Spring 5-1-2023

An Exploration of the Status Quo Bias in Nonhuman Primates

Maisy D. Englund

Recommended Citation

Englund, Maisy D., "An Exploration of the Status Quo Bias in Nonhuman Primates." Dissertation, Georgia State University, 2023.

doi: https://doi.org/10.57709/35396656

An Exploration of the Status Quo Bias in Nonhuman Primates

by

Maisy D. Englund

Under the Direction of Michael J. Beran, PhD

A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy

in the College of Arts and Sciences

Georgia State University

2023

ABSTRACT

A *status quo bias* is a tendency to resist change and keep things as they are. This bias is robust in humans and likely a byproduct of heuristic decision-making mechanisms, indicating that it may be an evolutionarily-conserved process that is phylogenetically widespread. However, few status quo bias studies have been conducted with nonhuman animals, and the evidence was mixed. Studying this question with animals could help inform welfare decisions for animals directly and it can shed light on the degree to which a status quo bias (as seen in humans) may be a result of human-unique experiences or the consequence of more fundamental decision-making mechanisms. The goal of this study was to explore whether other primates exhibit a preference for the status quo after controlling for reinforcement history, and to explore the relative influence of several different factors that may moderate the status quo bias effect. To test these questions, I conducted two experiments. In Experiment 1, capuchin monkeys and macaques made choices among computerized tasks, where one task was presented as the 'default' option (i.e., it could be played continuously without having to select it from a menu), after forced runs of trials that varied in length and which included trials of either a single task type or a mix of task types. I predicted that the monkeys would demonstrate a general preference for the default task over non-default alternatives, and that this preference would increase in magnitude after longer forced runs of the default task. In Experiment 2, lemurs and tamarins learned that boxes could be opened in two ways (lifting or sliding). I explored whether animals could be influenced to open the box by using one particular mechanism after recent exposure to that mechanism (i.e., establishing it as the 'status quo') while controlling overall reinforcement history for both mechanisms. The results indicated that the animals did not exhibit a status quo bias in these paradigms; other factors such as variety and task preference (E1) and approach angle (E2) had greater influence on animals’ choice behavior than the established status quo.

INDEX WORDS: Status quo bias, Cognitive bias, Choice behavior, Nonhuman primates, Comparative cognition

An Exploration of the Status Quo Bias in Nonhuman Primates

by

Maisy D. Englund

Committee Chair: Michael Beran

Committee: Sarah Barber

Sarah Brosnan

Katherine Cronin

Electronic Version Approved:

Office of Graduate Services

College of Arts and Sciences

Georgia State University

May 2023

ACKNOWLEDGEMENTS

I would like to express my deepest appreciation to the many people who helped me bring this project to completion:

To my advisor, Mike Beran, who has supplied unwavering support throughout my graduate career, and whose love of research and dedication to scientific rigor has always been a source of inspiration. To Katie Cronin, for her kindness and guidance, and for providing me with the wonderful opportunity to conduct research at the Lincoln Park Zoo. And to Sarah Brosnan and Sarah Barber, for their excellent advice and feedback throughout this process.

To my fellow researchers at the LRC – Liz Haseltine, Joey McKeon, Brooke Jackson, and Robert Vera – who graciously lent their time to make program modifications and collect data in my absence. And to the primate care staff at Lincoln Park Zoo, who (literally) crossed trees and waterfalls to bait and place boxes in animal exhibits every day.

To my in-laws, Doug Luke and Susan Englund, my go-to resources for all things graduate school, from emotional support ("Keep hope alive!") to logistical, statistical, and writing advice.

To my mother, Kathy Thurston, and my best friend, Grace McGovern, for always believing in me and offering me love, encouragement, and support, even when they had no earthly idea what I was studying.

And most of all, to my husband Andrew Englund, who has made numerous sacrifices to allow me to pursue this goal – from deferring from law school one year and agreeing to long distance the next, to spending his spring break cleaning my apartment so that I could write, to rearranging his exam schedule so that he would not miss my graduation – you have supported me at every turn and in every way, and I would not be here without you. Thank you.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 UNDERSTANDING CHOICE BEHAVIOR

1.1 The importance of choice

Cognition can be defined in part by the ability to process information and flexibly adapt behavior based on context. Choice behavior – the ability to weigh various options and make an intelligent decision – is a key component of cognition. Making intelligent choices is critical to survival: deciding who is friend and who is foe, which foraging patch to visit to maximize food reward, and when and with whom to mate are all decisions that directly influence an animal's fitness.

There is substantial evidence that animals actively seek out choice, and that the ability to make a choice is inherently rewarding. This is because being able to choose among alternatives instills a sense of control over one's surroundings (Perlmuter & Monty, 1977; Seligman & Maier, 1967) and allows for improved fitness by choosing positive outcomes and avoiding negative outcomes (Leotti et al., 2010). Eliminating all choice leads to learned helplessness, a psychological state in which animals do not even attempt to avoid aversive or painful situations because they have learned that they have no control over their surroundings (e.g., Seligman & Maier, 1967). In contrast, providing more choices increases animals' satisfaction, motivation, and performance, and overall well-being (e.g., Beran et al., 2007; Leotti et al., 2010; Langer & Rodin, 1976; Perlmuter & Monty, 1977; Washburn et al., 1991). In fact, humans and monkeys will sometimes make a choice that they do not prefer simply to keep that option available to them rather than allowing it to disappear entirely (Perdue & Brown, 2018; Shin & Ariely, 2004).

The importance of choice is two-fold: having choice is essential for animals' psychological well-being, and the choices animals make directly influence their fitness. Therefore, the mechanisms by which animals, including humans, make choices is of great interest: how do people and animals decide which alternative is best? How good are they at making the right choice, and why do they ever make a wrong choice? These are questions I will address in this dissertation.

1.2 How do we make decisions?

1.2.1 Homo economicus and expected utility theory

In centuries past, the commonly held belief was that humans make whatever choice is most ‘rational,’ or the decision that best advances their own self-interests. In fact, Aristotle claimed that rational thought is what distinguished humans from other animals (Heath, 2009). Classic economic theory has long relied on this assumption, equating *rational* behavior with *economic* behavior. The concept of *Homo economicus*, or the ‘economic man,’ is one that portrays humans as infinitely rational, possessing the ability to weigh costs and rewards for any given choice set and consistently make the decision that most optimizes their own self-interested pursuits. This supposition of human rationality is the foundation on which most economic theories and assumptions were established.

One such theory is expected utility theory. Expected utility theory was developed to explain economic behavior when a consumer is faced with a risky or uncertain decision (Bernoulli, 1738/1954; reviewed in Wu et al., 2004). “Utility” is the amount of satisfaction that a given option may provide to the decision maker. Expected utility theory states that individuals will always choose the option that will provide the greatest expected utility, or the greatest probability of providing the highest satisfaction. Von Neumann and Morgenstern (1947) formalized expected utility theory, mathematically modeling an individual’s preferences into a ‘utility function.’ The utility function can be derived by plotting the expected utility of consuming a good (where utility is the potential satisfaction multiplied by weighted probability and magnitude) against monetary gain (Figure 1.1). Mathematically modeling these preferences as a utility function necessarily requires that the preferences conform to a set of axiomatic principles: completeness, transitivity, continuity, and independence (von Neumann & Morgenstern, 1947). These axioms essentially require that an individual should be able to rank-order their preferences, and that ranking should remain stable regardless of context or irrelevant factors.

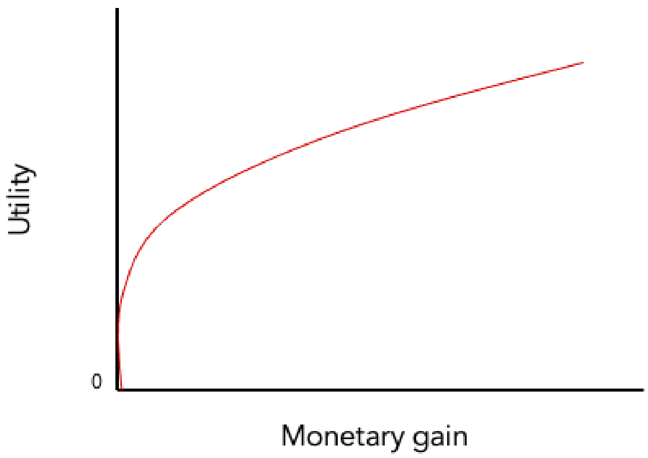


Figure 1.1. Example of a utility function for a risk-averse individual. Adapted from Kristensen et al. (2009).

Importantly, the utility function also reflects the risk attitude of the individual. A person who is risk neutral would have a perfectly linear utility function: they equally prefer a certain outcome to a risky bet of the same averaged value. In other words, a risk neutral person would be indifferent to the choice between receiving $50 with certainty to a risky bet with a 50% chance of receiving $0 and a 50% chance of receiving $100 (averaged utility = $50). However, most people are considered risk averse, and have a concave utility function (Figure 1.1). This is a consequence of diminishing marginal utility, where every subsequent dollar is considered less useful than the last. For example, a person who starts with $10 would find gaining $500 much more useful than would an individual who starts with $100,000; in other words, $500 (or any value) becomes less and less useful as monetary gain increases. Because of diminishing marginal utility, a typical individual is generally assumed to be risk averse: they would prefer a certain outcome of a value that is less than the averaged value of a risky outcome (i.e., $40 with certainty would be preferred to a 50% chance to receive $0 and a 50% chance to receive $100).

Although expected utility theory provided an elegant and simple mathematical model of human decision making, it had one major flaw: it was not very accurate in predicting human behavior in the real world.

1.2.2 The study of cognitive biases

Not long after a formalized theory of expected utility was proposed, evidence began to mount that humans not only failed to meet the assumptions of expected utility theory, but they were prone to making decisions that were *irrational,* or suboptimal. Tversky and Kahneman (1974) provided empirical evidence that instead of relying on logic or some probabilistic estimation of optimal utility, humans often employ mental short cuts, called heuristics, to make decisions. Furthermore, Tversky and Kahneman demonstrated that the use of such heuristics could lead to ‘systematic and severe biases’ in decision making. The first three heuristics identified by Tversky and Kahneman were availability, representativeness, and anchoring and adjustment; these heuristics described some of the ways that humans do not always choose optimally, or rationally, in many decision-making contexts.

The availability heuristic leads individuals to make judgments of probability based on the accessibility of information in the mind (Tversky & Kahneman, 1974). Those items that are more easily accessible (i.e., more easily recalled from memory) are deemed to be more common and likely to occur. This is often a useful and accurate means by which to make judgments because events that occur more frequently will be more easily recalled than events that happen rarely. For instance, an individual may choose to bring a light jacket when traveling by airplane because they can remember many past instances in which they were cold on the flight, and therefore presume it likely to happen again. However, in some cases, events are more easily called to mind not because they occur more frequently in the real world, but because they were recent or salient. In this case, relying on the availability heuristic can lead to irrational biases, because salient events are judged to be more likely than they truly are. A person who has just watched a news story about a plane crash may overestimate the likelihood of planes crashing, causing them to choose to drive to their destination instead of fly -- even though their chance of death is statistically much greater by car than by plane.

The representativeness heuristic leads individuals to make judgments based on how well a particular instance seems to belong to, or is representative of, a larger group (Tversky & Kahneman, 1974). This heuristic is a useful and often accurate means by which to make categorization judgments: we may observe an animal that we have never seen before and judge it to be a type of dog if it has fur and barks, because other members of the group “dog” typically possess these features. However, relying on the representativeness heuristic can lead individuals to ignore base rate probabilities and draw irrational conclusions. For instance, Kahneman and Tversky (1973) asked participants to predict the occupation of a person (e.g., lawyer, engineer) after providing them with a brief description of the person’s personality as well as base rate statistics, or the general proportion of those professions within the larger population. The participants largely ignored the base rate information, instead making predictions based on the similarity of the personality description and the stereotype of each profession.

Anchoring and adjustment is the tendency for individuals to make judgments that are influenced by some starting value (Tversky & Kahneman, 1974). For example, if an individual is planning to buy a new guitar, they may first ask other friends in their band what they paid for their guitars. They will then use those prices to make judgments about the fairness of prices offered in their nearby guitar shop. However, sometimes even arbitrary values can affect a person's judgment – in fact, starting values can influence the decision-maker even when the decision-maker *knows* the initial value is irrelevant to the judgment at hand. Exemplifying this, Tversky and Kahneman (1974) described a study in which individuals first spun a wheel that included numbers 0-100, rigged to land on either 10 or 65, setting an (arbitrary) anchor. Then, the individuals were asked to estimate what percentage of African countries were in the United Nations. Those who spun a higher number on the wheel of fortune guessed larger percentages than those who spun lower numbers (i.e., the median estimate from groups that received a 65 on the wheel of fortune was 45; the median estimate from groups that received 10 on the wheel was 25), even though the participants knew that wheel of fortune provided no relevant information about the number of African countries in the United Nations.

Availability, representativeness, and anchoring were the first three reported examples of 'non-rational' heuristic decision making (Tversky & Kahneman, 1974). Following this foundational article, researchers became fascinated by the field of suboptimal choice behavior. This led to a large amount of research largely focused on other cognitive biases and factors that could lead humans to make illogical decisions. This research demonstrated that humans are rarely able to weigh options completely objectively; rather, past experience, previous choices, and contextual framing, among other factors, can highly influence an individual's judgment.

One example is the mere exposure effect (Zajonc, 1968): simply being exposed to a certain stimulus can lead individuals to judge it more favorably, or higher on a given criteria, than stimuli to which they have not been exposed. This could lead to irrational judgments of value that are based on the familiarity of the alternatives at hand: I have far more exposure to apples than to kumquats, and therefore I may judge apples as being healthier or more nutritious than kumquats, even though I have no real evidence to support this claim. In fact, research by Eidelman and colleagues (2009) demonstrated that individuals need not even be physically exposed to a particular alternative, but merely *know that that alternative exists*, or is the current state of affairs, to judge it more favorably (mere existence bias). Participants were shown pictures of ‘galaxies’ (which were really a randomly generated scatter plot) and told the frequency that the structure of that galaxy occurs in nature (i.e., 40%, 60%, or 80% of galaxies exhibit the same structure). Participants were then asked to judge how aesthetically appealing the galaxies were. There was a positive correlation between the reported frequency that the galaxy appears in nature and aesthetic rating it received (Eidelman et al., 2009). In other words, people inferred goodness from existence: subjective aesthetic appeal has no relevant relationship to the frequency with which a galaxy occurs, and yet individuals’ judgments were nonetheless influenced by this factor. The mere exposure and mere existence biases suggest that sometimes people make choices based on familiarity (recognition/fluency heuristic, Goldstein & Gigerenzer, 2002; Schooler & Hertwig, 2005), or even by immediate evaluations of emotional states, where we judge the value of stimuli by the positive or negative valence it evokes (the affect heuristic, Slovic et al., 2007).

People also tend to prefer alternatives that they have chosen previously, and devalue alternatives that they have previously chosen against, in a bias known as choice-induced preference change (for reviews, see Egan et al., 2010; Harmon-Jones & Mills, 1999). That is, after making a choice between two equally-preferred alternatives, in future choice sets, individuals will devalue (choose against) whichever alternative was left unchosen from the initial choice set (e.g., Brehm, 1956). This is inconsistent with the economic assumption of stable rank-ordered preferences. This tendency likely can be attributed to cognitive dissonance reduction (Festinger, 1957): individuals prefer to be consistent in their choices because it is difficult to maintain two conflicting stances at the same time. Therefore, people make the assumption that an alternative they chose previously is ‘good,’ or aligns with their desires, and an alternative they previously chose *against* is ‘bad,’ so they will continue to behave in a manner that is consistent with this assumption.

Finally, research demonstrates that the *framing* of a problem can affect the decision made: a problem described in one way can lead the decision-maker to make a different choice than the same problem described in different terms, even when the absolute outcome is the same in both cases. For example, an individual may be more likely to undergo a surgery after hearing they have a ‘90% survival rate’ rather than a ‘10% chance of death.’ People are susceptible to framing effects because they tend to make judgments not based on end states but on how things change relative to a reference point (reference dependence), and are more sensitive to potential losses than to potential gains (loss aversion). These specific biases are integral components to Kahneman and Tversky’s establishment of prospect theory (discussed in section 1.4) which replaced expected utility theory as a model of consumer behavior under risk.

Taken together, the research on heuristics and biases clearly illustrates that humans do not always make purely objective decisions based on maximizing utility. Instead, there are a wide range of other influences that can change an individual’s judgment of the available alternatives, leading people to sometimes make inconsistent or suboptimal choices.

1.3 Why do we make these decisions?

Humans violate rational choice theory, demonstrate systematic biases, are subject to framing effects, and choose suboptimally. This begs a particular question: *why* are humans subject to such biases? If we are not optimizing utility according to rational choice theory, then what strategies *do* we use to make decisions? To answer this question, we must turn to evolutionary and comparative literatures.

Humans evolved to make decisions under uncertainty. We must be able to weigh potential costs and benefits about possible future outcomes, the probabilities of which are unknown. Furthermore, we had to adapt to make these sorts of judgments without access to unlimited resources, computational abilities, or time. Because of this, humans evolved not to weigh probabilities and utilities and consider how to maximize the best possible outcome, but to make fast and accurate choices with only limited information available using *heuristics*, or mental short cuts. In other words, it is not to say that humans are irrational; simply that our decisions are constrained by biology, psychology, and the environment, and we make the best choices with the information given and the processing capabilities available to us. In fact, Gigerenzer et al. (1999) contend that defining ‘rationality’ by the ability to calculate probabilities is arbitrary, even counterproductive. Instead, rationality should be measured by organisms’ success in their environment; according to this definition, humans are indeed quite rational.

1.3.1 Bounded and ecological rationality

Simon (1955) was the first to call into question the assumptions of rational choice theory by discussing the role of evolution and adaptation on human decision making. As Simon argued, the ability to weigh all the possible outcomes and their probabilities against one another in a way that is consistent across any context, as required by expected utility theory, is simply too cognitively demanding for any organism to be able to handle. He stated, "…there is a complete lack of evidence that, in actual human choice situations of any complexity, these computations can be, or are in fact, performed." (pg. 104). Instead, Simon contended that we must consider the way in which our own cognitive constraints influence our decision making. That is, humans exhibit *bounded rationality*, or rationality that is limited by our cognitive abilities and the information and time available to us.

Specifically, bounded rationality causes us to use strategies that simplify available information and leave us with satisfactory, if not perfectly optimal, outcomes. For instance, rather than rank ordering every possible outcome with respect to its probability and value, people may simplify the value of any potential outcome to 'positive,' 'negative,' or 'neutral,' and then choose a 'good enough' alternative given the circumstances (i.e., the satisficing heuristic). Additionally, Simon (1955) posited that people generally consider alternatives sequentially rather than all at once and, in some cases, individuals may make a selection simply to learn more about it. This leads to an imperfect procedure of decision making that brings an individual closer and closer to their ultimate goal, or at least satisfies their basic needs, but may not be the most efficient or optimal decision-making procedure according to classic economic theory (Simon, 1955).

