

## Research Article

# Spontaneous Discounting of Availability in Frequency Judgment Tasks

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**ABSTRACT**—Discounting is a causal-reasoning phenomenon in which increasing confidence in the likelihood of a particular cause decreases confidence in the likelihood of all other causes. This article provides evidence that individuals apply discounting principles to making causal attributions about internal cognitive states. In particular, the three studies reported show that individuals will fail to use the availability heuristic in frequency estimations when salient causal explanations for availability exist. Experiment 1 shows that fame is used as a cue for discounting in estimates of surname frequency. Experiment 2 demonstrates that individuals discount the availability of their own last name. Experiment 3, which used individuals' initials in a letter-frequency estimation task, demonstrates that simple priming of alternative causal models leads to discounting of availability. Discounting of cognitive states can occur spontaneously, even when alternative causal models are never explicitly provided.

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How common is the surname *Bush*? Asked about another name, you might rely on how easily it comes to mind, a trick known as the *availability heuristic* (Tversky & Kahneman, 1973). However, in the case of *Bush*, one reason for its familiarity is its regular presence in the newspaper, referring to the president of the United States. It would thus be wise to rely less on familiarity in judging this name than you would in judging the name of a less prominent person. I propose that people not only spontaneously recognize when familiarity of stimuli comes from sources other than frequency (e.g., fame), but also overcorrect, so that in an effort to be uninfluenced by irrelevant sources of familiarity they end up underestimating the frequency of such stimuli. Thus, you might underestimate the frequency of the name *Bush* by attributing familiarity of the name entirely to the American presidents who bore it.

When explaining events, individuals tend to prefer a single cause to multiple causes (Einhorn & Hogarth, 1986; Kelley, 1973). For example, upon noticing that the lawn is wet, an individual is faced with at least two possible causes: It could have rained, or the sprink-

lers could have turned on. However, once it is clear that it did rain, the individual might consider it less likely that the sprinklers turned on, even though these causes are not mutually exclusive. Although discounting is usually normative, there is substantial evidence that task demands can lead individuals to engage in overdiscounting and subsequently make judgment errors (see Morris & Larrick, 1995).

In addition to influencing causal judgments about external events, discounting principles can be applied to reasoning about internal affective states. Individuals are less likely to attribute their own state of arousal to anger if they are told that they have ingested epinephrine (Schachter & Singer, 1962) and are less likely to attribute their negative mood to melancholy if they are made aware that it is raining (Schwarz & Clore, 1983). The epinephrine pills and unpleasant weather provide alternative causal explanations for these affective states, leading people to discount internal causes and subsequently rate themselves as happier or less angry than they would have otherwise. Further, a prime's effects on judgment disappear when participants are made aware of them and can attribute their emotional state to the prime (Bargh, 1996; Erb, Bioy, & Hilton, 2002).

Research shows that discounting also occurs in reasoning about internal cognitive states. Whittlesea and Williams (1998) investigated perceptual fluency—the idea that people are likely to feel recognition for easily processed items (Johnston, Dark, & Jacoby, 1985). They found that like real words, nonwords that were difficult to process led to few false alarms. Only nonwords that participants found surprisingly easy to process were likely to be erroneously recognized (see also Whittlesea & Williams, 2001a, 2001b). These findings could be described as reflecting discounting: Participants used heuristic judgment only when surprised, and a lack of surprise in the case of real words indicated an obvious alternative causal explanation for fluency.

The availability heuristic (Tversky & Kahneman, 1973), one of the best-known heuristics, relies on the ease of retrieval of items. More easily retrieved items are judged to be more frequent than less easily retrieved items (Tversky & Kahneman, 1973). However, recent studies show that when participants are given an alternative explanation for an item's availability, the effect disappears (Schwarz, 1998; Schwarz et al., 1991; Waenke, Schwarz, & Bless, 1995). Participants who recalled three of their own assertive behaviors—an easy task that makes instances of assertiveness seem highly available—rated

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themselves as highly assertive. However, when told that a room's ambient music aided retrieval, participants associated ease of retrieval with the music and discounted availability, rating themselves as less assertive (Schwarz et al., 1991).

In the study by Schwarz et al. (1991), participants were explicitly provided with an external cause for availability, but here I explore the possibility that discounting occurs when alternative causes are implicitly embedded in the stimuli. Perhaps individuals engage in *spontaneous discounting*; some alternative causal hypotheses for availability might be so salient as to alert people to the potential bias of using availability in judgment. Such circumstances not only might invoke discounting automatically, but also might cause participants to overcorrect for potential bias, leading to bias in the other direction (see Wegener, Petty, & Dunn, 1998).

