keren (1988) in asking participants to indicate how much skill, luck, and chance each contributed to wins and losses in roulette by allocating each factor a score between 0-100 with the total of these three scores equalled 100. Wagenaar and Keren identified these three factors as being commonly implicated in people's beliefs about games of chance. We found that participants were more confident of winning the next spin after a streak of wins than losses and there was no impact of streak on switching wheels, indicating that the change from a static (in Experiment 1) to an interactive presentation of streaks made a critical difference. BIGL had no relationship with either measure. Although almost all participants thought luck was involved to some extent in the task, there was no evidence that the degree to which they thought luck was involved affected the impact of streaks. However, about half of the participants thought that skill had no impact at all on the task, and those participants showed no effect of streak on confidence.

Cox and Burns's (2008) results supported the claim that perception of mechanism is important by showing that the direction of a streak effect may depend on the way participants' experience a streak, as static history or through an interactive task. This may be because the method of presentation may change the inductions about mechanism that participants make. In addition there was evidence that beliefs in luck and the degree to which participants think skill plays a role in a specific task may mediate the effects of streaks.

The Current Studies

In Experiment 1 we tried to further explore the influence on streak responses of perception of mechanism, and in particular the role luck and skill play. In Experiment 2 we tried to go beyond measuring beliefs about the role of luck and skill, by inducing these beliefs.

Experiment 1

A basketball scenario was employed with streak of hits and misses for two players. Motivation was hypothesized to be a causal factor that may impact on performance, so we aimed to manipulate level of perceived causality via manipulating motivation. If it is perceived causality which predicts when people will follow streaks we propose the following two hypotheses: 1) if both players experience a streak of successful shots the motivated player should be chosen as the player more likely to hit the next shot compared to the neutral player; 2) if both players experience a streak of missed shots the neutral player should be chosen as the player more likely to hit a shot on their next attempt. For both streak directions it is the motivated player who was expected to continue the streak, whether it is a streak of success or a streak of failure. Unlike previous research investigating streaks type of generating mechanism was held constant while we manipulated the degree to which that mechanism would be seen as causal.

In order to investigate the role of perception of luck and skill as influencing events, participants were also asked for which player did they think their shot outcomes were more influenced by luck, skill and chance.

Method

Participants

Participants were 125 psychology students from the University of Sydney subject pool (mean age 20.29 years [SD = 4.59], 56% female) who received partial course credit. In Australia basketball is a minor sport (i.e., somewhat similar to soccer in the USA) so participants were unlikely to have complex theories about basketball shooting success.

Procedure

Participants read about two players described as having played basketball for the same number of years and having the same shooting percent (60%), and who were about to play in two different games. The *motivated* player's team was said to be playing for a place in the finals, there was a talent scout watching the game, and there was a cash bonus on offer if his team won. The *neutral* player's team has already qualified for the finals, so the game was irrelevant,

and there was no mention of a scout or cash bonus. As a manipulation check participants were asked to identify which player they believed would be more motivated for this game. Participants were also asked to identify which player they believed would score first, and which player would be influenced more by each of the following factors during the game: skill, luck and chance. In addition they were also asked what percentage of each player's shots would be successful during the game.

The computer then presented participants with a page that informed them that both players had experienced a streak of success (hit the last five shots) or that both players had experience a streak of failure (missed last five shots). Participants were then asked who was more likely to score on their next attempt following the streak. They also answered the question "For which of the two players do you think the following factors will play a larger part in the outcome of this shot?" for each of skill, luck and chance.

Results

The manipulation was successful in that 97.6% of participants identified the player in the motivated condition as more motivated, 79.7% believed the motivated player would score first, and they gave him a higher expected success rate of 63.2% (SD = 12.4) verse 58.7% (SD = 11.2), F (1,122) = 9.53, p = .002. However these all seemed to be seen as game specific advantages as there were no significant differences in terms of which players' outcomes were expected to be more influenced by luck, skill or chance.