Later, Gigerenzer et al. (1999) expanded upon this argument in their development of the theory of *ecological rationality*, maintaining that the bounds of human cognition should not be considered 'constraints,' and that the definition of rationality should not be based on optimization. Rather, rationality should be defined as it relates to success in the real-world, and human cognitive abilities examined based on how they may have evolved to fit their environment. Because these heuristic strategies tend to be faster, and do not rely on logic or statistics, there exists an entrenched assumption in the psychological literature that decisions made via heuristic strategy are inherently less accurate or rational. Gigerenzer and colleagues (1999, 2011) contend that this is a gross misrepresentation of heuristic strategies, which, they argue, are often *more* accurate than other strategies that utilize more predictors and take more time.

In support of this argument, Gigerenzer et al. (1999) pointed out that humans make excellent decisions even when ignoring many possible predictors. For example, an ER doctor who decides, based on three cut-off cues (systolic blood pressure, age, and the presence of sinus tachycardia), whether a heart-attack patient is low or high risk would often be more accurate (and faster to act!) in using this heuristic strategy than if s/he would have used a statistical model that included many more predictors of risk (Breiman et al., 1993, as cited in Gigerenzer et al., 1999).

Gigerenzer and colleagues (1999) argued that heuristics are part of humans' 'adaptive toolbox.' The adaptive toolbox is a collection of cognitive abilities that can be used to solve problems and make various decisions. There are endless heuristic strategies within the toolbox, which can be used in isolation or, more often, in conjunction with one another in order to make reasonable, adaptive decisions. Heuristics are domain-specific to the environment the animal has adapted to, but they are generalizable to a many different decision-making scenarios within that environment (Gigerenzer et al., 1999). Heuristics are therefore widely useful and effective, but, as previously discussed, can sometimes lead to biases or errors in judgment.

In summary, heuristics are one of the main strategies humans use to make judgments. If heuristics are evolved adaptations that are inherent to human decision making, it would follow that young children and non-human animals closely related to humans would employ common heuristic strategies for similar decision scenarios. In support of this idea, there is such evidence from developmental and comparative psychology.

1.3.2 Comparative evidence of cognitive biases

Understanding the mechanisms that underlie human decision making is critical to understand and predict human behavior in real-world situations. Human adults possess a suite of complex cognitive skills, such as highly advanced metacognitive, attentional, computational, and abstraction abilities, that enable us to make thoughtful, complex decisions that would be impossible for any nonhuman animal. For example, the highly-sophisticated economies that include international trade, intergenerational wealth, and large-scale cooperatively planned long-term projects are unlike anything seen in any other species (Addessi et al., 2020). Humans' economic decisions may also be influenced by factors that are unique to humans, such as language, cultural norms, a sophisticated sense of self, market experience, and more. Research with young children and nonhuman animals can shed light on foundational mechanisms of decision making; that is, how decisions can be made without the influence of higher-level cognitive abilities or human-unique factors. After all, young children and nonhuman animals also live in complex and uncertain environments and must be able to adaptive decisions. By studying decisions that are common to human adults, children, and nonhuman animals, we can gain a better understanding of the foundational mechanisms of decision making – the strategies within the 'adaptive toolbox' that are evolutionarily ancient, that emerge early in development, and are utilized by multiple species. There is evidence that young children and nonhuman animals exhibit some of the same cognitive biases as adult humans, suggesting that the heuristic strategies that lead to those biases may be phylogenetically widespread and available for use early in development (see Santos & Laksminarayanan, 2008, for a review). For example, like adults, young children utilize availability, representativeness, and anchoring and adjustment heuristics. Davies and White (1994) gave seven-year-old and ten-year-old children one of two lists of names: one list was comprised of 19 names of famous men and 20 names of less-famous women; the other list was comprised of 19 names of famous women and 20 names of less-famous men, and then asked the children to judge whether the list contained more male or female names. Just like adult participants (Tversky & Kahneman, 1974), young children demonstrated reliance on the availability heuristic: those who heard more-famous male names judged that list to have more male than female names, and the children who heard more-famous female names judged the list to be comprised of more female names.

Likewise, in a study by Jacobs and Potenza (1991), children and adults drew irrational conclusions by relying on the representativeness heuristic. When making judgments about individuals belonging to groups, children of varying ages (six, eight, and eleven years old) and undergraduate students ignored base-rate probabilities and instead relied on personality descriptions to determine group membership. However, in this study and a more recent study that included younger children (Gualtieri & Dineson, 2018), the results demonstrated that use of the representativeness heuristic seemed to increase with age, which suggests that this bias may be sensitive to experience or later-developing cognitive faculties.

Furthermore, children as young as eight are susceptible to anchoring effects. In Smith (1999), children and a control group of adults were asked to guess the number of jelly beans in a jar; half the participants were given a sheet of paper that asked them to guess whether the number of jelly beans was above or below 50, and the other half were asked to guess whether the number was above or below 250. Results demonstrated that all participants, regardless of age, had a significantly lower estimate when in the 50-item anchor condition compared to those in the 250-item anchor condition (Smith, 1999).

Nonhuman primates also display evidence of cognitive biases in certain decision-making contexts (Beran, 2017; Santos & Rosati, 2015). For instance, capuchin monkeys, like humans, exhibit choice-induced preference changes (e.g., Egan et al., 2007). In one study, monkeys were presented with two equally preferred chocolate candies that differed only in color (e.g., a red candy and a blue candy). After making their selection, the monkeys were then forced to choose between a novel, equally preferred chocolate candy (e.g., a yellow candy) and whichever candy was not chosen in the initial choice set. The monkeys tended to choose the novel candy, indicating that they devalued the candy that they had previously chosen against (Egan et al., 2007; see also Egan et al., 2010). West et al. (2010) replicated this finding with several other primate species, but not in other non-primate mammal and bird species, indicating this bias may be unique to primates. Studies have found that non-human primates demonstrate other biases seen in human decision making literature, including *risk*- and/or *ambiguity-aversion*, where individuals prefer certain outcomes over risky or unknowable outcomes (e.g., Rosati & Hare 2011, 2012, 2013); *peak-end effects*, where individuals judge a past event based primarily on how they felt during the event's peak goodness/badness and the event's end (e.g., Blanchard et al., 2014); and *counterfactual reasoning*, where individuals adjust behavior based on outcomes they could have had, had they made a different choice (e.g., Rosati & Hare, 2013).

Positive evidence from cross-cultural comparisons of biases could provide further support for the argument that heuristics are evolutionarily-conserved processes, because we would expect such processes to be universally available regardless of culture. However, studies that investigated cross-cultural comparisons on heuristics and biases are limited. Spina et al. (2009)

found that North Americans and East Asians both relied on the representativeness heuristic to make judgments about cause-and-effect correspondence, but that North Americans exhibited a more extreme form of the representativeness heuristic. Sunstein (2004) proposed that differences in perceptions of risk across groups and cultures could be attributed to the same underlying heuristic (the availability heuristic), such that individuals will judge events as more or less risky based on their experience of what is most vivid and salient in their respective cultures. For example, as a consequence of September 11 terrorist attacks, Americans may have an exaggerated sense of the risk of terrorism, whereas Canadians, who experienced an outbreak of SARS in 2003, may have a more realistic sense of the threat of terrorism but a more exaggerated sense of the threat of SARS. But, Kakinohana et al. (2023) found that susceptibility to the anchoring effect varied considerably by culture and was influenced by cultural values. Additional cross-cultural comparisons would be useful to gain a better understanding of how ‘universal’ these heuristics are in adults, and how culture may affect the degree to which individuals experience these phenomena; but even without such evidence, the animal and developmental comparative literature mostly supports the theory that heuristics are borne out of evolutionarily-conserved decision-making processes.

1.4 Prospect theory

Although much of the research on heuristics and biases came later, by the time Kahneman and Tversky published their highly influential (1979) article, *Prospect theory: An analysis of decision under risk*, there was already considerable evidence that expected utility theory was an insufficient model of human behavior (Wu et al., 2004). In addition to the early data indicating that humans demonstrate systematic biases in their judgments (e.g., Brehm, 1968; Tversky & Kahneman, 1974; Zajonc, 1968), there was also evidence that specific axioms of expected utility theory are routinely violated. For example, expected utility theory did not have an explanation for how an individual could be risk averse (e.g., choose to buy insurance) and risk seeking (e.g., choose to buy a lottery ticket) simultaneously (Edwards, 1954). This would require a utility function that was concave for some wealth levels and convex for other (Friedman & Savage, 1948) or multiple utility functions for each individual. Additionally, the Allais and Ellsberg paradoxes demonstrated that individuals routinely violated the independence axiom, because people fail to ignore probabilistic outcomes that are common to multiple alternatives (Allais, 1953) or disproportionately prefer options that are unambiguous (Ellsberg, 1961).

Expected utility theory assumes that individuals will consistently rank-order their preferences and weigh probability, magnitude, and utility in order to make judgments. But, if this were true, it would not explain the many scenarios in which humans made decisions that violated these assumptions, instead exhibiting biases or making irrational choices. In other words, expected utility theory presented an idealistic, but not realistic, model of how humans behave in the real world. In light of these constraints on expected utility theory, Kahneman and Tversky (1979) developed *prospect theory*: a model that addressees the concerns with the expected utility theory model, and accurately describe consumer choice in real-world contexts.

Prospect theory is based on three core tenets: (1) individuals make judgments relative to a reference point (i.e., the status quo) rather than to end states (*reference dependence*), (2) individuals are risk-seeking for losses and risk-averse for gains (*reflection effect*), and (3) losses are more psychologically impactful than equivalent gains (*loss aversion*). The value function (Figure 1.2) represents these assumptions and replaces the utility function of expected utility theory (Figure 1.1) by plotting preferences as a function of losses and gains relative to a reference point rather than as a function of monetary income. The value function also obeys the rule of diminishing sensitivity: raw differences in value become less important at larger magnitudes; therefore, people are less sensitive to gains and losses as they move further from the reference point. The value function is convex for losses and concave for gains, illustrating the reflection effect, and the value function is steeper in the loss domain than in the gain domain, representing loss aversion. Loss aversion, or the concept that losses loom larger than gains, is a critical component of prospect theory that has sparked some debate in the decades that followed, which I will discuss further in Chapter 2. Loss aversion and reference dependence have been proposed to explain why framing effects (Section 1.2.2) influence decision making. Some biases that are results of framing effects are the *endowment effect* and the *status quo bias;* these biases are two of the most widely studied phenomena that are used as evidence of loss aversion, and are discussed in detail below.

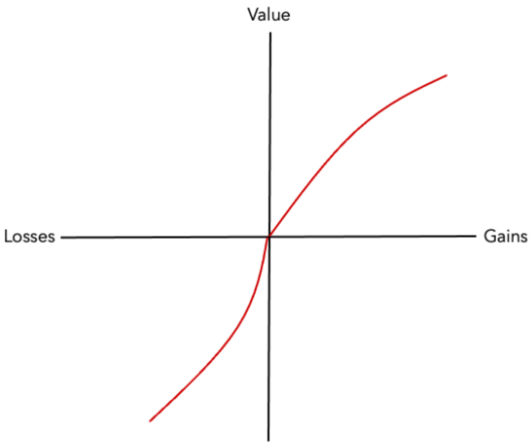


Figure 1.2. A hypothetical value function, as defined by prospect theory. It is (1) defined in terms of losses and gains relative to a reference point; (2) concave for gains and convex for losses; (3) steeper for losses than for gains. Adapted from Kahneman & Tversy (1979).

1.4.1 Endowment effect

Thaler (1980) expanded upon prospect theory, applying it to non-risky (deterministic) contexts and describing it in terms of opportunity versus out-of-pocket costs. Specifically, Thaler

(1980) argued that people overweight out-of-pocket costs compared to opportunity costs, a bias he dubbed the *endowment effect*. He related this phenomenon back to loss aversion: If people view out-of-pocket costs as *losses*, but view opportunity costs as foregone *gains*, according to prospect theory, it would follow that individuals would rather not lose something they already have (out-of-pocket cost) than lose the opportunity to gain something they do not yet possess (opportunity cost).

Some of the early and most well-known empirical evidence of loss aversion and the endowment effect came from experiments conducted by Knetsch and colleagues. One such study included three groups of undergraduate students who experienced different endowment conditions (Knetsch, 1989). Members of one group were initially given a coffee mug and then given the option to either keep their mug or trade it for a chocolate bar. Members of a second group started with the chocolate bar and then given the option to trade it (or not) for a mug. A third group of participants acted as the control group; they were given the choice between the chocolate bar or the mug from the start, with no initial endowment. The control group showed an approximately even divide in preference for the two items: 56% of students chose the mug and 44% of students chose the chocolate bar. Canonical economic theory and Coase theorem of rights and ownership (Coase, 1960) states that initial ownership should not influence the ultimate distribution of the goods in question. Rather, the goods should filter through the population and end up in the hands of those who want them most. Therefore, assuming there is a similar distribution of mug-lovers (people who prefer mugs to chocolate) and chocolate-lovers (people who prefer chocolate to mugs) in the other two groups, if one were to adhere to the assumptions classic economic theory and Coase theorem, one would predict that roughly half of the individuals in the other two conditions would choose to trade, so that all mug-lovers end up with mugs and all chocolate-lovers end up with chocolate. Instead, a robust endowment effect was clear: 89% of the individuals who were initially endowed with mugs chose to keep their mugs, and 90% of those who were initially endowed with chocolate bars chose to keep their chocolate bars (Knetsch, 1989). Knetsch and colleagues attributed these results to loss aversion; that is, once a participant was in possession of the item, they were more averse to the idea of losing or giving up that item than they were attracted to the idea of gaining a different item (Kahneman et al., 1990; Knetsch, 1989).

Another paradigm commonly used to demonstrate the endowment effect investigates the willingness-to-accept versus willingness-to-pay (WTA-WTP) gap, or the difference between the amount individuals report they would be willing to *pay* for an item and the amount individuals report they would be willing to *sell* that item for. In a classic experiment (Kahneman et al., 1990), half of the participants were endowed with a coffee mug (potential 'sellers') and were asked to consider at what price they would willing to sell the mug from a list of prices that ranged from $0 to $9.50, increasing by increments of 50 cents. The other half of the participants were not endowed with a mug (potential 'buyers') and were asked to determine at what price they would be willing to purchase the mug from the same list of prices. According to classic economic theory, people should value the good equally well regardless of whether they are considering gaining it or giving it up, so the price at which individuals were willing to buy or sell the item should be approximately equal (Willig, 1976). Instead, the results of this study revealed that there was a significant gap between sellers' 'Willing to Accept' price (median = $5.75) and buyers' 'Willing to Pay' price (median = $2.25; Kahneman et al., 1990). The authors applied prospect theory to explain this phenomenon: provided that people are loss averse, individuals will consider an item more valuable when they are thinking about losing that item than when they are thinking about gaining that item. Consequently, people should set a higher price to lose (sell) the item than to gain (buy) the item, consistent with the results of this study (Kahneman et al., 1990).

1.4.2 Status quo bias

The endowment effect could be argued to be the result of a larger ‘umbrella’ bias for maintaining the status quo (Gal, 2006). A *status quo bias* is a disproportionate preference for keeping things as they are, either by doing nothing or by maintaining an earlier decision (Samuelson & Zeckhauser, 1988). Exhibiting a status quo bias violates expected utility theory, because it demonstrates instability of rank-ordered preferences: an alternative becomes more preferred simply by occupying a status quo position. However, the status quo bias corresponds with prospect theory and loss aversion: individuals may maintain the status quo because the possible disadvantages of switching loom larger than the possible advantages (Kahneman et al., 1991).

Samuelson and Zeckhauser (1988) presented evidence of this bias and explained its real-world implications through survey data and field studies. They demonstrated that any given alternative was most preferred when it was presented as the status quo, second-most preferred when it was presented as a neutral option, and least preferred whenever it was presented as an alternative to a status quo. For example, a participant was told to consider a situation in which they recently inherited a large sum of money from their uncle. Some participants were then provided with a neutral frame: they are asked to choose from four different portfolios with varying levels of risk and return on an initial investment. In this condition, no alternatives are framed as the status quo alternative. In contrast, other participants were told that this uncle had already invested this money into one specific portfolio (e.g., Portfolio A), and they were then given the choice between keeping the money invested in the existing portfolio or change it to invest in another. In this scenario, Portfolio A was presented as the status quo alternative, and the other portfolios were presented as alternatives to the status quo. Response rates across conditions demonstrated that a portfolio was most frequently chosen when it was presented as the status quo alternative, least likely to be chosen when it was presented as an alternative to the status quo, and portfolios presented in the neutral condition were preferred at levels between the other two conditions. Furthermore, Samuelson and Zeckhauser (1988) demonstrated that the magnitude of the status quo bias increased as a function of the number of alternatives in consideration.

The status quo bias is also largely prevalent in the real world. Neipp and Zeckhauser (1985) demonstrated that Harvard employees exhibit a strong persistence in their health care plans from year to year. Although the employees had the option of changing their health care plan annually, only 3% of Harvard employees chose to switch their plan each year (Neipp & Zeckhauser, 1985). It is possible that this could reflect rational decision-making: people prefer the health care plan they chose originally, and therefore do not switch plans. However, by comparing two groups of Harvard employees, Samuelson and Zeckhauser (1988) demonstrated that this is unlikely to be the case. The first group were employees who were hired and enrolled into a plan in or before the year 1980. These individuals only had four health care plans to choose from, and there was a majority preference for one Blue Cross Blue Shield plan. The second group were employees that were hired in the years that followed, at which point Harvard had incorporated more health care plan options. Samuelson and Zeckhauser (1988) used the second group of employees as an incidental control group and assumed that their preferences represent the putative preferences of all Harvard employees when all health care plan options were available. Their results indicated that new employees were much more likely to enroll in a newer plan, but existing employees continued to enroll in the same plan and did not switch once new plans were offered. For all age groups, existing enrollees enrolled in Blue Cross Blue Shield at two to four times the rate as new enrollees. This suggests that existing enrollees continued to enroll in Blue Cross Blue Shield not because it was the best health plan available, but because it was the status quo.

Since Samuelson and Zeckhauser's (1998) initial experiment, many other studies have demonstrated that a status quo bias has a ubiquitous influence on everyday decision making, leading to important real-world implications. Preferring the status quo can affect us on a personal level and on a society-wide level, and can make us resistant to change, even to our detriment. For example, Hartman et al. (1991) demonstrated that the majority of households reported that they preferred their existing (status quo) electricity provider rather than a different provider, regardless of whether they found their existing provider to be reliable. Furthermore, having a status quo bias can influence our romantic choices (Gunaydin et al., 2018); and it may explain why patients refuse to adhere to medical advice, instead choosing to maintain their normal routines and activities rather than make lifestyle changes that could improve their health (i.e., "patient inertia," Suri et al., 2013). On a society-wide level, having a status quo bias could make us more likely to re-elect an incumbent over another candidate who could be more qualified (Samuelson & Zeckhauser, 1988), cause us to view any changes to the norm as more radical (Keltner & Robinson, 1997; Robinson & Keltner, 1996), slow down the development and passage of new policies (Atkinson, 2011), and otherwise hinder any cultural, social, or scientific progress that inherently includes change. One study demonstrated that the default framing of the option to donate organs or not (i.e., "opt-in" versus "opt-out" policies) profoundly affected individuals' subjective perception of the act on a population level: Germans and Americans (countries with opt-in policies) considered the act of donating organs to be akin to donating half of one's wealth to charity upon death (in terms of effort and self-sacrifice), whereas Austrians (a country with an opt-out policy) ranked the act of organ donation between letting others get ahead in line and volunteering some time to help people living in poverty (Davidai et al., 2012).