Some evidence for spontaneous discounting comes from an investigation of the recognition heuristic—the use of recognition as a cue in judgment tasks (Goldstein & Gigerenzer, 1999). Goldstein and Gigerenzer examined Americans' population estimations for the 30 largest German cities by pairing each of the cities with every other city and having participants make forced-choice judgments as to which city in each pair was larger. Recognition was the most accurate predictor of these judgments. However, using different stimuli, I (Oppenheimer, 2003) found that cities recognized for reasons other than size were judged to be smaller than unrecognized cities, even though the reason for recognition was never explicitly mentioned or asked for. Participants appeared to spontaneously discount recognition as a cue when there was a plausible reason for recognition. Although the purpose of the research was not to investigate discounting, the findings imply that individuals may discount even without external cues to do so.

This article is a report of a systematic investigation of spontaneous discounting for availability (Tversky & Kahneman, 1973) in frequency estimation tasks. The three experiments provide a clear demonstration that discounting occurs even when the alternative causes are implicitly embedded within the stimuli.

## EXPERIMENT 1

If one tried to guess surname frequencies in the United States, a useful cue might be availability. After all, particularly familiar surnames are likely to be highly prevalent. However, an alternative reason for availability is that the surname is associated with somebody famous. In fact, when Jacoby, Kelley, Brown, and Jasechko (1989) exposed participants to a list of names and later asked them to make fame judgments, some participants, especially in a divided-attention condition, mistook familiar names for famous names, erroneously attributing the availability of the names to fame instead of prior exposure. Because both fame and frequency lead to availability, if one recognizes a surname as being famous, one might discount the possibility that the surname is available because of prevalence, and consequently judge it to be less frequent than it actually is. Therefore, to investigate the possibility of spontaneous discounting, I examined frequency estimations of famous and nonfamous surnames.

### Method

#### *Participants and Procedure*

Fifty-two Stanford University undergraduates participated to fulfill part of a course requirement. Participation consisted of responding

**TABLE 1**

*Frequency of the Famous and Nonfamous Names Used in Experiment 1*

| Famous name | Ordinal rank | Nonfamous name | Ordinal rank |
|-------------|--------------|----------------|--------------|
| Bush        | 304          | Stevenson      | 345          |
| Nixon       | 661          | Winters        | 667          |
| Clinton     | 1,706        | Woodall        | 1,947        |
| Presley     | 1,825        | Rowell         | 1,856        |
| Cheney      | 2,346        | Callaway       | 2,424        |
| Lennon      | 4,111        | Nealy          | 4,150        |
| Furtado     | 5,747        | Glick          | 5,823        |
| Ashcroft    | 13,593       | Digby          | 13,809       |
| Kravitz     | 14,858       | Banes          | 14,995       |
| Morissette  | 15,734       | Hollen         | 15,798       |

**Note.** Surnames in the same row were paired for the forced-choice task.

to a survey included in a packet of 20 unrelated one-page questionnaires. Packets were distributed in class, and participants were given a week to complete the entire packet.

#### *Design and Stimuli*

Participants made forced-choice judgments of surname frequency in the American population. Each of the 10 pairs of surnames required comparing a surname of a famous individual against a surname with which no obvious famous individual was associated. In each pair, the famous surname was in reality more frequent than the nonfamous surname. Therefore, judging the famous surname to be less frequent than the nonfamous surname would not only go against availability, but would also be incorrect and demonstrate a bias.

To ensure that observed effects were not category-specific, I chose surnames from two categories: five politicians (*Ashcroft, Bush, Cheney, Clinton, and Nixon*) and five musicians (*Furtado, Kravitz, Lennon, Morissette, and Presley*). Additionally, to ensure that observed effects were not attributable to regression to the mean, I selected surnames that varied greatly in their actual frequency in the population, ranging from the 304th most common surname (*Bush*)<sup>1</sup> to the 15,734th most common surname (*Morissette*).<sup>2</sup> The nonfamous surnames were *Digby, Stevenson, Callaway, Woodall, Winters, Glick, Banes, Nealy, Hollen, and Rowell*. Surname frequencies were taken from U.S. Census Bureau (2002) data. The names and frequencies are summarized in Table 1.