After being informed of the streak participants were asked to indicate which player was more likely to score on their next attempt following the streak. Participants' responses are displayed in Table 1, and show that the player chosen as more likely to score first was influenced by the streak direction, $\chi^2(1) = 8.56$, $p = .003$. As hypothesized, participants expected the motivated player to be more likely to score following a streak of successful shots (thus more likely to continue the positive streak), but less likely to score next after a streak of misses (and thus continue the negative streak). Given that the motivated player was considered more likely to score absent any streak, it was not surprising that participants thought him more likely to score after a positive streak. Therefore the clearest indicator that participants thought the motivated player more likely to follow streaks was that the majority thought him less likely to break the streak of misses.

After selecting which player was more likely to score next, participants answered which players' next shot outcome would be more influenced by luck, skill and chance. For luck the majority chose the motivated player, but there was no significant difference for chance or skill (see Table 2). Participants' answers to these questions did not vary with streak condition (by Chi-square tests, all $p >$ .05). However which player was predicted to hit the next shot was positively correlated with which player's shot was considered more influenced by skill and negatively correlated with which player was chosen as more influenced by luck (see Table 2). Again these relationships were not moderated by streak direction (by log-linear analysis, all $p >$ .05). However luck and skill answers were negatively correlated (-.50, $p <$ .001), so to remove common variance we did partial correlations. Controlling for luck responses, skill and outcome still correlated (.32, $p <$ .001); but after controlling for skill responses, luck and outcome no longer significantly correlated (-.15, p = .11).

Table 1: Participants' answers to which player they though was more likely to score first following their streaks.

Score first	Streak direction	
	Positive streak (n=59)	Negative streak (n=65)
Motivated player	36	23
Neutral player	23	43

Table 2: Analysis of participants' choices for which player's (motivated or neutral) shot did they think luck, chance and skill played a greater role

	Percentage choosing motivated player as more influenced by factor (test vs 50%)	Correlation between factor and player chosen as more likely to hit next shot
luck	62% (p = .007)	r = -.32, $p <$ .001
chance	58% (p = .073	r = -.07, p = .42
skill	49% (p = .858)	r = .42, $p <$ .001

Discussion

As hypothesized, participants believed that the more motivated player was more likely to continue streaks of events in either direction. Manipulating the level of a causal mechanism, in this case motivation, while holding the type of generating mechanism (human) constant determined which player participants believed would display positive recency.

The distinction proposed by Ayton and Fischer (2004), of human and inanimate generating mechanism, while no doubt often leading to the correct predictions would need augmentation to account for these result. Clearly both mechanisms in this experiment were human; however one was significantly more likely to be predicted to follow streaks than the other. We believe that perceived causality provides a coherent explanation as to why this was found. If we are correct in assuming that people see motivation as making a person's behaviour more meaningful and goal-directed, and thus causal, then perceived causality can explain our results. When the mechanism could be thought causal compared to a random mechanism, participants followed streaks.

Caruso and Epley (2004) propose that the intentionality of the generating agent determines how people respond to streaks. It is possible that level of intentionality was manipulated in this experiment by manipulating motivation. However intentional mechanisms are normally also causal

ones. Therefore predictions that stem from the intentional, non-intentional dichotomy will invariably be in line with predictions drawn from the currently proposed determining factor of perceived causality.

Any effects on who was considered more likely to hit the next shot or who participants thought more influenced by skill or luck was independent of streak direction. Thus such beliefs account for different variance in participants' predictions about success than that accounted for by streaks. There was clear evidence that perceived skill was seen as a predictor of success, but the results for luck are less clear. It could be that the relationship between luck and outcomes is simply a result of the negative contrast participants made between luck and skill.

Experiment 2

So far any suggestion of a role for skill or luck in people's decisions has been correlational, but to draw stronger conclusions we need to be able to manipulate them. In particular, our results regarding the influence of belief in luck have been unclear. This could be because simply asking people to rate "luck" may be a poor way of eliciting responses, both because luck may mean different things to different people and because they may not wish to admit to seeing luck as important. To avoid this problem and to better establish the role of luck we need a way to manipulate perceptions of luck.