In summary, many of the decision scenarios we encounter in day-to day-life inherently include a default option; consequently, status quo biases can lead to pervasive and critical impacts on our lives. Rather than making judgments based on rationalization or optimization, we may often make judgments based on framing. This can sometimes lead to suboptimal decision making, as described above, because people may devalue or ignore a non-status-quo alternative that would otherwise (in a neutral setting) represent their preferred choice.

1.4.3 Evolutionary theory, comparative evidence, and prospect theory

Prospect theory was developed to replace the expected utility theory and provide a more descriptive model of human behavior. However, the key cognitive components of prospect theory are not unique to humans. Indeed, even rats exhibit Allais-like violations of the independence axiom, instead demonstrating a similar "certainty effect" as described in humans (Battalio et al., 1985; Kagel et al., 1990). Furthermore, Rachlin and colleagues (1986) argued that the seemingly cognitive decisions in which humans disregard "end states" when making choices between hypothetical gambles can be likened to the simple behavioral preference in rats, pigeons, and other animals who prefer a smaller reward now over a larger reward at a later time (delay discounting). Research has demonstrated that capuchin monkeys seem to exhibit reference dependence and loss aversion much like humans (Chen et al., 2006; though see Silberberg et al., 2008), and there is evidence that many primate species are susceptible to the endowment effect, at least for food items (e.g., Brosnan et al., 2007). Taken together, comparative evidence indicates that the biases described by prospect theory are not a consequence of a rich sense of self, cultural learning, market experience, or other human-unique factors, but instead are integral components of basic primate (and perhaps mammals more generally) decision-making mechanisms.

McDermott et al. (2008) provided a possible evolutionary explanation for why animals demonstrate prospect-like preferences. First, primates are inherently reference-dependent because they evolved to be more sensitive to change than to stasis: a change in current state of affairs, and specifically changes that may result in potential losses, is more relevant to immediate survival than consideration of ultimate end-states. Reference dependence in primates, at least, may have evolved as a result of social pressures (i.e., comparing what one has to what another has; Brosnan, 2006a, b) or out of a more domain-general mechanism based on attending to and learning from past and present rewards (i.e., comparing the current payoff to a past payoff in a similar context; Chen & Santos, 2006). Furthermore, it follows that animals evolved to be especially sensitive to losses (loss averse) because avoiding potential fitness losses (e.g., eating poison or being attacked by a predator) even once is more critical to survival than achieving most potential fitness gains multiple times (e.g., finding a foraging patch, mating; McDermott et al., 2008).

Chen et al. (2006) was the first study to show evidence of nonhuman primates exhibiting behaviors consistent with prospect theory. Chen and colleagues trained capuchins to make exchanges in a token economy; that is, monkeys learned to trade arbitrary tokens (coin-like disks) with experimenters to receive food rewards. The monkeys first demonstrated behavior consistent with law of demand, such that they adjusted their buying behavior according to price and wealth changes. Then, the experimenters investigated framing effects on capuchin decision making by allowing capuchins to choose with which of two experimenters they wanted to trade, when each experimenter offered different payoffs.

Experiment 1 confirmed that capuchins' choices respected first-order stochastic dominance: the monkeys preferred to exchange with an experimenter that provided an equal chance of a one or two apple slice payoff over the experimenter that provided a sure payoff of one slice of apple. Experiment 2 tested monkeys' reference dependence. Both experimenters provided equal probability (50-50) of a one or two apple slice payoff, but Experimenter 1 started by presenting one apple piece and sometimes adding a second piece, whereas Experimenter 2 started by presenting two apple pieces and sometimes removed one piece. Monkeys demonstrated a preference to trade with Experimenter 1, favoring the alternative that was framed in terms of gains (i.e., a potential for a bonus apple) over a functionally equivalent alternative that was framed in terms of losses (i.e., a potential for an apple 'penalty'). This pattern of behavior is consistent with reference dependence: monkeys did not consider alternatives in terms of final states – 50-50 chance of one or two apple slices – but in terms of changes relative to a reference point (Chen et al., 2006).

Experiment 3 tested whether the capuchins showed evidence of loss aversion. Both experimenters always provided a payoff of one apple slice. However, Experimenter 1 presented one apple slice from the beginning (ultimately exchanging exactly what they displayed), whereas Experimenter 2 initially presented two apple slices, but ultimately exchanged only one apple slice. Although both experimenters provided the same ultimate pay off (one apple slice), capuchins displayed a preference for trading with Experimenter 1 (the constant reward) over Experimenter 2 (the sure loss). In combination with the results from Experiment 2, these data provide support that capuchins are loss averse in both risky and deterministic contexts: they preferred half a chance of a gain over half a chance of a loss, and they preferred receiving exactly what was shown over a sure loss (Chen et al., 2006).

However, Silberberg et al. (2008) questioned the validity of the Chen et al. (2006) results, pointing out that these results violate the reversed-contingency effect. The reversed-contingency effect is a phenomenon that has been well-documented in nonhuman primates such that primates are unable to inhibit their response to reach for a larger amount of food over a smaller amount of food, even if reaching for the smaller amount of food would ultimately reap the greater reward. Yet the monkeys in Chen et al.'s (2006) study demonstrated a preference for the experimenter who presented (and ultimately provided) a single apple over the experimenter who presented two apples (but ultimately provided one apple). Silberberg et al. (2008) proposed that Chen et al.'s (2006) could be potentially be explained instead by a time delay: in the original experiment, the constant reward could presumably be presented by the experimenter immediately, whereas the sure loss would require the experimenter to take the time to remove a food item. Consequently, the monkeys may have preferred the constant alternative not due to loss aversion but because it was delivered more quickly than the sure loss alternative.

Brosnan and colleagues' (2007) study on the endowment effect in chimpanzees provided further, more concrete comparative evidence of loss aversion. Like the Knetsch (1989) mug study, Brosnan et al. (2007) gathered data on the population-level preferences of two food items (a juice popsicle and a PVC pipe filled with peanut butter) and two non-food items (a rope toy and a rubber bone toy). Then, chimpanzees were endowed with one of items and presented with the opportunity to exchange for the other corresponding food or non-food item. Chimpanzees showed an endowment effect for food items but not for non-food items. At the group level, 58% of chimpanzees preferred peanut butter over juice, but after being endowed with peanut butter, 79% of chimpanzees chose to keep the peanut butter rather than exchange it for juice. Similarly, although 42% of chimpanzees preferred juice over peanut butter at a population level, 58% of chimpanzees chose to keep juice when they were endowed with it rather than exchange it for peanut butter. In contrast, chimpanzees preferred to exchange nonfood items rather than keep them. As a group, 74% of chimpanzees preferred the bone and 26% of chimpanzees preferred the rope, but after being endowed with the item, subjects only chose to keep the bone 16% of the time and the rope 10% of the time. Brosnan et al. (2007) suggested that this was because chimpanzees preferred interacting with the experimenters (i.e., by making an exchange) over either of the nonfood items.

Brosnan et al. (2007) contended that this pattern of results suggests that nonhuman primates may exhibit an endowment effect for items that are evolutionarily salient (e.g., food) but not for items that are not evolutionarily salient (e.g., toys). Studies including gorillas (Drayton et al., 2013; Kanngiesser et al., 2011), orangutans (Flemming et al., 2012; Kanngiesser et al., 2011), bonobos and chimpanzees (Kanngiesser et al., 2011), and capuchin monkeys (Lakshminarayanan et al., 2008) produced similar results. Furthermore, humans also showed differential endowment effects across different categories of items. Jaeger et al. (2020) investigated the relationship between evolutionary salience and the endowment effect with human participants: humans exhibited a stronger endowment effect for items that could directly influence their fitness through health or wealth (e.g., free healthcare for life; gold) than for items that were not relevant to their evolutionary fitness (e.g., Styrofoam packing peanuts).

These findings lend themselves to certain adaptive explanations of the endowment effect and loss aversion. Before the existence of fiat currency, abstract rights of ownership, and third-party enforcement of certain trading rules, any sort of exchange of goods would be inherently risky; giving up one item in the hopes of attaining something better could end in the loss of both items (Brosnan & Jones, in press; Jaeger et al., 2020; Jones, 2001). Therefore, animals are predisposed to want to hang on to the items they have – at least when they are relevant to survival – rather than run the risk of losing everything in an exchange.

Although there is considerable evidence pointing to evolutionary foundations of the endowment effect, to date no study has tested whether nonhuman primates demonstrate a status quo bias outside of the endowment effect. This is an important question to address, because the endowment effect and status quo bias have often been attributed to a common source (loss aversion), and the endowment effect has been proposed to be one manifestation of a larger, more general status quo bias (Gal, 2006). Yet, this evidence indicates that nonhuman primates are ‘loss averse’ for food items but not for non-food items, indicating there may not be an underlying, general preference to keep things as they are (i.e., a status quo bias, as seen in humans) but a specific preference to maintain food items already in their physical possession. To further complicate things, other evidence suggests that susceptibility to the endowment effect is a byproduct of market experience rather than a consequence of an innate bias (Apicella et al., 2014), and Gal (2006) has called into question the validity of utilizing loss aversion as the sole explanation for the status quo bias and the endowment effect. Therefore, it is necessary to garner a deeper understanding of the possible moderators and mechanisms of the status quo bias and consider whether it may not be a dissociable construct from the endowment effect.

1.5 Chapter 1 Summary

In the past, research on economic decision making relied on the assumption that humans were rational actors, able to weigh probabilities and utility in order to maximize the ultimate payoff. But then it became increasingly evident that human decisions did not correspond to the predictions made by classic economic models, such as expected utility theory. Instead, humans often rely on heuristics, or mental short cuts, to make quick and relatively accurate decisions with limited information. Heuristics are adaptive, evolutionarily-conserved decision-making strategies that are common to adults, young children, and nonhuman animals.

To replace the canonical economic theory of decision making, Kahneman and Tversky (1974) developed prospect theory. Prospect theory assumes that humans are reference dependent and loss averse. In support of this theory, humans demonstrate evidence of the endowment effect, such that we prefer items we possess over items we might be able to acquire, and the status quo bias, such that we prefer to maintain current states of affairs rather than consider all alternatives equally. Importantly, nonhuman primates also exhibit behaviors that are consistent with prospect theory: there is evidence that capuchins are reference dependent and loss averse, and that chimpanzees and other primates are prone to the endowment effect. This suggests that loss aversion, reference dependence, and the endowment effect evolved as adaptations to an uncertain environment.

Outside of the endowment effect studies, there has not been a direct test of the status quo bias in nonhuman primates, so it is not confirmed whether they may exhibit this effect at a more ubiquitous or universal level as it is seen in humans (although studies on habitual behavior or perseveration, discussed in Chapter 2, could be considered indirect tests of a status quo bias). Moreover, the data indicating that primates exhibit the endowment effect for food items but not for non-food items suggests that this effect is driven by time-shifted rationality (Jones, 2001) and evolutionary salience (Jaeger et al., 2020), but not a more general preference for an existing state (i.e., the status quo bias). Yet, there are several basic mechanisms that would likely independently or collectively lead to a preference for existing states of affairs, such as psychological inertia and fluency effects. Because of this, I thought it likely that primates would exhibit a status quo bias in other contexts than habitual or endowed-food situations, although the degree to which any of the cognitive factors described earlier would influence such a bias remains to be seen. In the next chapter, I discuss the various theories that examine underlying mechanisms of the status quo bias.

2 THE COGNITIVE MECHANISMS BEHIND THE STATUS QUO BIAS

The status quo bias can infiltrate our lives in many capacities, affecting our politics (e.g., Keltner & Robinson, 1997; Robinson & Keltner, 1996; Samuelson & Zeckhauser, 1988), policies (e.g., Atkinson, 2011), and cultural perceptions (e.g., Crandall et al., 2009; Davidai et al., 2012), and influencing our personal preferences in decisions concerning life style (e.g., Hartman et al., 1991; Samuelson & Zeckhauser, 1988), relationships (e.g., Gunaydin et al., 2018), and health (Suri et al., 2013). This means that developing a better understanding of the mechanisms behind this bias is crucial and could potentially inform best practices to reduce the bias in cases where it may produce detrimental consequences.

Historically, the status quo bias has most often been attributed to loss aversion (Kahneman et al., 1991; Mrvka et al., 2019; Samuelson & Zeckhauser, 1988). That is, when options are similarly appealing (i.e., all options have some advantages and some disadvantages), people are more sensitive to the disadvantages of the other options in reference to the status quo option than they are to the potential advantages. However, loss aversion is not the only plausible explanation (Godefroid et al., 2022; Samuelson & Zeckhauser, 1988) nor a wholly sufficient explanation for the status quo bias (Gal & Rucker, 2016). There are other possible mechanisms that can better explain the bias in some contexts, including when options are not framed in terms of losses or gains (Gal, 2006; Samuelson & Zeckhauser, 1988). Furthermore, loss aversion is not as universal or all-encompassing as it is touted to be: in some contexts, losses loom larger than gains, but in other contexts, gains and losses are judged equally or gains loom larger than losses (Gal & Rucker, 2018). There are also some inherent constraints with the loss aversion principle (Gal, 2006; Gal & Rucker, 2018), such that it lacks explanatory power and presents a circuitous definition: the endowment effect and status quo bias are cited as evidence for the existence of loss aversion, but the proposed explanation for those phenomena is that losses loom larger than gains (i.e., loss aversion). Therefore, although loss aversion may sometimes account for the status quo bias (Mrvka et al., 2019; Samuelson & Zeckhauser, 1988; Xiao et al., 2021), it does not apply to every context, and other psychological mechanisms must also be considered. Most likely, there is not one mechanism that can wholly account for the status quo bias, but a range of influences that may moderate the effect at varying degrees.

In their seminal article, Samuelson and Zeckhauser (1988) proposed three categories of explanations for the status quo bias: cognitive misperception, rational decision making, and psychological commitment. Cognitive misperception is a construal of the presented information that leads to a bias toward the status quo, particularly when the status quo is viewed as the reference point. Samuelson and Zeckhauser (1988) lumped loss aversion (weighing losses heavier than gains) and anchoring (judging the optimal value based on the first-presented value) as examples of cognitive misperception. Rational decision making was presented as the second explanatory category: individuals could exhibit a status quo bias because the status quo truly represents the most beneficial option, or because they want to avoid transition costs, uncertainty costs, or switching costs associated with making a change from the status quo. Finally, according to the explanations of the third category (psychological commitment) individuals may prefer to maintain the status quo because they have already invested money, effort, or time, into the default option. Sunk cost and regret avoidance are examples of explanations belonging to this category.

As more explanations of the status quo bias come to light, researchers have continued to lump them into the three original categories proposed by Samuelson and Zeckhauser (e.g., Godefroid et al., 2022). These categories of explanations can be useful, as they demonstrate that a variety of factors, based in different cognitive mechanisms, could evoke a status quo bias. Furthermore, different countermeasures could be employed depending on which descriptive category is identified as the cause for the status quo bias in a given context (Godefroid et al., 2022).

However, there are certain limitations that come along with attempting to group all possible explanations of the status quo bias into these three distinct categories. First, having three categories implies that the underlying explanations in one category are independent and separable from explanations belonging to another category, when in reality many of the examples provided have common underlying mechanisms, overlap with other explanations, or are otherwise difficult to disentangle as constructs. For example, loss aversion (lumped in the cognitive misperception category) has been proposed as one explanation of the sunk cost effect (lumped in the psychological commitment category), because people perceive out-of-pocket costs as *losses* but opportunity costs as *foregone gains* (Thaler 1980). Additionally, regret avoidance (‘psychological commitment;’ Godefroid et al., 2022) and uncertainty costs (‘rational decision making;’ Godefroid et al. 2022) are arguably inextricably linked, and would almost always work in tandem to evoke a status quo bias. Furthermore, some more basic mechanistic explanations (such as reinforcement history or attentional capacities) have rarely been discussed in status quo bias literature, and those mechanisms may underly multiple other explanations belonging in each of the overarching explanation categories. For example, the Law of Effect (Thorndike, 1911) states that we are likely to repeat behaviors for which we have been rewarded in the past; this is both logical (i.e., rational decision making) because there is reason for us to expect this behavior will be rewarded again in the future, but could also become a psychological commitment (i.e., a habit) when we continue to engage in that behavior even when it is no longer rewarding (Dickinson, 1985). And, previous exposure to one option could lead us to prefer that option, perhaps because to a cognitive misperception, such as an existence or exposure bias, where we irrationally perceive existing states of affairs as ‘good;’ or, because that option is familiar and therefore unthreatening (a rational reason to prefer that option); or, because it simply requires fewer cognitive resources to consider than other alternatives (loosely, psychological commitment).

Therefore, in the sections that follow, I discuss many possible evolutionary and mechanistic explanations of the status quo bias, but I do not attempt to group them into the categories of "cognitive misperception,” “rational decision making,” or “psychological commitment.” As Gigerenzer and colleagues (1999) argue, many of the cognitive faculties we possess evolved because they are often ‘rational’ in the context of making decisions in an unpredictable environment, but those same faculties may lead us to exhibit biases, cognitive misperceptions, or psychological commitments in other contexts. Instead, I discuss possible explanations for the status quo bias in a general sense, with an understanding that many explanations may be true at the same time, and that mechanisms may work in tandem in order to evoke a status quo bias, habitual behavior, or other related concepts. However, the ultimate goal of this research project is to tease out the relative degree of influence of some of these possible explanations as they relate to the status quo bias.

2.1 Reinforcement history

Comparative psychologists who study nonhuman animals are often tasked with proving that any cognitive phenomenon demonstrated by their subjects cannot be explained by simple associative learning or reinforcement history (e.g., metacognition; see Smith et al., 2018). The same such requirement is often not present in human literature; sometimes, a higher order cognitive process is simply assumed to explain the results, even when more basic processes could be at work. For example, reinforcement history has never been discussed as a possible mechanism for status quo bias in the human literature. In some studies, there is not much reason to consider the role of reinforcement history, because humans are presented alternatives for which they have had no past experience with, such as hypothetical scenarios. However, in other instances, the status quo option is the option for which people have been reinforced in the past. For example, in Samuelson and Zeckhauser's (1988) seminal article on the status quo bias, they describe a man who brings the sandwich for lunch every day as someone who exhibits a status quo bias. Is that a status quo bias, or is it a habit (see Section 2.1.1)? Are habits and status quo biases the same thing, or should they be categorized differently? I am agnostic as to what the answer is to this question, and as such, I have included below a discussion of the role that reinforcement history can play status-quo-like behavior. However, because we know already that animals will develop habits and demonstrate behavioral perseveration, the experiments in this study aimed to explore the possibility of a status quo bias beyond the influence of reinforcement history.

2.1.1 Habit

People may adhere to the status quo as a result of habitual (automatic) behavior or reinforcement history. Habits are behaviors that are performed repeatedly in the same contexts, to the point that those behaviors are eventually carried out automatically (i.e., without goal-directed intentions) when prompted by contextual cues (Wood & Rünger, 2016). In other words, a habitual behavior is a *default response* in a given context, resulting from learned stimulus-response associations (Dickinson, 1985; Hull, 1943; James, 1890), that can then sometimes be overridden by more goal-driven, intentional behavior.