Additionally, 10 decoy pairs were created to disguise the experimental hypothesis. These included 5 pairs in which both surnames were famous and 5 pairs in which neither was famous. Instructions were as follows:

For each pair of surnames listed below, please put a check next to the name which you think is more common in the *United States* population. If you aren't sure which name is more common, make your best guess. Please DO NOT look up information while filling out this survey.

The instructions were immediately followed by the surname pairs. The order in which the surnames were presented was counterbalanced, as was the order in which pairs were presented.

<sup>1</sup>The cumulative frequency in the population was 29.63%.

<sup>2</sup>The cumulative frequency in the population was 75.75%.

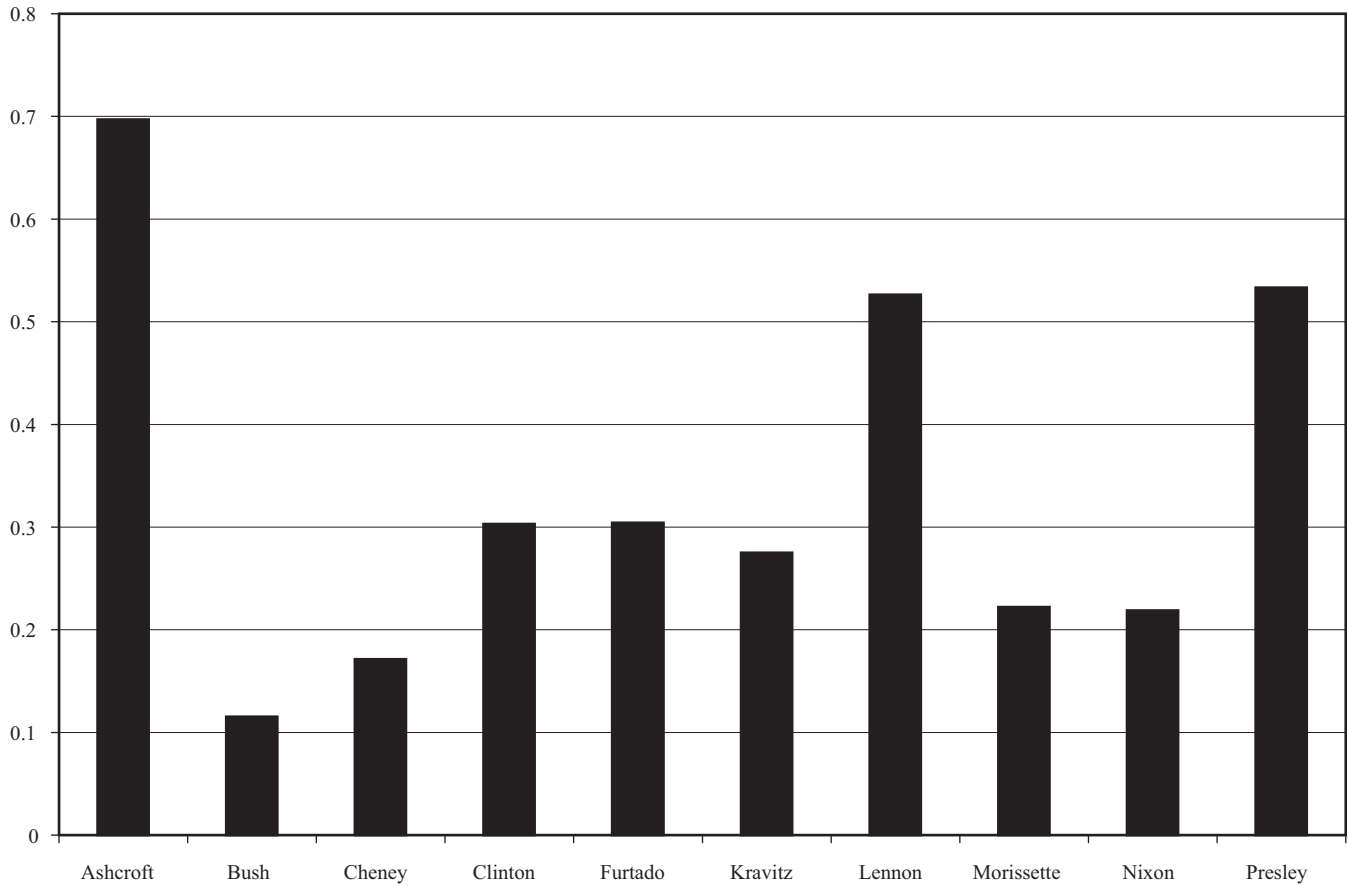


Fig. 1. Results from Experiment 1. The graph shows the proportion of trials on which the participants' frequency judgments were consistent with availability for each famous surname.