Previous attempts to deliberately manipulate beliefs in luck have been problematic (e.g., Drake & Freedman, 1997b). So we exploited the finding that the inductions people may make about a sequence may depend on whether they think they have control (Pritchard & Smith, 2004). If people think they have control (even if they are wrong) then they will tend to attribute good performance to skill, whereas if they have no control they will be more likely to attribute good performance to luck. So to induce a feeling of skill or luck we gave participants a simple form of video golf in which they had to swing a club to putt a ball into the hole. In the *skill* condition they thought they had some control over the club whereas in the *luck* condition they clearly had no control. After experiencing first failure then success, we expected to induce an attribution of success due to skill or luck.

We wanted to see if this induction would affect future decisions, so after completing the golf task we described to participants new tasks and asked them how successful they though they would be at them. Our hypothesis was that skill would be less transferable than luck. People recognize that skill is specific to a task, being well practiced at one task may have little impact on performance in another task. So skill as a mechanism may have little impact on a new task. However luck seems to operate like an unspecific mechanism, lucky numbers are lucky no matter the context. The person experiencing a big stoke of luck may be told to "go buy a lottery ticket" as if their current state of luck can be transferred to a different task, though this affect may only last for a short period of time. So we predicted that participants would be more confident in success on transfer tasks if they were in the luck condition.

Method

Participants

Participants (n = 137) were paid approximately Aus$15 to complete a series of tasks. Participants' mean age was 22.7 years (SD = 5.59) and 68.6% of the participants were female.

Procedure

All information and questions were presented by computer as a series of webpages. All animation was done using the Flash program. We designed a golf putting task in which participants were randomly assigned to one of two versions. In the *skill* version participants were shown a putting green and selected a club hitting strength from 1-4. They then watched the club hit the ball and saw either the ball go in the hole or miss (randomly under- or over-shoot). The *luck* version was identical except that participants only watched the numbers 1-4 flash on the screen as their shot strength was randomly generated by the computer. There were 20 trials and on each trial they saw a different image of a golf putting green. All participants first experienced failure (2 successes in the first 10 trials) then success (8 successes in the last 10 trials).

To check if we had induced a feeling of skill or luck participants were asked to rate the roles of skill, luck and chance in the golf putting game by dividing 100 points between the three factors, as described above for Cox and Burns (2008).

Participants then had described to them a series of five tasks. They were asked to rate their confidence in success for each task, but did not actually participate in any. We did not wish them to experience any success or failure in case that diluted the effect of our induction of skill or luck. Tasks related to golf driving from a tee, basketball shooting (free throws), lottery numbers, reaction times, and a social networking game.

Results

Mean ratings of skill, luck and chance are presented in Table 2. On average participants in the skill condition rated skill as playing a significantly greater role than participants in the luck condition, $F(1,135) = 22.26$, $p < .001$, participants in the luck condition rated chance as playing a significantly greater role than participants in the skill condition, $F(1, 135) = 17.67$, $p < .001$, but there was no significant difference in luck ratings. The correlations between ratings of the roles of skill, luck and chance also varied with conditions (Table 3 and Table 4).

Results for transfer

Table 5 shows the mean confidence in success participants had in each condition for each task. A 2x5 ANOVA found a main effect of task, $F(4,132) = 46.25$, $p < .001$, but no main effect of condition, $F(1,135) = 0.46$, $p = .50$, although there was a significant interaction between task and condition, $F(4,132) = 2.55$, $p = .039$. Table 5 shows that only the

basketball task showed a significant effect, with higher confidence in the luck condition.

Table 2: Mean ratings of skill luck chance in either a game of skill golf or chance golf

	Skill	Luck	Chance
Chance condition	22.32 (30.58)	26.67 (26.11)	51.01 (35.20)
Skill condition	45.24 (26.06)	24.29 (14.99)	30.47 (19.77)

Table 3: Correlations of ratings of skill, luck and chance in game of chance golf for skill condition.

	Skill	Luck	Chance
Skill	-	-.24	-.69**
Luck	-	-	-.54**
Chance	-	-	-

Table 4: Correlations of ratings of skill, luck and chance in game of skill golf for luck condition.