Thorndike's (1898, 1911) Law of Effect postulates that behaviors that are rewarded are likely to be repeated. Habits are behaviors that start out as intentional and goal-directed (i.e., I turn left at a particular intersection because it is the fastest way home) but then, after multiple repetitions in the same context, become automatic (i.e., I turn left at this intersection because it is what I always do; Miller et al., 2018, 2019; Wood & Rünger, 2016). Contextual cues eventually activate the habitual response, and individuals can then carry out that response without explicitly deciding to do so (Evans & Stanovich, 2013; Wood & Rünger, 2016). This can lead to "habit slips," where individuals carry out a habitual behavior unintentionally, especially when attention was directed elsewhere or there is an increased demand on cognitive resources (de Wit et al., 2014; Reason, 1979; Ruh et al., 2010). Indeed, animal research has demonstrated that habitual (overtrained) behavior is performed even when the relevant action-reward contingencies have changed or when the behavior leads to an outcome that is no longer desirable (Dickinson, 1985).

Importantly, much of our daily activities and choices may be driven, at least in part, by habit. In a self-report diary study in which participants described their hourly behaviors and thoughts, Wood et al. (2002) found that 43% of actions were performed almost daily and in the same location, and that individuals' thoughts while performing those actions were often unrelated to the actions themselves (indicating greater automaticity of those behaviors), whereas actions performed less often or in more variable contexts were more often accompanied by thoughts directly related to those actions (indicating greater cognitive control over nonhabitual behavior).

Furthermore, habits can influence judgment and decision-making contexts that are one step removed from the action itself. Aarts et al. (1997) discovered that, when engaging in a judgment task involving modes of transportation, participants who had stronger habits to ride a bike or drive their car biased the searches toward their habitual choice and utilized less of the available information to make judgments than those with weaker habits. Similarly, after forcing individuals to establish a routine in a computer-controlled microworld, Betsch et al. (2001) found that individuals then maintained their routine despite being exposed to information that suggested deviating from the routine would be beneficial. Furthermore, participants with strong established routines sought out information that favored maintaining similar routines, and avoided unfavorable information (Betsch et al., 2001). Put another way, individuals preferred to maintain the status quo, or their existing personal traditions, because they wished to preserve their established habits and routines.

2.1.2 Behavioral inflexibility

Research on behavioral perseveration and cognitive set flexibility provides further evidence that animals, including humans, tend to get ‘stuck in their ways,’ often failing to relinquish or modify inefficient behaviors, even after learning about alternative, more productive methods. Although humans (e.g., Diamond & Kirkham, 2005; German & Barrett, 2005; Gopnik et al., 2015; Pope et al., 2015, as cited in Davis et al., 2019), and other animals (e.g., Gruber, 2016; Hrubesch et al., 2009; Marshall-Pescini & Whiten, 2008; Vale et al., 2017) demonstrate perseveration, humans and animals tend to show differences in their flexibility to change their behaviors. Humans have a greater tendency to change their behavior to conform to norms of the group (e.g., Asch, 1956; Bond & Smith, 1996), and are more likely to develop cumulative culture (i.e., the ability to continuously improve and build upon efficient cultural behaviors; Basalla, 1988; Lehman, 1947; see Dean et al., 2014, for a review) than nonhuman animals, who are more likely to exhibit behavioral perseveration (ignoring the methods used by other members and continuing to use their learned strategy; Dean et al, 2014; Marshall-Pescini & Whiten, 2008; Whiten et al., 2009; Vale et al., 2017; but see Davis et al., 2016; Lehner et al., 2011; Watson et al., 2018). Behavioral perseveration is a consequence of associative learning and procedural memory, and the behavioral flexibility required to switch to cultural norm requires higher-order cognitive processing such as behavioral inhibition and working memory (Davis et al., 2019), which could explain why humans may be more likely to socially learn more efficient methods.

In other words, research on behavioral perseveration presents two conflicting status quos: the one that is established by cultural norms and one that is established through reinforcement history. Humans may be more likely to be influenced by a cultural status quo whereas animals may be more likely to be influenced by a ‘learned’ status quo. However, humans are more prone to a cognitive set bias than nonhuman primates, such that when the social-learning element is removed, after learning a certain ‘rule’ or strategy to solve a task, humans are less likely to be able to flexibly adapt and use a different (shortcut) strategy to solve a task (e.g., Luchins, 1942) compared to other primates (Pope et al., 2015, 2020; Watzek et al., 2019). This could be because language enables humans to more firmly encode the initial rule and this makes them less likely to switch to a different strategy later on (Watzek et al., 2019). Together, these results suggest that human-unique factors (language, complex culture) can moderate the degree to which humans, at least, are susceptible to a learned (reinforced) status quo.

In summary, habitual behaviors are, by definition, behaviors that maintain the status quo. However, a status quo bias may not always be a result of habit or reinforcement history, and can still be influenced by other cognitive factors, such as those described in this chapter. Many of the studies on the status quo bias in humans involve one-off questionnaires (e.g., hypothetical investment opportunities) where the influence of previous experience is minimized; although reinforcement history cannot be ruled out entirely, framing effects and related cognitive factors may be more likely to influence judgments in such instances. Additionally, it is possible that a behavior that was performed recently (thereby becoming a status quo alternative) could be preferred even if that particular behavior has not been reinforced more than another, equally possible behavior, or is not yet habitual (i.e., automatic). This study will explore whether or not a status quo bias emerges after an animal has recently engaged in a certain behavior, even when that behavior has been rewarded in equal magnitude to another possible behavior.

2.2 Cognitive fluency

The status quo bias has been attributed to easier or faster processing of the status quo alternative, giving it a ‘psychological advantage’ over other alternatives (Eidelman & Crandall, 2009). One reason for this is that people inherently have limits to their attentional abilities. When choosing from a choice set that is quite large or complicated, individuals tend to focus their attention on a subset of available options (Dean et al., 2017; Masatlioglu & Ok, 2014) The status quo option will necessarily always receive attention, even if it may not have in choice sets where it is not presented as the status quo. Moreover, due to these attentional limits, some alternatives may be ignored or ruled out, but the status quo will always remain in consideration (Dean et al., 2017).

Similarly, the status quo alternative will be more easily processed because it is more available and accessible: it will automatically receive attention even when other options may not (Dean et al., 2017; Masatlioglu & Ok, 2014), individuals will have more exposure and experience with the status quo option, and it will be more ubiquitous than other alternatives (Eidelman & Crandall, 2009). Furthermore, primacy effects may lead us to focus more and give more weight to the option considered first (the status quo alternative); blocking effects may cause the existence of the status quo to inhibit learning of other options; and anchoring effects and reference-dependence would lead us to judge all other alternatives based on their change from the status quo (Eidelman & Crandall, 2009; Samuelson & Zeckhauser, 1988). These factors provide a psychological advantage to the status quo alternative and place all other alternatives at a disadvantage.

In addition to increased fluency of the status quo over other alternatives, individuals are also more likely to judge the status quo alternative more favorably, making it easier to rationalize their choice. Research on the mere-exposure effect and the recognition heuristic informs us that we judge familiar items more favorably than unfamiliar or less-familiar items, even without any reinforcement for doing so (Gigerenzer & Gaissmaier, 2011; Goldstein & Gigerenzer, 2002; Schooler & Hertwig, 2005; Zajonc, 1968). As such, the more we are exposed to a particular option, the more we will like that option. Since we are more likely to have greater exposure to the status quo alternative, it follows that we will also judge it more favorably than other alternatives.

Similarly, we tend to infer goodness from existence (Eidelman et al., 2009). In other words, even without ever having been physically exposed to something, simply knowing it is the existing or long-standing state of things leads people to judge an option more favorably

(Eidelman et al., 2009). For example, participants were told that either 32 or 38 credit hours were the standard requirement to graduate within a major, but that this requirement may be changing (to the other alternative) in the future. Participants rated the initial credit hour value as more “good,” “right,” and “the way things ought to be” compared to whichever option was presented as the change (Eidelman et al., 2009). Furthermore, the longer an option has held the status quo position, the higher its perceived value (Eidelman et al., 2010). For example, individuals judged oak trees to be more aesthetically pleasing the longer the tree was said to exist (either 500, 1500, or 4500 years), and rated sodas and chocolates as better-tasting the longer they were reported to have been on the market (Eidelman et al., 2009, 2010). Because the status quo is the existing state of affairs, we are likely to judge it more favorably than other options by nature.

A study by Fleming et al. (2010) demonstrated that the neural activation patterns that were involved in rejecting the status quo resembled the neural patterns exhibited when an individual is actively suppressing a response (i.e., via behavioral inhibition). The study looked at individuals’ tendency to judge a virtual tennis ball as ‘in’ or ‘out’ of bounds, when one of the calls (‘in’ or ‘out’) was framed as the default and the other as a rejection of the default. To make a call, individuals either continued to depress a button (the default option) or had to release the button to switch to a different key to reject the default. Individuals made the in/out judgments while in an fMRI machine; decision difficulty was manipulated by how near the ball fell to the boundary line. The results indicated that people exhibited a greater status quo bias when decisions were difficult compared to when they were easy. Importantly, Fleming et al. (2010) investigated the neural underpinnings of this effect and found that rejecting the status quo on difficult trials involved greater activity in the subthalamic nucleus and the right inferior frontal cortex. These areas are involved in response inhibition and controlled switching behavior, suggesting that rejecting the default requires increased cognitive control, particularly when the decision is difficult to judge.

Taken together, these data suggest that we process the status quo alternative more fluently and more favorably than other alternatives, such that maintaining the status quo is generally an automatic process (Eidelman & Crandall, 2009). In contrast, selecting a non-status-quo alternative requires greater attention, effort, and cognitive control. Larger choice sets, more difficult decisions, and concurrent cognitive loads all increase an individual’s tendency to exhibit a status quo bias (Dean et al., 2017; Eidelman & Crandall, 2009; Fleming et al., 2010; Samuelson & Zeckhauser, 1988). For these reasons, individuals may generally choose to maintain the status quo, unless they are sufficiently motivated and have enough available cognitive resources to seriously consider other alternatives.

2.3 Cost of change

Individuals also may maintain the status quo because the status quo is known to be an acceptable option, and other alternatives may be unfamiliar or risky. In a replication of the Samuelson and Zeckhauser (1988) status quo experiments, Xiao et al. (2021) found that individuals demonstrated differing degrees of status quo biases depending on the scenarios at hand. The scenarios that included greater uncertainty and larger potential costs of change (e.g., deciding the budget allocation for public programs or choosing between job offers) led to a greater status quo bias than a scenario that presented certain alternatives with low costs associated with making a change (e.g., choosing the color of a wagon for purchase). However, this pattern of results may also be attributable to other factors that differed between scenarios, such as disclosed longevity of options, the influence of participants’ prior preferences, and the compelled or autonomous nature of participants’ choices (Xiao et al., 2021). Similarly, Ashby and Teodorescu (2019) found that people were more likely to repeatedly make the same choice (i.e., choice inertia) when there was a cost associated with switching, including when the initial choice made was an inferior alternative to the choice they could switch into.

Several factors that influence people to fear or avoid change are likely evolved traits. For example, neophobia, or fear of novel stimuli, can protect animals from danger: by sticking to what they know, animals can avoid unfamiliar foods that may be poisonous and evade predators that may be hiding in yet-unexplored terrains (Crane et al., 2020). Similarly, humans and other animals tend to be risk-averse, such that they prefer fixed, sure options over options that are not certain. This is likely an evolved trait, as well: evolutionarily-relevant, high-risk/high-reward events are relatively rare, and the costs associated with taking a risks may have often outweighed the potential benefits that could be gained (Hintze et al., 2015). Additionally, weighing all possible outcomes may be very taxing or even impossible (Gigerenzer et al., 1999) or waste resources such as time, effort, and money (Ashbey & Teodorescu, 2019), so it can be more efficient to use a cut-off strategy once a good-enough option is found (Ashby & Teodorescu, 2019; Simons, 1955). Finally, individuals wish to avoid making decisions they will regret, and people tend to imagine greater regret for consequences that may result from action taken compared to consequences that may occur without any action taken on the part of the individual (Kahneman & Tversky, 1982).

This general fear of the unknown or risky outcomes may influence individuals to exhibit a status quo bias. The status quo bias is often already familiar, and maintaining the status quo generally leads to a certain outcome with predictable costs. Therefore, people may choose to ‘stay the course’ to avoid the risks associated with making a change. However, it is important to note that there is evidence that individuals still demonstrate a status quo bias even when transaction costs are minimized and the element of risk is removed (e.g., Samuelson & Zeckhauser, 1988; Thaler, 1980).

2.4 Inertia and inaction biases

Often, maintaining the status quo is a result of inaction, whereas changing from the status quo requires action. Therefore, a preference for inaction can reinforce a status quo bias. Correspondingly, evidence indicates that people would often prefer to do nothing rather than do something, often referred to as an omission bias (Ritov & Baron, 1992). In fact, just as taking prior action increases the likelihood individuals will take further action in the future (i.e., the sunk cost effect, Arkes & Bloomer, 1985), prior *inaction* similarly stimulates individuals to continue *not* to act, a phenomenon known as inaction inertia (Tykocinski et al., 1995). This failure to act has often been attributed to anticipatory regret, or cost of change (e.g., Anderson, 2003). However, research has demonstrated that people will fail to act even when transition costs and risk are eliminated, and even when there were higher costs associated with inaction. For example, Suri et al. (2013) demonstrated that participants often did not press a button that would have reduced their probability of receiving an electric shock or the time spent waiting to potentially receive the shock (Suri et al., 2013). And, older and younger adults often chose to do nothing and view lower-valence images than press a key on a keyboard to view higher-valence images (Barber et al., 2018).

Relatedly, Gal (2006) proposed that a status quo bias is driven by what he terms *psychological inertia*. Gal's psychological inertia theory of the status quo bias relies on the assumptions that (1) motives drive behaviors and (2) people do not have clearly defined preferences, but instead have 'fuzzy,' or unclear, preferences. That is, people do not experience a continuum of preference for item A to preference for item B with a clear and precise line dividing where one would become more preferred than the other; rather, a preference for A may exist on one end of the spectrum, with a lot of fuzzy uncertainty in the middle area, and then a preference for B exists at the other end of the spectrum. As a result of these ill-defined preferences, if one of those alternatives is then presented as the status quo, individuals will simply stick with that status quo option because they are not sufficiently motivated to actively change to a different alternative (Gal, 2006). This is why, Gal contends, if a person is indifferent between options A and B, they will not suddenly prefer A plus one penny over option B. In other words, even when costs of change are minimal, or at least when the costs are certain and known, people would still not experience any motivation to make a change when the alternatives in question are ambiguous or similarly preferable (Gal, 2006).

Gal (2006) empirically demonstrated this by showing that people will generally choose to maintain a coin they already own rather than exchange the coin for one that was minted in a different state. In this instance, the status quo was maintained even when there was virtually no risk or transition costs associated with making a change. Importantly, this finding cannot be attributed to loss aversion, unlike similar findings in endowment effect studies, because the loss aversion principle assumes that an exchange of identical items would not be perceived in terms of a loss/gain trade off (Gal, 2006; Novemsky & Kahneman, 2005). Rather, Gal contends that individuals maintain the status quo in this instance, because individuals' preference for one coin or the other is not strong enough to motivate any deviation from the status quo.

Gal (2006) applies this theory to classic examples of status quo bias, such as the endowment effect WTA-WTP gap and the risky bet premium. Gal proposed that the WTA-WTP gap actually represents the range of our fuzzy preferences: when an individual does not already own something, they would not feel particularly motivated to spend more than the lower boundary of their fuzzy indifference range (WTP); however, when an individual does already own something, they would not feel particularly motivated to give up that item for less than the highest boundary of their fuzzy indifference range. Similarly, the risky bet premium (in which people demand a premium over the expected value to accept a bet), which has generally been attributed to loss aversion (people demand a premium because the potential loss looms larger than the potential gain for taking the bet), could also be reconceived as a tradeoff between status quo (not taking the bet) and change (taking the bet). Gal (2006) suggested that people demand a premium because, as a result of experiencing fuzzy preferences, they would otherwise be unmotivated to change from the status quo. Gal (2006) provided evidence for this claim by demonstrating that when a status quo is removed (i.e., by forcing individuals to allocate money toward *either* a safe bet or a risky bet, eliminating the option to do nothing) people were more likely to take the risky bet than when the status quo existed (i.e., by asking only what amount of money they would allocate toward taking a risky bet).

In summary, omission biases, inaction inertia, and psychological inertia are closely related constructs that describe why individuals may fail to act and maintain the status quo. An omission bias (Ritov & Baron, 1992) is a general descriptive construct that describes situations in which individuals to do nothing when faced with a choice and could be a consequence of anticipatory regret or decision difficulty (Anderson, 2003), or perhaps other possible factors including inaction inertia and psychological inertia. Inaction inertia (Tykocinski et al., 1995) describes situations in which individuals who have previously foregone an opportunity to act fail to act in the future. Psychological inertia proposes that a failure to make a change is a result of ill-defined preferences between options and insufficient motivation. The Suri et al. (2013) study, which found that individuals failed to press a button to reduce the possibility of electric shock, may be explained by inaction inertia, as there was evidence that forcing early button presses increased later likelihood of button pressing; but these results cannot be explained by psychological inertia, because there was a clear disparity in the desirability of the options (a higher or lower likelihood of being shocked).

Some evidence has demonstrated that omission biases and inaction inertia are independent and separable constructs from the status quo bias (e.g., Baron & Ritov, 1994; Schweitzer, 1994), and therefore should be discussed separately (Feldman et al., 2020; Xiao et al., 2021). However, these biases are often compounded in real-world decision scenarios, and may be driven by some of the same underlying causes (Anderson, 2003). Some researchers have also contended that psychological inertia is an insufficient explanation for the status quo bias (e.g., Mrvka et al., 2020). This study aims to further explore the role of psychological inertia on the status quo bias.

2.5 Cognitive dissonance

Cognitive dissonance theory states that people are motivated to possess consistent and harmonious attitudes and beliefs (Festinger, 1957). In other words, people find it unpleasurable to act in a way that is inconsistent with their beliefs, and therefore they adjust their attitudes or behaviors to reduce such cognitive dissonance. In the classic study of this phenomenon, participants were required to engage in a series of boring and tedious tasks (Festinger & Carlsmith, 1959). Next, the participants were offered either $1 or $20 to convince another individual that the task was actually fun to perform. Finally, the participants were asked to evaluate the task: the results showed that those who were paid $1 ultimately reported much more enjoyment of the experiment than those paid $20. Festinger and Carlsmith (1959) attributed this finding to cognitive dissonance reduction: those who were paid $20 were essentially provided a justification for lying, permitting individuals to rationalize why they would say they liked a task even when they did not (i.e., they were paid sufficiently well to do it) and eliminating any cognitive dissonance. However, a $1 payment was not a sufficient incentive to justify lying; therefore, individuals had to rationalize this behavior by adjusting their attitudes, ultimately forcing themselves to believe the tasks were more enjoyable than they truly were (Festinger & Carlsmith, 1959).

Choice-induced preference changes have been attributed to cognitive dissonance theory. That is, individuals update their current preferences to reflect their past decisions, either by further devaluing items they have previously chosen against or increasing their favor for items they had chosen before (e.g., Brehm, 1956; Egan et al., 2007, 2010). Presumably, this pattern of behavior is propelled by a similar desire to maintain consistency and rationalize past choices. This drive for consistency can lead to a status quo bias: making a choice increases the value of that option in the future. Therefore, once an alternative has been chosen, it is likely to be chosen again, favoring the maintenance of a status quo option over making a new choice (Eidelman & Crandall, 2009; Samuelson & Zeckhauser, 1988).