On a separate page, participants were given all the surnames used and instructed, "For each surname listed on this page, please list all the individuals that you can think of who have this surname." This manipulation check ensured that participants knew of the famous individuals in the study, and that the nonfamous surnames were not the names of local celebrities.

## Results

If a participant failed to recognize a famous surname or recognized individuals associated with a nonfamous surname, the associated trial was discarded. Furthermore, some participants left items blank. Thus, the total number of participants per trial varied, ranging from 23 in the case of *Furtado*, to 45 in the case of *Morissette*.

On average, participants judged the famous name as more frequent than the nonfamous name only 33.7% of the time, which is significantly less than chance,  $\chi^2(1, N = 350) = 33.32, p < .001$ . Figure 1 summarizes the results for each of the famous surnames.

To eliminate dependencies in the data, I also ran chi-square tests on each surname. Six of the famous surnames were significantly likely to be judged as the less frequent member of the pair ( $p < .05$  for *Bush*, *Cheney*, *Nixon*, *Clinton*, *Morissette*, and *Kravitz*). Judgments for three names were not statistically different from chance (*Furtado*,<sup>3</sup>

*Presley*, and *Lennon*), and one name was significantly likely to be judged as the more frequent member of the pair ( $p < .05$  for *Ashcroft*).

## Discussion

The fact that six famous surnames were significantly likely to be judged as less frequent than the nonfamous surnames with which they were paired provides strong evidence that instead of using availability as a cue for judgment, participants discounted availability. Moreover, judgments about three of the surnames were indistinguishable from chance; although these names were highly available, there was no evidence of the availability heuristic being used. This provides further, albeit weaker, support for the discounting hypothesis. Only the judgments about *Ashcroft* were strongly inconsistent with discounting.

To determine the reason for the discrepancy between *Ashcroft* and the other famous surnames, I conducted informal interviews with some of the participants a week after the surveys were collected. Several participants reported that although they knew of John Ashcroft and could pass the manipulation check, the surname had not stood out to them during the survey. Therefore, I conducted a follow-up study to determine whether simple priming could make *Ashcroft* available enough to lead to discounting.

An article on the topic of gun control (Eggen, 2002) was taken from the *Washington Post* and edited to fit onto a single page. The article opened with the line, "Attorney General John D. Ashcroft announced

<sup>3</sup>The results for *Furtado* approached significance at  $p < .10$ .

plans yesterday to curb gun purchases.” Although the attorney general was referred to several times throughout the article, he was never again mentioned by surname, only by title and affiliation with the Bush administration.

Thirty-three Stanford University undergraduates recruited from dining halls read the article and answered a set of decoy questions about political attitudes intended to allay suspicion about the purpose of the manipulation. They then completed several unrelated distractor tasks. Finally, participants made a forced-choice judgment on the frequency of surnames in the United States. The same *Ashcroft-Digby* pairing used in Experiment 1 was hidden among a set of decoy choices. In postexperimental interviews, none of the participants reported noticing the link between the surname judgment task and the initial newspaper article.

In Experiment 1, 69.7% of the participants judged *Ashcroft* to be more frequent than *Digby*. However, in this follow-up priming condition, only 42.4% believed *Ashcroft* to be more frequent,  $\chi^2(1, N = 66) = 5.41, p < .05$ .

Priming the surname *Ashcroft* made the surname more available, but resulted in a lower frequency estimation. Moreover, even though the surname *Ashcroft* was primed, the alternative cause (fame) was not. That is, it was never made explicit to the participants what alternative causal mechanism existed.

Although participants in the follow-up study were drawn from the same population as those in Experiment 1, it is difficult to draw any strong conclusions when comparing across studies. These results nonetheless suggest that when the fame associated with a surname becomes sufficiently obvious, discounting occurs even when the alternative causal model for availability is not explicitly provided.

## EXPERIMENT 2

Presumably, the discounting demonstrated in Experiment 1 arose from participants attributing the availability of surnames to fame rather than frequency. However, if the results reflect spontaneous discounting, then one would expect any sufficiently salient alternative causal explanation for availability, not just fame, to lead to discounting. One reason (aside from fame or frequency) that a name might be available is that it is one’s own last name. Experiment 2 investigated discounting of availability for participants’ own last names in a frequency estimation task.

### Method

#### *Participants and Procedure*

One hundred sixty Stanford University undergraduates were recruited at resident dining facilities or participated to fulfill part of a course requirement. Participants recruited from the dining halls were not compensated for their participation.