	Skill	Luck	Chance
Skill	-	-.66**	-.82**
Luck	-	-	.11
Chance	-	-	-

Table 5: Means confidence in success for each transfer task for land skill conditions. P-level is result of t-tests between conditions

	Luck condition (n=69)	Skill condition (n=68)	p-level
Driving range	3.80 (0.994)	3.59 (0.981)	.218
Basketball	3.99 (0.978)	3.60 (1.039)	.028
Lottery	3.22 ().783)	3.21 (0.873)	.935
Reaction time	4.30 (.960)	4.49 (0. 889)	.254
Social networking	4.25 (1.063)	4.31 (1.026)	.727

Discussion

Our manipulation appears to have had some impact, but more follow-up work is necessary. There is evidence of an impact on the transfer tasks but why only for the basketball task did participants have higher confidence in the luck condition is unclear. It is possible that it was seen as most similar to the golf putting task both because it is a sport and it involved propelling a ball over a short distance with an expectation of success (which would apply less to driving a golf ball from a tee).

The controllability manipulation was effective at changing the perception to which skill was involved in the golf putting task, but the trade-off seemed to be with chance ratings rather luck ratings. This is evidence against our luck condition being properly named, but if there is a transfer effect then it would be hard to see how beliefs about chance would be the vehicle. However the change between conditions in the pattern of correlations between luck, skill and chance ratings suggest that how people interpret the meaning of luck ratings may vary with context. Perhaps luck is viewed as a causal mechanism in the absence of an alternative explanation for events. In situations where chance has a large role such as our luck condition, luck may be seen as the opposite of chance. Thus chance is a random mechanism while luck may be viewed as a causal mechanism. However when other mechanisms, such as skill, are readily available references to luck may be to indicate the role of chance in influencing performance. Prichard & Smith (2004) also point to evidence that use of the term luck may be somewhat context dependent.

General Discussion

Overall the results add to the claim that people's perceptions of the mechanism underlying streaks are critical to how they react to them. Manipulating how motivated a player was thought to be resulted in participants being more likely to see that player as continuing both a positive streak and a negative streak. So the critical factor was not whether the streak was generated by a person or not. A relatively small tweak to how much the player wanted to score was sufficient to alter whose outcomes were expected to follow the streaks. Presumably this was because the motivated player would be expected to apply more of themselves to producing an outcome, and in that sense they were more causal. In this way the results fit better with Caruso and Epley (2004) emphasis on intentionality as affecting how streaks are responded to than Burns and Corpus (2004) randomness, or Ayton and Fischer's (2004) human performance distinction. However Cox and Burns (2008) suggested that all of these dichotomies may be too simplistic, instead perceiving the mechanism may be better characterized as a process of building a mental model, as Orkarsson (2006) suggested.

If building a mental model of the mechanism behind a streak is critical then our results give some support to the claim that skill and luck are part of this perception, but also point to some unresolved issues. Perceptions of skill in Experiment 1 were important as they were in Cox and Burns (2008), and we seem to have successfully manipulated the perception of skill as being involved in Experiment 2. Our attempt to build on the findings of Cox and Burns that beliefs in luck are important was more equivocal. Our measure of luck did not relate to decisions and whether we successfully induced luck is not entirely clear.

Simply asking participants to rate the role of luck, skill, and chance in a task may not be an effective way to measure how much they perceive luck as involved. The finding in Experiment 2 that the correlations between luck, skill and chance changed drastically between conditions suggests that what the word "luck" means may vary depending on context. Burns and Cox (2008) found that the concept of "randomness" is not unitary, instead it has two largely orthogonal dimensions which bear differing relationships to measures of intelligence, so perhaps luck is also not a unitary concept. BIGL is presented as a unitary scale but it seems to encompass two potentially different concepts, the extent to which someone sees luck as a force in the world, and the extent to which they see themselves as personally lucky. Therefore to more fully examine luck we may need to develop better measures of it.

Although we did not confirm that people saw luck as playing a larger role in our luck condition than in our skill condition, we did find some support for our hypothesis that there would be better transfer from the luck condition than the skill condition. This will require further research, but there will be limitations on the potential of research exploring the role of luck in decision making until reliable ways of manipulating it can be established. That luck plays some role in decision making seems clear, but luck is by its nature transitory and difficult to define, as well as hard to get people to admit to. So studying it is a challenge, but one that may be important to meet because it may be necessary for understanding individual variation in decision making.

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