2.6 Sociocultural factors

Certain cultural norms, expectations, or values may also influence people to maintain the status quo rather than consider other alternatives (Eidelman & Crandall, 2012). People will change their own pre-existing behaviors and attitudes to match that of the group – even, sometimes, to the detriment of the individual (Asch, 1953; Bond & Smith, 1996). This conformist behavior can lead to a global tendency to maintain a status quo on a societal level. System justification theory (Jost & Banaji, 1994) maintains that people tend to view existing laws, policies, and norms as fair and justifiable, leading to a conservative bias (Frank, 2004; Jost, 2006). In line with this theory, people judged reformers who sought to change current laws or policies as more self-interested, more radical, and less rational than individuals who sought to maintain the existing states of affairs (e.g., Keltner & Robinson, 1997; O'Brien & Crandall, 2005; Robinson & Keltner, 1996). Alarmingly, when torture was framed as a long-standing tradition, it garnered greater support from Americans compared to the same torture described as a newer practice (Crandall et al., 2009). This finding may be due in part to the belief that long-standing policies are difficult to change, that other people support those policies, or simply the previously described automatic heuristic that longevity and existence is equal to goodness (Eidelman & Crandall, 2012). Furthermore, people may assume that an existing state has passed the inspection of others in the past and therefore is a logical state of affairs (Eidelman & Crandall, 2012). As discussed in the behavioral inflexibility section (2.1.2), humans may be more likely to be influenced by sociocultural influences than nonhuman primates; however, humans and nonhuman primates can use social learning to develop new behaviors (e.g., Whiten et al., 1996).

2.7 Present experiment

In many decisions we make, a status quo alternative already exists. This means that a bias toward maintaining a status quo can have robust, pervasive, and important effects – both on an individual and a societal level. A status quo bias can lead us to be short-sided and resistant to change, hindering our ability to choose optimally for ourselves or to make progress. Therefore, furthering our understanding of the underlying mechanisms that bias us toward the status quo can shed light on the contexts in which it is most likely to occur and, possibly, how to minimize its influence.

The status quo bias is an umbrella, descriptive term to describe humans' general preference to maintain the current state of affairs. There are many possible mechanisms that bring about such a bias in various contexts or moderate the effect to varying degrees. Although rarely discussed in the status quo literature, simple reinforcement history may often explain our tendency to demonstrate a ‘status quo bias.’ In this sense, we know that animals, too, can exhibit a ‘status quo bias,’ when they exhibit habits or behavioral perseveration. However, other factors can influence us to exhibit a status quo bias beyond the influence of our reinforcement history. In humans, research has shown that sociocultural influences, the cost of change, cognitive dissonance, psychological inertia, and cognitive fluency can also influence people’s tendency to maintain the status quo when they have received no reinforcement for alternatives, or when their reinforcement history should influence them to make the opposite choice. For example, people show the mere existence effect, such that they prefer alternatives that they have been told existed, but with which they have no personal experience or history of reinforcement for that alternative (*cognitive fluency*); they are willing to change a previously-reinforced behavior to a new behavior after socially observing group members engaging in other behaviors (*sociocultural influences*); they are unwilling to give up less preferred items for more preferred items, suggesting they will choose against the option for which they have received greater reinforcement (*cost of change*/*endowment effect*); and, they may stick with the status quo because they have fuzzy preferences among options (i.e., reinforcement history does not differ between options or does not affect preferences; *psychological inertia*).

The evidence on the degree to which these factors may affect nonhuman primates is mixed, and often it seems that reinforcement history is the main motivating factor behind behaviors that appear to be status quo bias-like in animals. For example, nonhuman primates demonstrate behavioral perseveration, such that they are more likely to stick with behaviors they have been rewarded for in the past than to change their behaviors based on social observations.

But there is evidence that many animals exhibit a mere exposure effect, such that they will demonstrate a preference for alternatives after exposure to those alternatives, even without reinforcement, indicating that cognitive fluency could lead animals to exhibit a status quo bias. Nonhuman primates are also sensitive to the cost of change; they can be neophobic and risk-averse. In many cases, these phenomena could also be explained by reinforcement history (why switch to a novel or different alternative after being reinforced for the existing alternative?), but research on the endowment effect shows that they will prefer to maintain the status quo (keep the endowed item) in some instances, even when it is less preferred than the alternative option, suggesting that switching costs could outweigh the valuation of how rewarding a particular alternative is.

The goal of this study was to investigate how certain factors (specifically, psychological inertia and ‘cognitive fluency’ as it manifests by recent, prolonged exposure) could influence animals’ exhibition for a status quo bias beyond the influence of any reinforcement history, and when switching costs were eliminated. Unlike studies on the mere exposure effect, the animals in this study were exposed to all options equally, but I investigated whether recent, prolonged exposure could instantiate an experience of a status quo and lead to a status quo bias. Furthermore, I attempted to evoke ‘fuzzy preferences’ between alternatives in order to explore the degree to which psychological inertia may play a role in nonhuman primates susceptibility to a status quo bias.

There are many advantages to testing this question with nonhuman primates. First, many choice-studies with human participants include hypothetical outcomes or negligible payoffs. Research has demonstrated that people’s choices often differ when considering real-world compared to hypothetical scenarios (e.g., Ebbesen & Konečni, 1975). In the methodology proposed here, subjects would be making choices that affect them directly through the delivery of preferred rewards.

Second, studying other species is critical to comprehending the evolution of any psychological process, just as studying multiple age groups is crucial for understanding the developmental trajectory of a particular cognitive skill, or studying multiple societies is essential for discerning the influence of any one culture on a specific thought process. By virtue of our extra-ordinary cognitive capacities – ranging from our sophisticated linguistic abilities to advanced computational skills, from our rich sense of self to our complex economies and intricate cultures – humans inherently have psychological experiences unlike those of any other animal. It is not unreasonable to think, then, that humans' decision-making experience may also be unique, and these influences may fundamentally distinguish our choices from those of other animals in similar contexts. After all, research on the endowment effect in monkeys and apes demonstrated that nonhuman primates experience the effect for food items but, unlike humans, do not exhibit the effect for other non-edible goods. A status quo bias would predict that the animals should exhibit a similar pattern of behavior (i.e., a preference for the endowed item) for all goods, albeit to differing degrees. In these instances, it is possible that any potential bias to maintain the status quo was overridden by the animals' enjoyment of exchanging with experimenters, or an inhibition failure to give up a food item. Or, perhaps there is something unique about humans that makes us exhibit a more general status quo bias – a more general aversion to change – that is not common to other animals.

Yet, the extensive comparative literature on decision under risk, prospect theory, and cognitive bias indicates that nonhuman animals often demonstrate similar biases to those seen in humans, due to evolutionarily-conserved decision making mechanisms. Many of the mechanisms described above, believed to underlie the status quo bias, have already been evidenced in other animals, or there is reason to believe those factors could influence animals' choices. But, without investigating the status quo bias in other animals, we cannot hope to parse out the role of evolutionary-conserved, fundamental decision-making mechanisms on humans' susceptibility to the status quo bias from societal, cultural, and human-unique influences. I predicted that nonhuman primates would exhibit a status quo bias in this study such that options framed as the default would be preferred above neutral or non-default alternatives, even beyond the influence of reinforcement history and switching costs. Furthermore, I predicted that recent, prolonged exposure, and psychological inertia would moderate this bias, such that increased exposure to the status quo and approximately equivalently preferable alternatives would strengthen any existing status quo bias.

The present study investigated whether primates exhibited a status quo bias in tasks that did not involve an endowment or exchange, where food was not a primary feature of the choice set, and where the influence of associative learning was minimized. Furthermore, this study explored some of theorized mechanisms of the status quo bias, such as fuzzy preferences, and recent/prolonged exposure to a certain alternative. The aim of the study was to establish whether nonhuman primates exhibit a status quo bias beyond the influence of reinforcement history, and to explore the role of two proposed moderators on this effect.

3 EXPERIMENT 1: METHODS

3.1 Subjects and housing

Subjects included five tufted capuchin monkeys (*Sapajus apella;* 1 male, 4 females; ages 15-23 years old) and five rhesus macaques (*Macaca mulatta;* all males; ages 21-30 years old) housed at Georgia State University's Language Research Center (LRC).

The capuchins lived in three social groups that included between four and eight individuals. Each social group inhabited enclosures that included indoor and outdoor access, and each group had visual and auditory access to at least one other social group for most or all of the day. Each day between 8 and 10 am, capuchin monkeys had the opportunity to separate individually into smaller testing enclosures that are attached to the main enclosure. Choosing to separate into a testing box was entirely voluntary; monkeys were rewarded with a pecan or peanut for separating, but they received no punishments or water/dietary/social restrictions if they chose not to separate into an individual testing station. Monkeys that entered a testing station remained physically separated from their social group (but continued to have auditory and visual access to groupmates) and were tested on computers (see Apparatus) until approximately 2 pm. At this point, the separated monkeys received a small fruit reward and were released back into their main enclosure with their social group. Monkeys who did not separate for testing received two pieces of monkey chow around 12 pm. All monkeys, regardless of testing status, were then provided a meal of fresh fruit, vegetables, nuts, monkey chow, and other enrichment foods.

The rhesus macaques remained physically isolated from one another in their home testing enclosures for approximately 18 hours a day, but they had continuous visual and auditory access to conspecifics. While in their home testing enclosures, monkeys had continuous access to the computerized testing apparatus. When not in their testing stations, the monkeys were given access to their outdoor enclosure with a compatible conspecific. Those who were not compatible with any partner monkeys were still given outdoor access but remained physically separated from conspecifics. Regardless of any monkeys’ performance on their computer tasks, all monkeys were provided a daily diet that consisted of fresh vegetables, fruit, nuts, monkey chow, and other enrichment foods.

No monkeys at the LRC were ever food or water deprived for testing purposes. All diets were veterinarian-approved to meet monkeys’ caloric needs. The LRC is accredited by the International Association for Assessment and Accreditation of Laboratory Animal Care. The procedures utilized in this experiment were reviewed and approved by the Institutional Animal Care and Use Committee of Georgia State University.

3.2 Apparatus

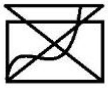
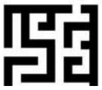
Monkeys completed trials using a computerized testing system (CTS). Each monkey had its own computer and observed a 17 in computer monitor through a clear faceplate. Monkeys manipulated a joystick that was vertically mounted to their faceplate in order to make responses via cursor on the computer program. Correct responses were rewarded with 45 mg banana-flavored pellets (Bioserv) that were automatically dispensed to the monkey through a tube connected to the faceplate. The testing program for this study was written in Visual Basic 6.0. Monkeys have extensive experience being tested in this manner. For further details about the CTS, see Evans et al. (2008) for capuchins and Richardson et al. (1991) for macaques.

3.3 Procedure

3.3.1 Tasks and the SELECT menu

In these experiments, monkeys had the opportunity to engage with several different computer tasks, described below, and make choices about those tasks. These particular tasks were chosen because minimal training would be required: they were simple psychomotor tasks, several of which the monkeys had experienced in past experiments. Correctly completing a trial of any task resulted in a pellet reward and immediate generation of the next trial. There was no way to ‘fail’ any of the tasks; the trial continued until the monkey met the objective. At several points throughout the experiment, monkeys were also required to make choices among tasks by utilizing a SELECT menu. The SELECT menu is an array of digital icons, where each icon corresponds to one specific task (e.g., Englund & Beran, 2022; Washburn et al., 1991). Monkeys could navigate their cursor via joystick to contact an icon in the array; in so doing, they initiated a trial of a corresponding computer task. These monkeys had prior experience with making choices from SELECT menus, and their differential and consistent preference for certain task icons in previous experiments demonstrates that they have learned icon-task associations before (e.g., Washburn et al., 1991). Some novel icons and procedures were used in this experiment, so monkeys underwent a 1,000 trial forced-choice exposure phase (see Section 3.4 Training Phase).

Table 3.1. Abbreviated task descriptions and corresponding icons.

Icon	*Task*	*Description*
	CHASE	Chase a moving target with cursor. Trial ends on contact.
	ERASE	Move the cursor continuously to contact rows/columns of consecutive squares. Each square in the line disappears on contact. Trial ends after the entire line has been ‘erased’.
	MAZE	Navigate around a barrier maze to reach a stationary target. Trial ends on contact.
	DEFLECT	Move the cursor to contact a sequence of targets that appear onscreen one at a time. Trial ends after 8 of targets have been contacted.

3.3.1.1 CHASE

Monkeys were required to track and contact a moving target with their cursor. The target moved in a saw-tooth zig-zag pattern (and ‘bounced off’ the edges of the screen) as long as the cursor was moving. The cursor could be moved freely and continuously; whenever the cursor was stationary the target was also stationary. The trial ended as soon as the cursor made contact with the target, at which point the monkey received a pellet reward.

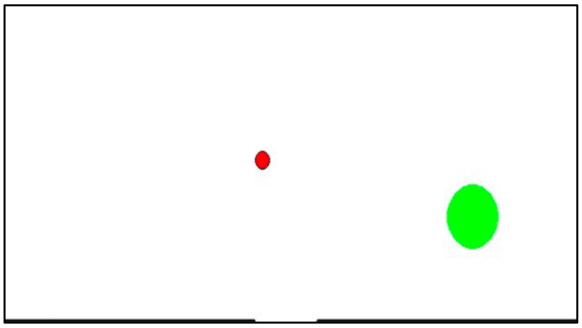


Figure 3.1. CHASE.

3.3.1.2 ERASE

Monkeys were required to move the cursor continuously to contact a line of three consecutive squares. Squares in the line disappeared on contact, making the line appear shorter. On any given trial, the line appeared in one of 10 possible locations on screen. The trial ended when the line was completely erased (the cursor made contact with all three squares).

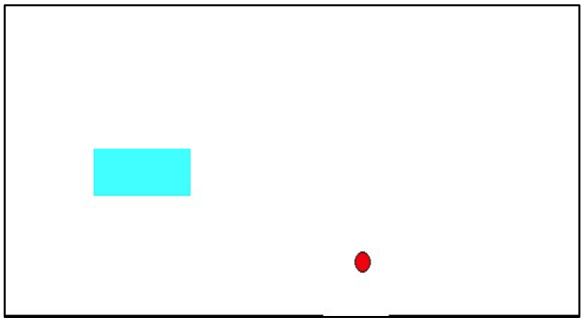


Figure 3.2. ERASE.

3.3.1.3 MAZE

Monkeys were required to navigate around barriers to reach a target. The cursor started at the bottom (base) of the maze and could be moved continuously upward along a vertical path. Two horizontal paths, one on top of the other, protruded from a 90 degree angle about halfway up the length of the vertical path, so that monkeys could choose to enter the top left, bottom left, top right, or bottom right path. At the start of each trial, a target (green square) would appear in one of the four possible pathways. The monkey had to run the cursor along the correct path until making contact with the target, at which point the trial ended and they would receive a pellet reward.

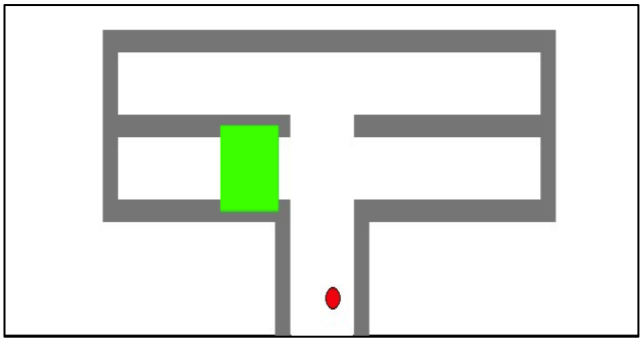


Figure 3.3. MAZE

3.3.1.4 DEFLECT

Monkeys were required to contact a sequence of targets. The targets were solid ovals that appeared north, east, or west of the cursor. Monkeys could move the cursor continuously in the direction of the target until contact was made. On contact, the cursor would return to the center and a new oval would appear. After contacting eight ovals, monkeys received their pellet reward.

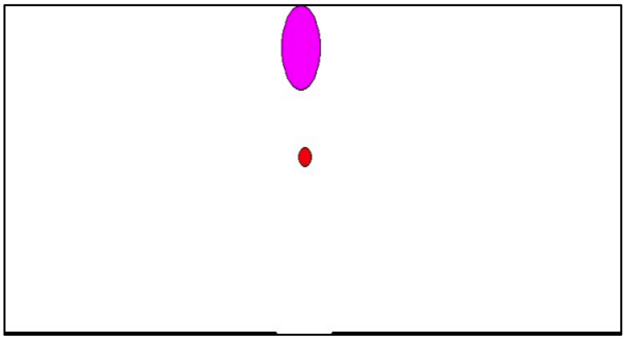


Figure 3.4. DEFLECT.

3.3.2 Screen

For the duration of the experiment, the screen was divided into three sections: the "task space," the "cursor space," and the "choice space" (Figure 3.5). The top section was the "task space," where monkeys engaged with the tasks as described below. A narrow row in the center of the screen acted as the "cursor space," a neutral area between the top and bottom sections of the screen, through which the monkey would have to move their cursor in order to navigate to either the top or bottom section of the screen. The bottom section was the "choice space," which included a SELECT menu.

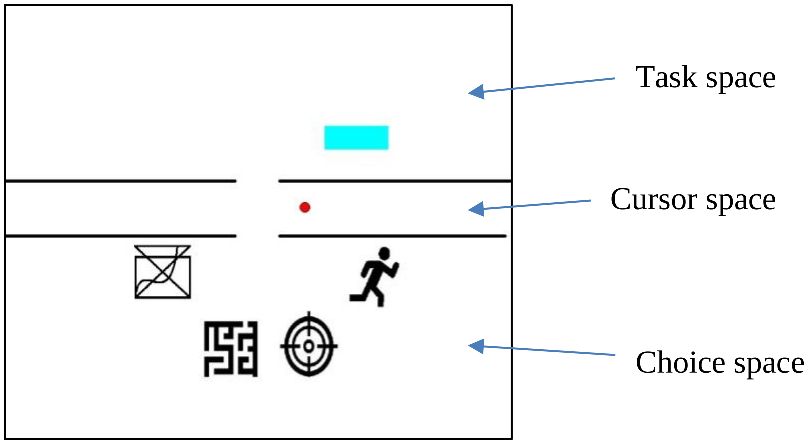


Figure 3.5. Screen layout for Experiment 1

Depending on the experimental condition and the trial presented, either the task space or the choice space could be empty (i.e., not contain any icons or stimuli), or both spaces could be simultaneously available to interact with. In cases where both the task space and the choice space were available and contained stimuli, the monkey had to choose to enter either the task space or the choice space by navigating through the cursor space. The cursor was set off center to force animals to contemplate their choice rather than reflexively navigating upward (consistent with what they may have begun habitually doing during the run of forced trials). As soon as a space was chosen (i.e., the cursor exited the cursor space and entered either the task or choice space), stimuli in the unchosen space would disappear, and the cursor could not exit the chosen space until the trial ended, either by choosing from the SELECT menu or completing the task trial. During forced runs of trials (described below), the cursor generated in the task space at the start of each trial instead of in the cursor space.