#### *Design and Stimuli*

Each participant judged the frequency of his or her own surname relative to a set of 12 anchor surnames. These anchors were selected such that they formed a series with each name falling 8 percentile points in frequency from the previous name. The surnames were *Smith, Garcia, Ramirez, Snyder, Walton, McKnight, Aaron, Gruber, LeGrand, Mackin, Crafford, and Crupper*.

The surnames were stacked vertically with *Smith* at the top, labeled “most frequent,” and *Crupper* at the bottom, labeled “least frequent.” In between each adjacent set of surnames was an arrow with enough space for participants to write in a surname. Participants were instructed:

The surnames below have been ranked by their frequency of occurrence in the United States population. The top name is the most common, and the bottom name is the least common. Please write your last name on an arrow to indicate where in the ranking you think your last name falls.

Participants in the own-name condition could place their surname into 1 of the 11 percentile categories (between *Smith* and *Garcia* is Category 1, between *Garcia* and *Ramirez* is Category 2, etc.). Participants who placed their surname in a higher percentile category than the one in which it belonged overestimated the name’s frequency, and those who placed it in a lower percentile category than the one in which it belonged underestimated the name’s frequency.

Frequency estimations for a total of 100 surnames were collected. I then created a set of control surveys that yoked control participants to participants in the own-name condition. These surveys were identical to the own-name surveys except that in the instructions the phrase “your last name” was replaced with “the last name *X*” (where *X* represents one of the 100 last names collected from the own-name survey).

### Results

Accurate percentile ratings were determined by looking up surnames in the U.S. Census Bureau (2002) database of last names. Surnames in Category 1 were discarded because it was impossible to overestimate the frequency of such surnames. Likewise, surnames in Category 11 were discarded, as it was impossible to underestimate their frequency. It is important to note that only surnames that actually fell into these categories were discarded; items that were incorrectly judged to fall into either category were retained. The data from 3 participants who did not write down a surname and 2 participants with illegible handwriting were also discarded. In the end, 81 responses in the own-name condition were collected. Sixty participants in the other-name condition were randomly yoked with a surname gathered from the own-name condition.

For each response, a score was calculated by subtracting the actual ranking of the last name from the percentile category of the guess. Thus, positive scores indicate underestimation of frequency (e.g., a subject who guessed Category 10 for a Category 8 surname received a score of 2), and negative scores indicate overestimation of frequency.

The mean score for the own-name condition was 1.8, whereas the mean score for the control condition was  $-0.2, t(58) = 5.8, p < .001$ . Additionally, a one-sample *t* test was run on all 81 of the own-name scores against a null hypothesis of accuracy; this analysis showed that participants significantly underestimated the frequency of their own names,  $t(79) = 6.57, p < .001$ .

### Discussion

Although one’s own surname is likely more available than any other, individuals tend to underestimate the frequency of their surnames. The results cannot be explained as due to people simply being bad at the task, as control participants showed no bias in either direction.

Together with Experiment 1, Experiment 2 provides solid evidence for discounting.

However, an alternative explanation for the findings is that something about the task of surname frequency judgments precludes the use of availability. To refute that possibility, it seemed important to investigate discounting using a different frequency estimation task.

### EXPERIMENT 3

One paradigm for studying discounting of frequency estimations is based on Nuttin's (1987) name-letter effect. Nuttin investigated the mere-exposure effect—that individuals tend to like items to which they have been previously exposed (Zajonc, 1968). Nuttin found that individuals prefer the letters in their own name—especially their initials—to random letters in the alphabet. The mere-exposure interpretation is that people see their own initials more frequently than other letters, which implies that their initials would be more available. Therefore, people should overestimate the frequency of their own initials because of the availability heuristic (Tversky & Kahneman, 1973). However, if it became salient to participants that the reason for the availability of certain letters is that the letters are their own initials, one would expect discounting, and underestimation of the letters' frequency.

#### Method

##### *Participants and Procedure*

Twenty-seven Stanford University undergraduates participated to fulfill part of a course requirement. The procedure for distributing and collecting the questionnaire was the same as in Experiment 1.

##### *Design and Stimuli*

A survey that ostensibly measured attitudes about numerology was created. The own-initials survey read as follows:

Please place your initials in the space provided. Please do not give your full name (in the interest of anonymity), just your initials:

One of the premises of numerology is that your initials have predictive power in regard to your behavior, attitudes, and personality. That is, a numerologist could accurately assess your personality knowing just your initials. Do you believe that your initials have predictive power?