3.4 Training phase

Before testing began, monkeys underwent an exposure phase so that they could learn to associate the icons with the tasks (Figure 3.6). Like the experimental conditions, the screen was divided into three sections: a task area, a cursor area, and a choice area. At the start of each trial, one of the task icons appeared in the choice area. Monkeys had to navigate their cursor to touch the icon in the choice space, at which point the icon disappeared, and a trial of the corresponding task appeared in the task space of the screen. After completing this trial, a new icon appeared in the choice space. All icons were be presented pseudo-randomly across trials, with 250 trials of each task icon for a total of 1,000 trials.

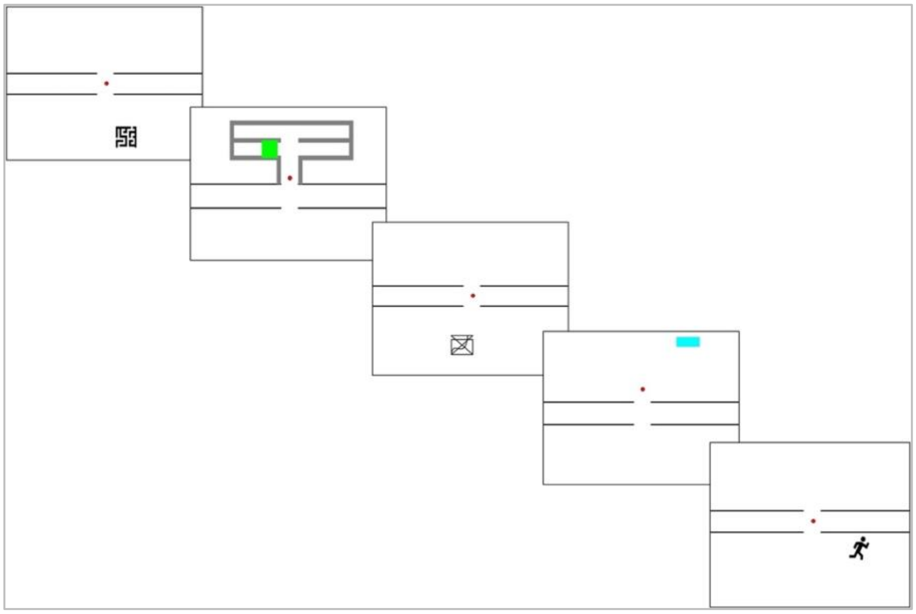


Figure 3.6. Training Phase. Monkeys learn task-icon associations through forced-choice trials.

3.5 Testing phase

As previously discussed, a status quo bias could be a result of experience or exposure, where an animal chooses the status quo option because they have developed a preference for that task over time. Or, a status quo bias could be a result of psychological inertia, such that the animal may be indifferent between options and simply prefer to continue engaging with whatever task is readily available rather than exert effort to change to another option. The aims of this phase of the experiment were (1) to determine whether monkeys exhibit a status quo bias as a result of prolonged exposure to one task, and (2) to determine whether and to what degree psychological inertia influenced a potential preference for the status quo alternative.

In this phase of the experiment, monkeys either experienced (a) prolonged exposure to a run of trials of a single task (the *Exposure Condition*, Section 3.5.3) or (b) prolonged exposure to a run of trials where each trial presented a different task (precluding prolonged exposure to any one task; the *Inertia Condition*, Section 3.5.4). Then, monkeys were presented with two simultaneous options: continuing with the ‘default’ option (a readily-available task at the top half of the screen), or opting out of the default and choosing another task from a task menu on the bottom half of the screen. This ‘prolonged exposure’ period varied in length, consisting of either 5, 10, 20, or 40 trials (as a within-subjects design, all monkeys experienced all conditions). I hypothesized that (a) monkeys would be more likely to choose the default task in the Exposure Condition compared to the Inertia Condition., and (b) the longer the run length in the Exposure Condition, the more evident the preference for the default task would become, but run length would not affect monkeys preferences in the Inertia Condition.

Because I knew it was possible that monkeys could develop a preference for one particular task (thereby choosing to engage with that task exclusively because it was most preferred, but not because of a status quo bias), I included a condition that would reveal monkeys’ task preferences (the *SELECT Condition*, Section 3.5.1). In the SELECT Condition, monkeys were never presented with a default task, and made every choice from a SELECT menu.

3.5.1 SELECT Condition

The SELECT condition was used to establish base preferences across tasks, where monkeys made active choices among neutral alternatives (i.e., no status quo framing). Monkeys completed the SELECT condition three times: once at the start of the experiment (before completing any other conditions), once in the middle of the experiment, and once at the end of the experiment (after all other blocks were complete). In this condition, monkeys were presented with choice trials that included a menu of task icons in the bottom section of the screen, and no task was presented in the top portion of the screen (Figure 3.7). Monkeys had to navigate their cursor from the cursor space (center screen) into the choice space (lower screen). Each of the four task icons were roughly equidistant from the cursor when it first appears at the top edge of the choice space, but icon locations were not randomized in the SELECT menu, which means that task selections were confounded with icon location in this experiment. However, subsequent analyses demonstrated that the tasks monkeys were most likely to choose in the SELECT menu were also the tasks they were most likely to ‘stay’ with when that task was presented as a default (see Section 4, Experiment 1: Results). This indicates that choices reflected true task preferences rather than a preference for icon location.

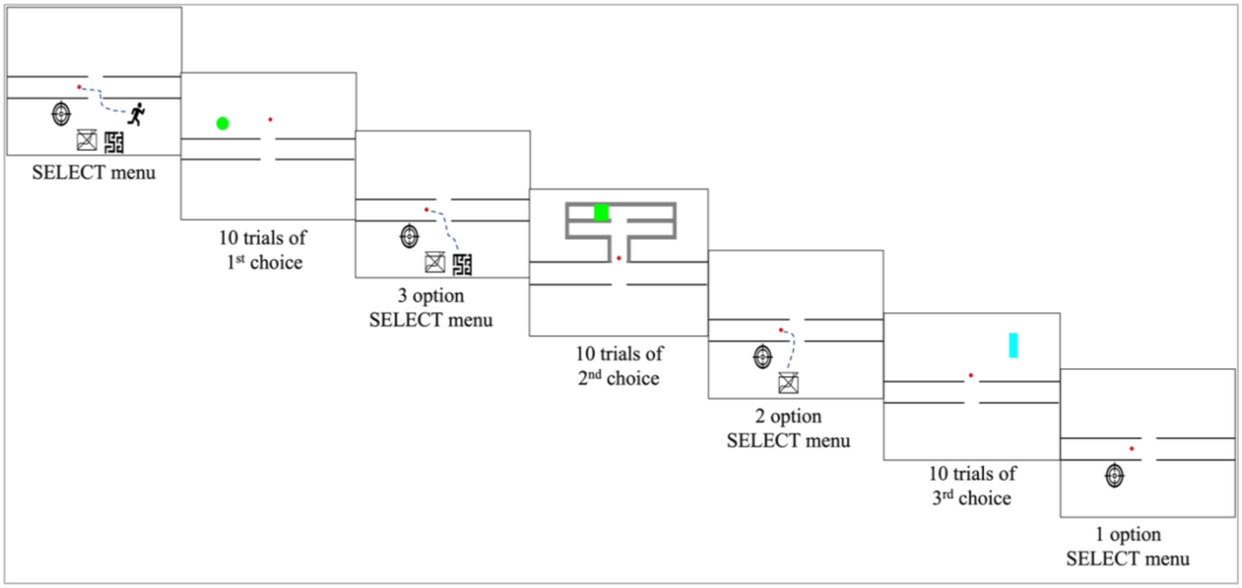


Figure 3.7. SELECT condition. Monkeys could choose from a 4-option SELECT menu. After making their first choice and completing 10 trials of that chosen task, they were presented with a new SELECT menu, which included the three previously unchosen task options. Monkeys continued to complete trials and make choices from a diminishing SELECT menu, until all options had been selected, at which point, on the subsequent SELECT trial, all task options became available again.

After selecting an icon from the SELECT menu, monkeys completed 10 forced trials of the corresponding task in the top half of the screen. During these forced trials of the selected task, the SELECT menu was not available. At the start of each of these forced trials, the cursor automatically appeared in the task space section of the screen; the monkeys were not required to move it up from the cursor space into the task space at the start of each trial.

After completing the ten forced trials, monkeys were presented again with the SELECT menu (with no task in the upper task space), and were able to make another choice. So that the monkeys could not fall into a self-selected status quo bias (i.e., continuously choosing the same task on every choice trial), after a task was chosen, it was excluded from the SELECT menu on the subsequent trial(s), until all four tasks were chosen. In other words, on the first trial of the day, monkeys were presented with a SELECT menu that included all four task options; after selecting and completing trials for a task, they would then be presented with a SELECT menu that included only three task options – the previously selected task icon excluded. This continued until monkeys were presented with only one task icon (i.e., provided a forced choice). Following this forced choice, the subsequent SELECT menu reset, and included all four task options. This cycle would repeat until the monkey completed 50 “choice trials” (where a SELECT menu was presented).

3.5.2 Run Lengths (5, 10, 20, 40) as an Independent Variable

In addition to the SELECT Condition, monkeys alternated between blocks of the Exposure Condition and blocks of the Inertia Condition (described in more detail below). Each block differed in the number of trials that were included in the forced runs: 5, 10, 20, or 40 trials. Differing run lengths were included in this experiment for a few reasons. First, there is no literature that describes *how much* exposure leads to an instantiation of a status quo. But, when the role of exposure is discussed, it is generally described in terms of is positive relationship with a status quo bias (e.g., Eidelman & Crandall, 2012), indicating that more exposure leads to a stronger status quo bias. The longevity effect (Eidelman et al., 2010) tells us that the longer people *believe* an alternative has been the existing state of affairs, the more favorably it is judged (although the longevity effect refers to scenarios in which the individuals have had no direct exposure to the alternative in question). Additionally, people tend to show an increase in choice inertia (repeatedly making the same choice) as experience increases (Ashby& Teodorescu, 2019). 40 trial runs seemed long enough for the monkeys to experience ‘getting into a groove,’ perhaps even entering a flow-like state (Csikzentmihalyi, 2000), while also keeping in mind the logistic consideration that the only trials of relevance from a data analysis perspective were the choice trials that occur *after* each run.

However, because these tasks were not very cognitively demanding compared to other programs with which these particular monkeys are used to engaging, there was a potential for the monkey to become bored after long runs of a single task type. Intuitively, we know that too much of something can make us like it less: think of any song that has been played on the radio one too many times. In line with this, research on the mere exposure effect suggests that although initial exposure increases preference for a stimulus, extended exposure leads to a decrease in preference for that stimulus (Bornstein et al., 1990). Perhaps, then, there could be an inverted U-shaped curve in the exhibition of a status quo bias, such that very low levels of exposure are unlikely to evoke the effect, but extremely high levels of exposure may lead to ‘oversaturation’ and a desire to defer from the norm. To explore how different amounts of exposure could influence the status quo bias, I included four different run lengths as an independent variable. Monkeys experienced both conditions (Exposure, Inertia) with each run length (5, 10, 20, 40), for a total of 8 experimental blocks (plus the three SELECT blocks). Monkeys were assigned either to a 40-20-10-5 sequence (where they experienced Exposure trials with 40-trial run lengths, then Inertia trials with 40-trial run lengths, then Exposure trials with 20-trial run lengths, then Inertia trials with a 20-trial run length, and so on) or a 5-10-20-40 sequence.

3.5.3 Exposure Condition

This condition was meant to test whether monkeys would develop a status quo bias as a result of prolonged exposure to a single task. In this condition, monkeys experienced forced runs of varying lengths (5, 10, 20, 40). One of the tasks (randomly generated), continuously and automatically populated the task space at the top of the screen; that is, as soon as one trial was completed, a new trial of the same task would appear, for the run of *n* trials.

During a forced run, the SELECT menu was not available in the choice space at the bottom of the screen, and the cursor automatically appeared in the task space at the start of each trial (not in the cursor space). After the monkey completed all trials in the forced run, the monkey experienced a choice trial. In the Exposure Condition, a choice trial consisted of a SELECT menu in the choice space on the screen, as well as a trial of the "exposure task" (the task for which the monkey had just experienced a forced run of trials) in the task space of the screen. The cursor was situated in the cursor space on screen, slightly to the left or the right of center. Monkeys could either navigate their cursor upwards into the task space, to engage with the presented task, or they could navigate their cursor down into the choice space, to make a selection from the SELECT menu.

If the monkey navigated their cursor into the task space (i.e., choosing to engage with the default task), the SELECT menu would disappear from the choice space, and the monkeys could complete the trial of the available task. This was considered a 'stay' response, because the monkey chose to stay with the readily-available default task. Upon completion of the trial, monkeys would be faced with another choice trial: the cursor would return to the cursor space, another trial of the default task would appear in the task space, and the SELECT menu would become available in the choice space. As long as the monkey continued to choose to stay with the default task in this manner, it would be presented with another choice trial, for up to five choice trials (Figure 3.8). Monkeys were given five potential choice trials at the end of every forced trial block so that if the monkeys had learned to ignore the choice space during the forced run block, or had gotten into the habit of navigating the cursor upward without regard for what else was on screen, they would have multiple opportunities to realize that a choice menu was available to them before having to enter another run of forced trials. If the monkey chose to stay for all five choice trials, then the subsequent trial would begin a forced run of trials of a new task (i.e., any of the other three tasks that had not just been the exposure task).

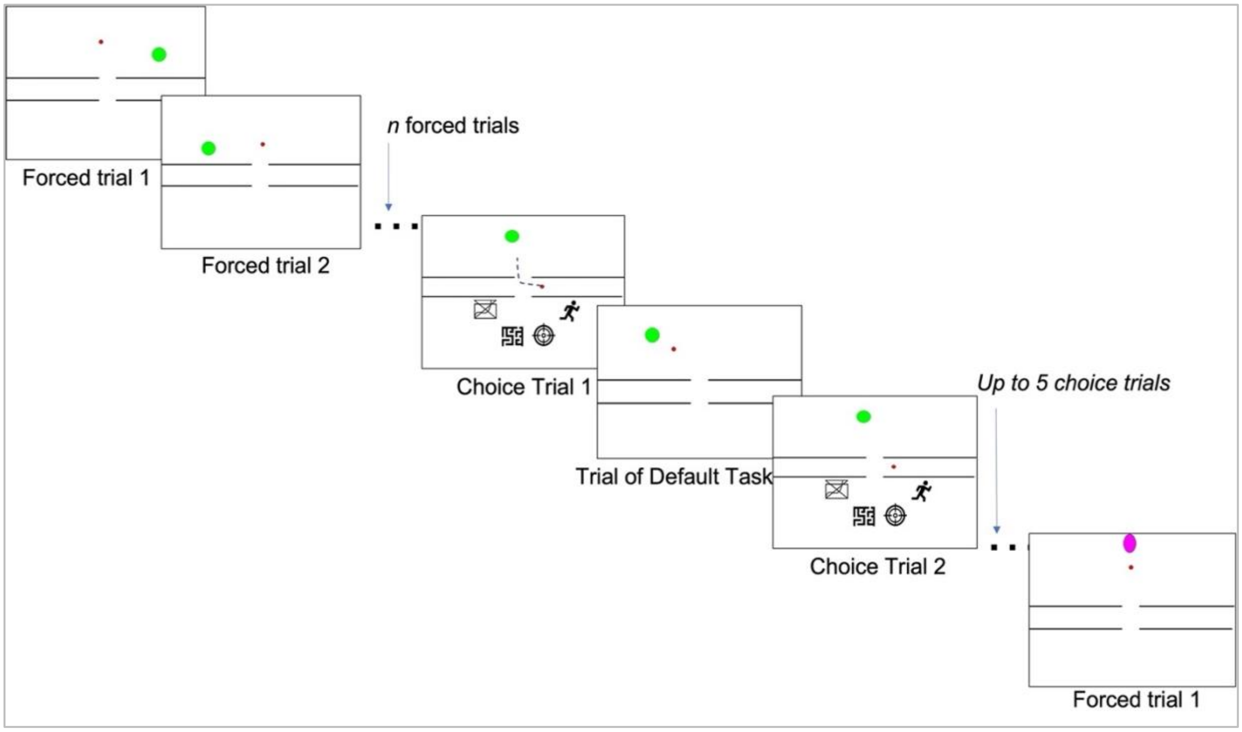


Figure 3.8. Exposure Condition with Default Task Chosen. Monkeys undergo n forced trials of a single task. They then are presented with a Choice Trial, where they can either continue engaging with trials of the default task by navigating to the task area on screen or choose another task from the SELECT menu in the choice area on screen. If the monkey chooses to navigate up to the default task, they will complete a trial of that task, and then be presented with another Choice Trial. If the monkey chooses the default task every time, they will complete five Choice Trials, and then a new forced run will initiate of a different task.

If instead the monkey navigated their cursor into the choice space (i.e., choosing to opt out of the default task), the trial in the task space would disappear until the monkey made a selection from the SELECT menu. The SELECT menu always included all four task icons, including the icon for the default task. Including the default task icon in the array was meant to act as a measure of internal validity: at the time of study design, I assumed that if monkeys understood the study's contingencies, there would be no reason for them to opt out of the default task only to opt back into it from the SELECT menu (this methodological decision is discussed in more detail in Chapter 4: Experiment 1 Results).

Making a choice from the SELECT menu (coded as a 'switch' response) generated a different sequence of events than a stay response (Figure 3.9). Rather than only experiencing one trial of the task and then being presented with another choice trial, after selecting a task from the menu, the monkey experienced a forced run of their chosen task, yoked to match the length of the run for randomly generated tasks (5, 10, 20, or 40 trials). Then, after completing the run of trials for the task they had chosen from the menu, monkeys were then be presented with another forced run of trials of a new, randomly generated task (i.e., any of the other three tasks that the monkey had not just chosen), before experiencing another choice trial. This was meant to ensure that the monkey had experience with forced runs of all the tasks, rather than leaving open an opportunity for the monkey to choose the same task at every choice trial and experience only one task for the entire condition block. During these forced runs (whether of a chosen task or of a randomly generated one), the cursor always began in the task space (not the cursor space; Figure 3.5) and the SELECT menu was not present in the choice space of the screen.

The block ended after monkeys completed 50 choice trials. The total number of trials experienced by a monkey in a given block could vary, depending on the assigned run length (5, 10, 20, and 40 trials), as well as how often the monkey chose to make stay responses (which would enable them to complete up to 5 choice trials for every forced run of trials) compared to switch responses (potentially causing a monkey to complete only 1 one choice trial for every two forced runs -- one forced run of the chosen task, followed by a run of a randomly generated task, before another choice trial would occur).

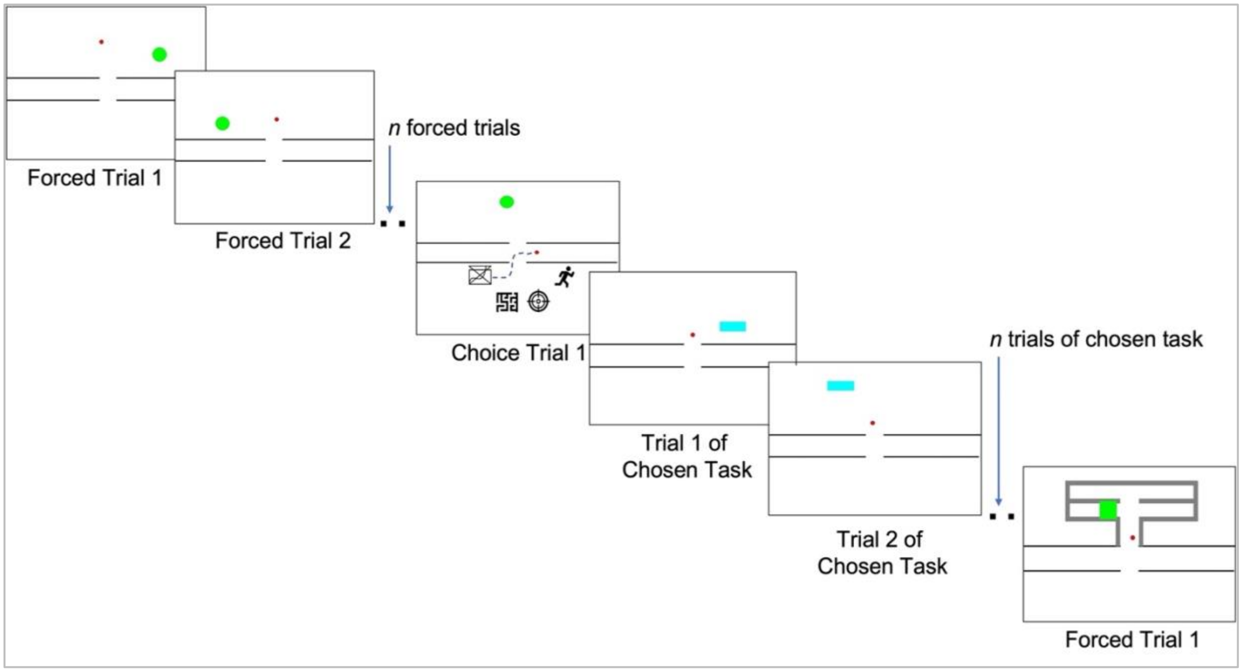


Figure 3.9. Exposure Condition with Nondefault Task Chosen. Monkeys undergo n forced trials of a single task. They then are presented with a Choice Trial, where they can either continue engaging with trials of the default task by navigating up to the task area on screen or choose another task from the SELECT menu by navigating the cursor down choice area on screen. If the monkey chooses to navigate down to the SELECT menu, they will undergo a run of trials of whatever task they choose. At the end of that run, a new forced run will initiate of a different task.

3.5.4 Inertia Condition

This condition was mean to reveal to what degree psychological inertia might explain any potential status quo bias that could have manifested in the Exposure Condition. The theory of psychological inertia posits that people (and presumably animals) would maintain the status quo when they have fuzzy preferences between alternatives and therefore are not motivated to change from the default. If monkeys were to exhibit a preference for the readily-available, default task in the Exposure Condition, that could have been a result of a preference for that task as a result of prolonged exposure, or it could have been a result of insufficiently strong motivation to make an actionable change due to fuzzy preferences (psychological inertia). The Inertia condition was included as a control condition to test whether monkeys preferred to engage with the default task due to its readily available nature, regardless of the previous exposure to that default task. This experiment specifically tests psychological inertia (Gal, 2006) rather than an omission bias (Ritov & Baron, 1992), because monkeys were required to take some action on every trial (i.e., either engage with the on-screen task or make a selection from the menu) and therefore did not have the option of omission.

The procedure for the Inertia Condition was similar to that of the Exposure Condition: monkeys progressed through a forced run of some number of trials before being presented with a choice trial. However, instead of the forced run consisting of trials of only one task type, as in the Exposure Condition, in the Inertia Condition, every trial in the forced run consisted of a different task type than the previous trial. In other words, if monkeys saw MAZE on Trial 1, Trial 2 would be a trial of either CHASE, DEFLECT, or ERASE. Just like the Exposure Condition, the SELECT menu was not present on screen during the forced run, and the cursor began in the task space at the start of each trial.

At the end of the forced run, the monkeys were presented with a choice trial: the cursor would generate in the cursor space, the SELECT menu would become available in the choice space, and a trial of some task would be present in the task space on screen. The monkeys could navigate their cursor up into the task space (a ‘stay’ response) to engage with whatever task was readily-available. Similar to the Exposure Condition, after making such a ‘stay’ response, a new choice trial would generate after the completion of the trial. However, in the case of the Inertia Condition, the task in the task space would be different in each trial, rather than being the same task for every trial as it was in the Exposure Condition. If monkeys chose the readily-available default task every time, they would experience five Choice Trials and then begin another forced run of trials were each trial consisted of a different task (Figure 3.10). If instead the monkey chose to make a choice from the SELECT menu, they would experience a run of trials of their chosen task (yoked in length). At the end of the run of the chosen task, the monkey would experience another forced run of trials where each trial consisted of a different task before being presented with another Choice Trial (Figure 3.11).

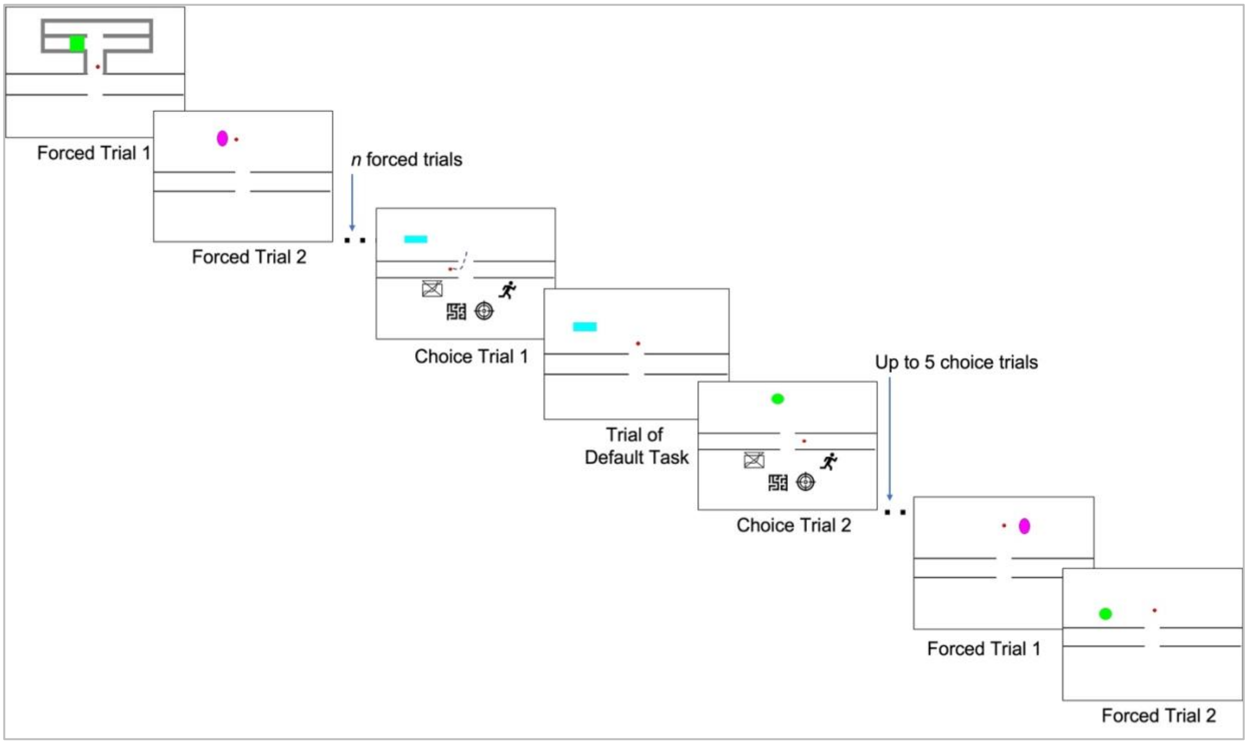


Figure 3.10. Inertia Condition with Default Task Chosen. Monkeys undergo n forced trials, where each trial consists of a different task. They then are presented with a Choice Trial, where they can choose to engage with the readily-available default task by navigating up to the task area on screen or choose another task from the SELECT menu by navigating the cursor down choice area on screen. If the monkey chooses to engage with the default task, after completing a trial, they will again be presented with a Choicer Trial, but with a different default task. If the monkey chooses the default task every time, they will complete five Choice Trials, and then experience a new forced run, where every trial consists of a different task.

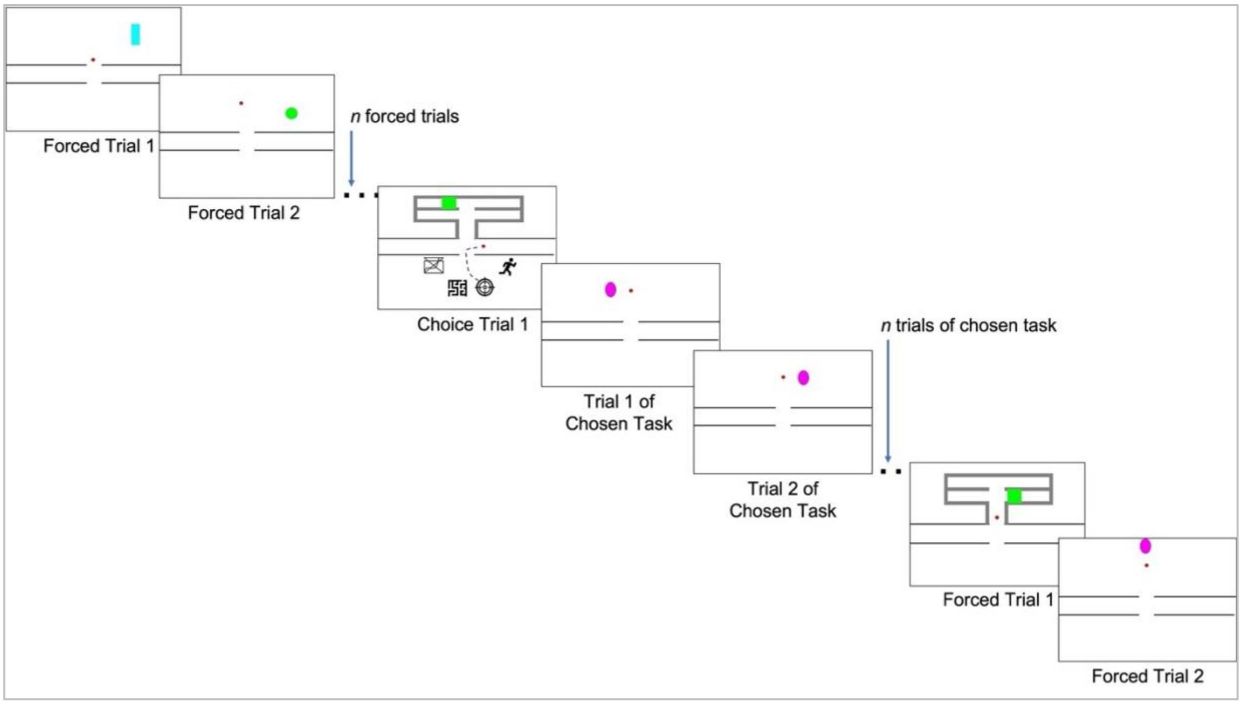


Figure 3.11. Inertia Condition with Nondefault Task Chosen. Monkeys undergo n forced trials, where each trial consists of a different task. They then are presented with a Choice Trial, where they can choose to engage with the readily-available default task by navigating up to the task area on screen or choose another task from the SELECT menu by navigating the cursor down choice area on screen. If the monkey chooses to navigate down to the SELECT menu, they will undergo a run of trials of whatever task they choose. At the end of that run, a new forced run will initiate, where each trial consists of a different task.

4 EXPERIMENT 1: RESULTS

The goal of this experiment was to determine if (a) presenting a task as a ‘default’ option influenced monkeys’ preference for that task and (b) whether and to what degree exposure or psychological inertia impacted this potential preference.

4.1 Baseline task preferences

I analyzed baseline task preference information using data gathered in the SELECT condition. In 150 choice trials across 3 blocks of the SELECT conditions, monkeys had the opportunity to choose tasks from a SELECT menu[1]. On the first presentation of the SELECT menu, all four tasks were available; after making this initial selection and completing the subsequent trials, monkeys then were able to choose from another SELECT menu, this time including the three remaining tasks, then the two remaining tasks, and finally only one task icon would be presented in the SELECT menu. After the forced 'last choice' trial, the menu reset to allow for all four options. This allowed me to create a preference profile for each monkey (described below), which was essential for interpreting the potential presence of a status quo bias in the rest of the experiment: if a monkey always stayed for its most preferred task, but always switched for its least preferred task, this would be indicative of 'rational decision making' (that is, simply choosing to engage most frequently with their favorite task) rather than a status quo bias (a preference for a task that resulted from the experimental manipulations of the status quo). Based on the results of the SELECT condition, I was able to include task rank as a predictor variable in subsequent analyses, enabling me to investigate the potential influence of task preference on stay/switch behavior.

To determine task rank, pairwise comparisons were conducted for every possible task pair combination (i.e., Chase vs. Maze, Chase vs. Erase, Chase vs. Deflect, Maze vs. Erase, Maze vs. Deflect, and Erase vs. Deflect) for each monkey. That is, for each pair, I compared the proportion of trials that Task A was chosen relative to Task B when both Task A and B were available in the menu and either Task A or Task B was chosen. If Task A was chosen at least 20% more often than Task B (i.e., >= 60% of the time that both options were available), Task A was considered to be preferred to Task B; if neither task was chosen at least 20% more often than

---

[1] 2 capuchin monkeys, Gretel and Lychee, did not complete the 3rd block of SELECT. Their preferences were analyzed based on the 100 choice trials from SELECT blocks 1 and 2.

the other, the tasks were considered equally preferred. Based on this information, I categorized each task as high or low preference for each monkey.

Because these data were going to be used as input factors in subsequent modeling and statistical analyses, I chose to create two preference groups rather than maintaining a 1-4 ranking scale, both to simplify the subsequent modeling analyses, and because many monkeys had two- and three-task ties or circular preferences (see Table 4.1). Trials that included tasks that did not clearly fit into higher- or lower-preference categories due to circularity of preferences (e.g., Irene Gretel, Luke) were excluded from future analyses.

Table 4.1. Monkey task preferences based on a 60-40 pairwise comparison cutoff, and the subsequent grouping into high- and low-preference categories.

Name	Species	Task Ranking	High pref	Low pref
Chewie	Mac	Maze > Chase > (Erase = Deflect)	Maze, Chase	Deflect, Erase
Han	Mac	Maze > Chase > Erase > Deflect	Maze, Chase	Erase, Deflect
Lou	Mac	Chase > Maze > Erase > Deflect	Chase, Maze	Deflect, Erase
Luke	Mac	Chase = Maze = Deflect // Maze > Erase // Chase > Erase // Deflect = Erase	Chase, Maze	Erase
Murph	Mac	(Chase = Maze) > Deflect > Erase	Chase, Maze	Deflect, Erase
Gretel	Cap	Erase > Maze // Chase = Erase // Chase = Maze // Chase, Maze, Erase > Deflect	Erase	Deflect
Irene	Cap	Deflect > Erase, Chase // Maze > Chase // Chase > Erase // Maze = Deflect, Erase	Deflect	Erase
Lychee	Cap	Chase > (Erase = Maze = Deflect)	Chase	Erase, Maze, Deflect
Nkima	Cap	Erase > Chase > Maze > Deflect	Erase, Chase	Maze, Deflect
Wren	Cap	Chase > (Erase = Maze = Deflect)	Chase	Maze, Erase, Deflect

4.2 Regression analyses

Ten monkeys (five capuchins, five macaques) were included in final analyses, each of whom completed 50 choice trials in every condition, for a total of 400 choice trials per monkey[2].

---

[2] 2 capuchin monkeys did not complete the final block of testing. Gretel's final block was 40-run-length Inertia, and she completed 38 out of 50 possible trials (or 388 total trials out of 400). Lychee's final block was 5-run-length Inertia, and she completed 15 out of 50 possible trials (or 365 total trials out of 400). All completed trials were included in the logistic regression analyses.

Each line of the data sheet represented one trial for one monkey, and included the monkey’s ID and species, the condition (Exposure, Inertia) and run length (5, 10, 20, 40), and the block number. Also recorded for each trial was the monkey’s choice to stay or switch, which task was ultimately chosen, and which task was the default task. To these data, I appended a “Pref” variable, which represented the relative preference level (high or low) for the *default* task (not the task ultimately chosen) on any given trial, as determined for each monkey in the SELECT data analyses. For the subsequent mixed-effects logistic regression analyses, condition, default task preference, and species were coded as categorical fixed factors, run and block as continuous numeric factors, and the outcome variable of choice was coded as a binary variable (stay = 0, switch = 1). The categorical fixed factors were specified as contrasts centered around zero (-1/1) and the continuous factors were centered and scaled using Z-score standardization. This allowed the coefficients for all input variables and their interactions to be interpreted together. Subject ID was included as a random factor.

Using the lme4 function (Bates et al., 2015) in R version 4.2.2 (R Core Team, 2022), I created a series of mixed-effects logistic regression models that included each input variable independently and also the interactions between condition, default task preference, and run length, the factors of interest in this study. The resulting candidate models were compared considering their Akaike information criterion with correction (AICc) values (Symonds & Moussalli, 2011) using AICmodavg (Mazerolle, 2020; see Table 4.2).

Table 4.2. Model comparison for stay/switch outcome, beginning with best-fitting model. Abbreviation: AICc, Akaike information criterion with correction.

Factors included in the model	*AICc*	*∂AICc*	*Model Rank*
Condition + Pref + Run + 2-way interactions + 3-way interaction	2061.17	0	1
Pref + Run + Pref*Run	2061.73	0.57	2
Condition + Pref + Run + Pref*Run	2063.64	2.47	3
Condition + Pref + Run + Condition*Pref + Pref*Run	2064.18	3.01	4
Condition + Pref + Run + 2-way interactions	2065.92	4.76	5
Pref + Run	2104.61	43.44	6
Condition + Pref + Run	2106.59	45.42	7
Condition + Pref + Run + Condition*Pref	2107.00	45.83	8
Pref	2132.23	71.06	9
Condition + Pref + Condition*Pref	2134.95	73.78	10
Block	2256.47	195.30	11
Run	2284.67	223.50	12
Condition + Run	2286.67	225.50	13
Condition + Run + Condition*Run	2288.36	227.19	14
Species	2303.82	242.65	15
Condition	2314.27	253.10	16

The best fitting model was the one that included all main effects and interactions between the predictors of condition, task preference, and run length. However, this model was not significantly different (∂AICc < 2) from the simpler, 2nd best fitting model that included only task preference, run length, and their 2-way interaction. Consequently, the simpler model (Pref + Run + Pref*Run) was utilized here. This model revealed a significant 2-way interaction between default task preference and run length (Table 4.3).

Table 4.3. Results of mixed-effects binary logistic regression on stay/switch behavior.

Fixed Effects		*Coeff.*	*SE*	*z-value*	p
(Intercept)		2.800	0.49	5.71	<.001
Pref (Low vs. High)	*Main effect*	-0.771	0.06	-11.91	< .001
Run	*Main effect*	0.168	0.06	2.68	.007
Pref * Run	*2-way interaction*	0.422	0.06	6.76	<.001
Random Effects		*Std. Dev*	*Variance*		
Monkey		1.50	2.26		
Model Fit		*Deviance*	*AIC*	*BIC*	
		2051.7	2061.7	2092.4	

Graphing the probabilities of switching as a function of default task preference and run length revealed that monkeys exhibited extremely high probabilities of switching (>80%), regardless of any input parameters (Figure 4.1). However, monkeys were least likely to switch after shorter runs when the default task was of higher preference.