The control condition was similar, but asked for the participants' birthdays instead of their initials.

After participants had given their initials (or birthdays), they were asked to estimate the frequency of letters in typical English text. The exact prompt read as follows:

We are interested in people's estimations of letter frequency in typical English text. To that end, please imagine a typical text of 10,000 letters. Approximately how many times would each of the following letters occur:

A list of the letters in the English language followed, and participants judged the frequency of each letter.

#### Results

Participants were identified by numbers that were linked to their demographic information. Therefore, the human participants coordinator was able to provide the initials of the participants in the birthday condition, while maintaining their anonymity. The data from 1 participant were discarded because of illegible handwriting.

For each letter, the average frequency judgment across the 26 participants was calculated. Each participant's judgment of the frequency of his or her own last initial was then compared with the average for that letter. For example, the judgment of the frequency of the letter *S* by a participant named Smith would be subtracted from the average frequency judgment of *S*. Therefore, positive scores indicate underestimation, and negative scores indicate overestimation.

The mean difference score in the own-initials condition was 115.2, whereas the mean in the birthday condition (control) was  $-51.8$ ,  $t(24) = 3.8$ ,  $p < .001$ . Additionally, the results demonstrated a basic availability effect; a one-sample *t* test on the birthday condition against a null hypothesis of zero (the overall mean estimates for a letter) showed significant overestimation,  $t(12) = -2.3$ ,  $p < .05$ . For a stronger demonstration of discounting, the own-initials condition was also run against a null hypothesis of zero, and significant underestimation was found,  $t(12) = 3.1$ ,  $p < .01$ .

#### Discussion

Participants in the control condition behaved in accordance with the availability heuristic and significantly overestimated the frequency of their own initials. In contrast, participants who were primed with their own initials tended to underestimate the frequency of these letters. The fact that the judgments of the participants in the experimental condition tended to be inconsistent with availability is especially powerful considering that the priming should have increased how available those letters were. However, this result is consistent with spontaneous discounting. Participants had an obvious explanation for why their initials were available, and thus discounted the cue. Note that participants were never explicitly provided a reason for the availability of their initials; merely making evident the fact that certain letters were their initials (in an ostensibly unrelated task) was sufficient to lead to discounting behavior.

### GENERAL DISCUSSION

These three experiments thus show that individuals spontaneously discount the cognitive state of availability in frequency judgments when conspicuous alternative explanations are available. Experiment 1 shows that when an association between a famous person and a surname is sufficiently salient, participants tend to judge less available surnames as more frequent. Experiment 2 shows that individuals tend to underestimate the frequency of their own surnames, despite the fact that their own surnames are highly available. Experiment 3 shows that priming alternative causal attributions to explain the availability of individuals' initials can lead to discounting in a letter-frequency task.

This research has several important implications. First, individuals appear to make causal attributions to explain their own cognitive states, and do so spontaneously. Second, individuals seem to use these attributions in making judgments. As judgments are ubiquitous in psychological tasks, this implies that discounting may be observable

in a variety of mental operations. Indeed, there is some evidence that discounting-like processes occur in memory (Bernstein, Godfrey, & Loftus, 2002; Whittlesea & Williams, 1998), in categorization (Whittlesea & Leboe, 2000), and in inductive reasoning (Collister, 2002).

This research may also shed light on the question of when different heuristics are used. As Kahneman and Tversky (1979) noted, which heuristics are used on a given problem and the order in which they are applied can dramatically influence the outcome of a judgment task. These studies suggest that one of the factors influencing whether an individual applies a particular heuristic may be whether the individual understands the reason for a given cognitive state.

One question that naturally arises is whether discounting occurs at a conscious or nonconscious level. Informal interviews with participants after Experiment 1 indicated that they were consciously aware of discounting for at least some of the famous names. However, conscious awareness of discounting is unlikely to have occurred in Experiment 3, because participants judged all 26 letters of the alphabet and the manipulation was extremely subtle. It seems likely that as the salience of alternative causes increases, people move from not discounting, to nonconsciously discounting, to consciously discounting. However, further research is necessary to determine which circumstances trigger each of these situations.

Although heuristics are often described as simple rules (Hastie & Dawes, 2000) or mental shortcuts (Plous, 1993), this research implies that the implementation of heuristic reasoning may be more complicated than traditionally thought. In any case, the existence of causal explanations of mental states during simple judgments demonstrates how ubiquitous causal reasoning is, and that it is an essential part of how we understand the world.

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