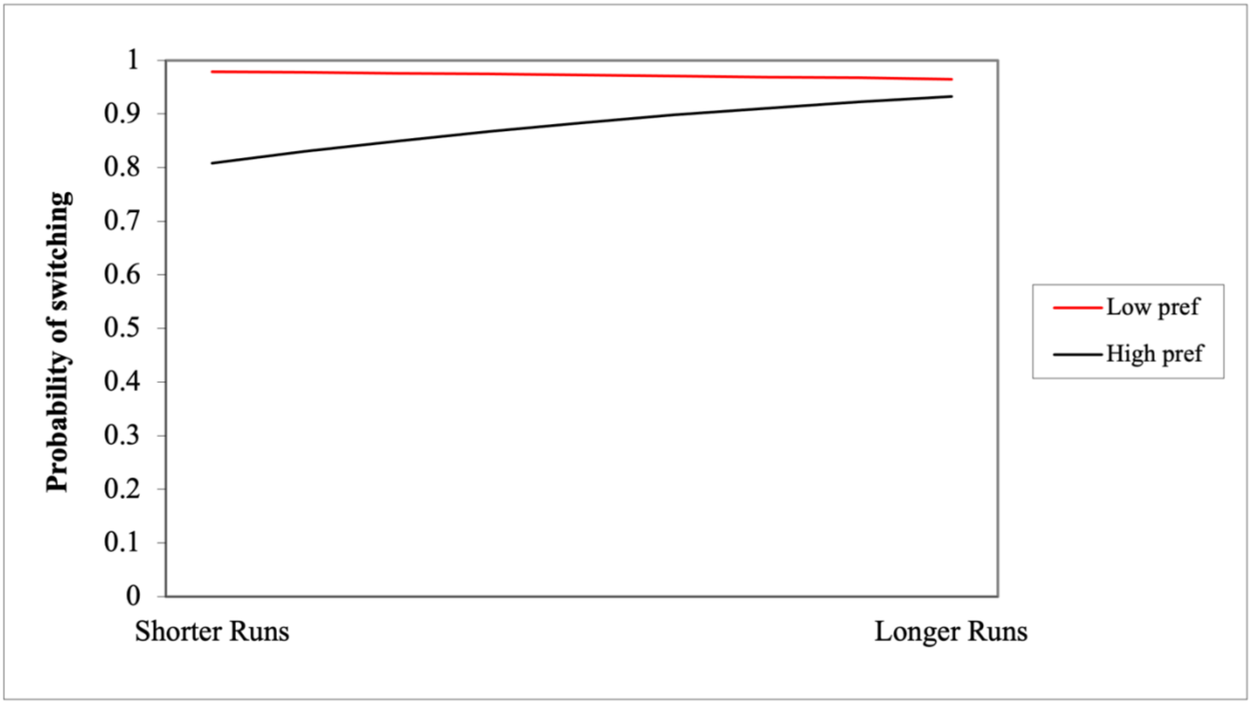


Figure 4.1. Monkeys' probability of switching in Experiment 1. Monkeys exhibited a high probability of switching in general, but were least likely to switch after shorter runs when the default task was higher preference.

Overall, this pattern of results is not consistent with a status quo bias, where one would expect much higher probabilities of staying in general, and especially after longer run lengths of one task type (i.e., Exposure condition). Instead, the condition variable (Inertia vs. Exposure) did not add enough predictive power to be included in the model, and monkeys showed a greater probability of staying after *shorter* runs (i.e., a potentially less instantiated status quo), and only for their *higher* preference tasks (which is not indicative of a bias, but *rational decision making*).

Due to the relatively low variability in the choice behavior, I chose to examine more closely which tasks monkeys were choosing to switch *into*. Informal observation of the data revealed that monkeys were often choosing to switch into the task that was already available as the default. In other words, instead of navigating up to the task space (a ‘stay’ behavior), monkeys were choosing the task which was already available as the default from the SELECT menu at the bottom of the screen. Consequently, further analyses were run after recoding the outcome variable: a stay-with-default (previously ‘stay’) and a switch-to-default (previously ‘switch’) were collapsed into a new response labeled stay*. A switch-to-nondefault task was coded as switch*. Candidate models were compared with the updated dependent variable, including the same predictors and standardization procedures as previously described (Table 4.4).

Table 4.4. Model comparison for stay/switch* outcome, beginning with best-fitting model.* Abbreviations: AICc, Akaike information criterion with correction.

Factors included in the model	*AICc*	*∂AICc*	*Model Rank*
Condition + Pref + Run + 2-way interactions + 3-way interaction	3405.59	0	1
Condition + Pref + Run + Condition*Pref + Pref*Run	3420.32	14.73	2
Condition + Pref + Run + 2-way interactions	3422.32	16.73	3
Condition + Pref + Run + Condition*Pref	3425.04	19.45	4
Condition + Pref + Run + Pref*Run	3428.95	23.36	5
Condition + Pref + Condition*Pref	3430.50	24.92	6
Condition + Pref + Run	3433.63	28.04	7
Pref + Run + Pref*Run	3483.64	78.05	8
Pref + Run	3487.93	82.34	9
Pref	3493.16	87.58	10
Condition + Run	3921.13	515.55	11
Condition + Run + Condition*Run	3923.06	517.47	12
Condition	3925.10	519.51	13
Block	3976.05	570.46	14
Run	3978.17	572.59	15
Species	3978.26	572.67	16

The best fitting model was the one that included all main effects and interactions between the predictors of condition, task preference, and run length. This model revealed a significant three-way-interaction between condition, task preference, and run length (Table 4.5).

Table 4.5. Results of mixed-effects binary logistic regression on stay/switch* behavior.*

Fixed Effects		*Coeff.*	*SE*	*z-value*	p
(Intercept)		1.066	0.18	5.85	< .001
Condition (Inertia vs. Exp)	*(Main effect)*	0.300	0.04	6.66	< .001
Run	*(Main effect)*	0.092	0.04	2.07	.038
Pref (Low vs. High)	*(Main effect)*	-0.934	0.05	-20.13	< .001
Condition * Run	*(2-way interaction)*	-0.044	0.04	-1.00	0.318
Condition * Pref	*(2-way interaction)*	0.139	0.04	3.13	.002
Pref * Run	*(2-way interaction)*	0.123	0.04	2.78	.005
Condition * Pref * Run	*(3-way interaction)*	0.190	0.04	4.30	< .001

Random Effects	*Std. Dev*	*Variance*
Monkey	0.56	0.310

Model Fit	*Deviance*	*AIC*	*BIC*
	3387.5	3405.5	3460.8

Graphing the new outcome variable of stay* and switch* behavior reveals that many of the switch behaviors in the original analyses were not switches into different tasks, but a switch into the same default task (i.e., stays*), especially when the default was a higher preference task (Figure 4.2). There is a clear difference in switching* behavior between high and low preference tasks. When the default task was of lower preference, monkeys demonstrated a consistently high (>80%) probability of switching*, regardless of condition or run length (Table 4.6). This is a rational pattern of behavior: when the default task was less preferred, monkeys chose to switch into an entirely different (presumably higher preference) task.

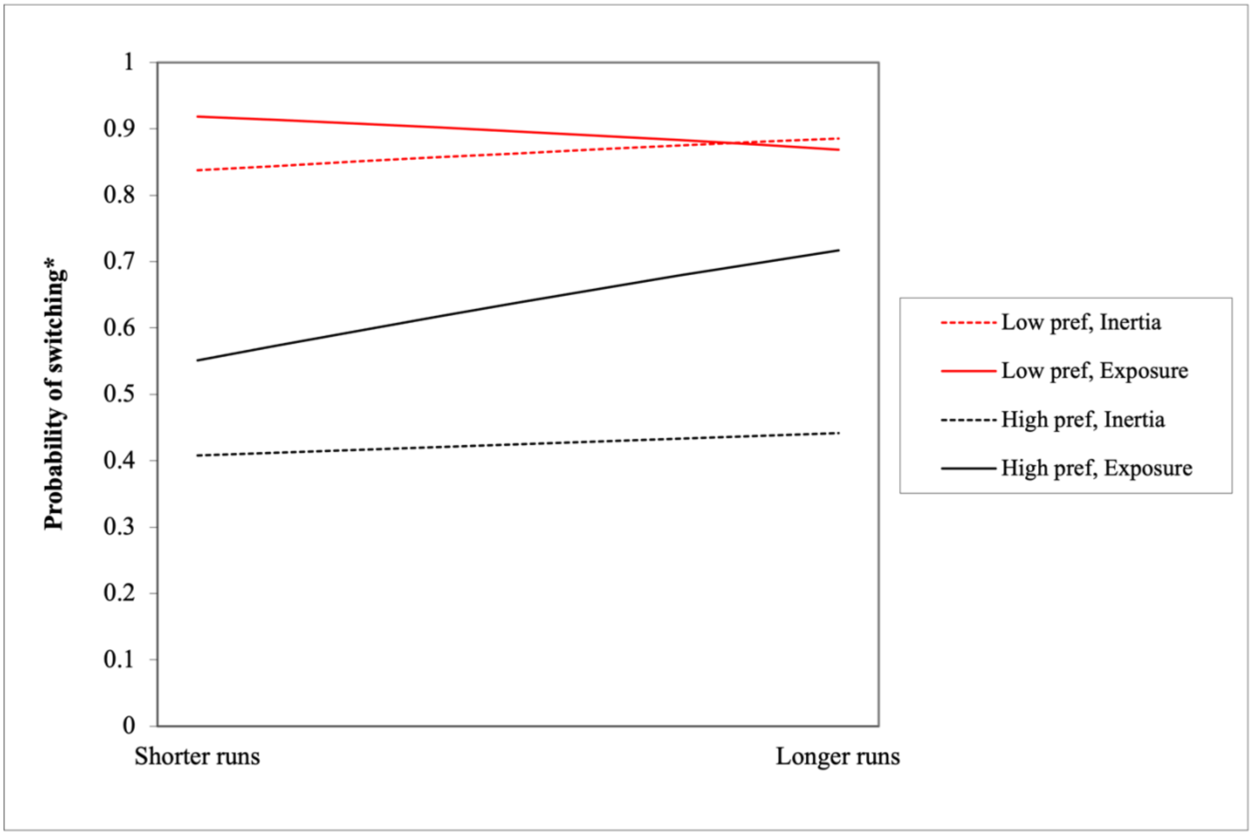


Figure 4.2. Monkeys' probability of switching at each level of the three-way interaction.* Monkeys were most likely to switch* out of the default task when it was of low preference. When it was of high preference, they were least likely to switch* out of the default task in the Inertia condition; they were more likely to switch* out of a higher preference task in the Exposure condition, especially after longer runs.

In general, monkeys were much more likely to stay* for high preference tasks compared to low preference tasks. This was particularly evident in the Inertia condition, where monkeys demonstrated less than a 50% probability of switching* out of their higher preference task regardless of run length. They showed a substantial (14-28%) increase in switching* probability for their high preference task in the Exposure condition compared to the Inertia condition (Table 4.6). This pattern of behavior speaks to a preference for *variety* as opposed to a preference for the status quo, indicating that there is an upper limit to how much a monkey wants to engage with a single task: even after runs that consisted entirely of their most preferred task(s), monkeys were more likely to switch* to a brand new task than after runs of a mix of tasks (Inertia). In fact, in opposition to my hypothesis, longer runs of a single (higher preference) task led to a considerably higher probability of switching* (72%) than shorter runs of that task (55%; Table 4.6).

Table 4.6. Monkeys' probability of switching at each level of the predictor variables.*

	Lower preference tasks				*Higher preference tasks*			
	Shorter runs		*Longer runs*		*Shorter runs*		*Longer runs*	
	P(x)	95% CI	P(x)	95% CI	P(x)	95% CI	P(x)	95% CI
Inertia	0.84	[0.78, 0.88]	0.89	[0.84, 0.92]	0.41	[0.32, 0.50]	0.44	[0.35, 0.54]
Expos.	0.92	[0.88, 0.94]	0.87	[0.82, 0.91]	0.55	[0.45, 0.65]	0.72	[0.62, 0.79]

4.3 Experimental follow up

In the initial experiment, the task presented as the default in the top half of the screen was also included as an option in the SELECT menu at the bottom of the screen. This was an intentional methodological choice: I wanted to ensure that if the task at the top of the screen was chosen, it was chosen at least in part as a consequence of it being in the default position, and not because of a simple preference for that task. It was assumed that if the monkeys understood the experimental contingencies, there would be no reason for monkeys to opt out of a task already available as the default option in order to opt into it again from the SELECT menu. However, as evidenced in the relative increase in stay* behaviors (which included switch-into-default outcomes) compared to stay behaviors (which did not include switch-into-default outcomes), monkeys did demonstrate a preference to choose a task from the SELECT menu even when it was already available at the top of the screen.

In retrospect, there were many logical reasons why switching into a preferred task was more optimal than 'staying' with that task. One reason could have been a methodological difference that was associated with stay behaviors but not switch behaviors: on all choice trials, the cursor automatically generated in the ‘cursor space’ in the middle of the screen, but on all forced trials, the cursor automatically generated in the task space. This meant that when a monkey chose to ‘stay’ with a task, they had to move the cursor up from center screen into the task space. Following the completion of that trial, they would be presented with another choice trial, and another ‘stay’ response would require the animal to again navigate the cursor from the cursor space into the task space. However, if the monkey chose to ‘switch’ into that same task, they would be presented with a run of trials of that task where the cursor began in the task space and did not require the additional cursor movement that accompanied a ‘stay.’ In other words, choosing to ‘stay’ with a task required extra time and effort via cursor movement compared to ‘switching’ into that same task by choosing it once from the SELECT menu.

A follow up experiment was conducted with 3 male rhesus macaques (ages 23 - 30) and 2 tufted capuchin (21-year old female and 15-year old male) which eliminated the methodological discrepancy that may have led to an unbalanced switch preference in the original experiment. The methodology for this experiment was identical to the original experiment, except for a change in the starting location of the cursor. In this experiment, the cursor started in the cursor space on every trial (forced or choice). This prevented monkeys from being able to ‘cheat the system’ by opting into a task in order to complete more trials with less cursor movement. Monkeys experienced only the 5-trial and 40-trial forced run lengths in each the Exposure and Inertia condition[3] (the 10 and 20 trial forced runs conditions were excluded from this follow up study).

---

[3] Two macaques (Murph, Luke) completed this experiment in its entirety. One capuchin (Nkima) did not complete the final block (40-run-length Inertia) but completed all other blocks. One macaque (Lou) and one capuchin (Irene) completed the 5-run-length blocks (Exposure and Inertia) and partially completed the 40-run-length Exposure block (Irene completed 48 of 50 choice trials in the 40-run-length Exposure block, and Lou completed 41 of 50 choice trials in the 40-run-length Exposure block), but did not complete any trials in the 40-run-length Inertia block. All completed trials were included in the regression analyses.

Data were analyzed using the same mixed-effects logistic regression models as previously described and included the stay/switch outcome variable. The best fitting model was one which included the predictors of task preference and run. Results indicated there was a significant main effect of both predictors (Table 4.7).

Table 4.7. Results of mixed-effects binary logistic regression on stay/switch behavior in experimental follow up.

Fixed Effects		*Coeff.*	*SE*	*z-value*	p
(Intercept)		2.170	0.50	4.33	< .001
Pref (Low vs. High)	*Main effect*	-0.541	0.12	-4.59	< .001
Run	*Main effect*	0.845	0.13	6.27	< .001
Random Effects		*Std. Dev*	*Variance*		
Monkey		1.06	1.13		
Model Fit		*Deviance*	*AIC*	*BIC*	
		551.7	559.7	578.0	

Compared to the initial experiment, switching behavior decreased as a result of this methodological change, indicating that the discrepancy in cursor effort influenced switch/stay behavior (Figure 4.3). However, monkeys were still more likely to switch than not switch, and the overall pattern of results remained consistent to the original experiment: monkeys switched more for less preferred tasks than more preferred tasks, and switched more after longer runs compared to shorter runs.

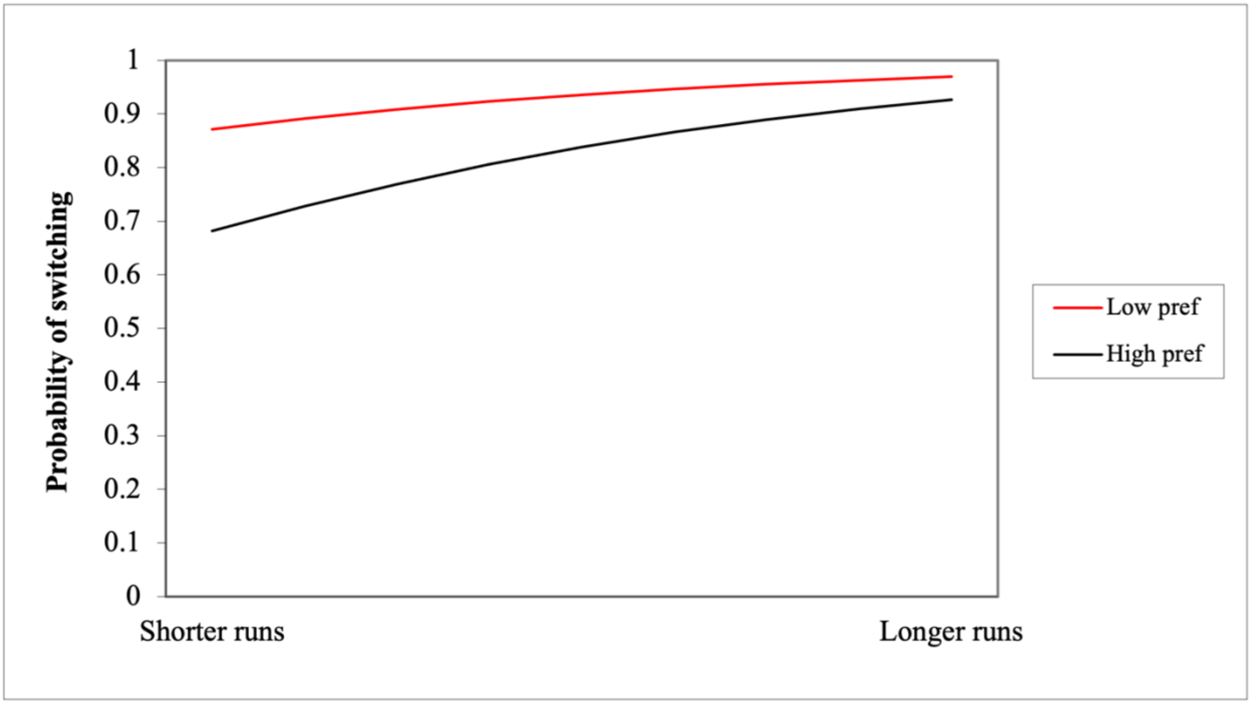


Figure 4.3. Monkeys' probability of switching in experimental follow up. After equating cursor navigational effort for stay/switch behaviors, monkeys stayed slightly more often than the original experiment, but the overall pattern of results was the same. Monkeys did not exhibit a status quo bias, and they stayed with a task more after shorter runs and for their more preferred task.

To determine if the switching behavior in the follow up experiment was exclusively switch-to-nondefault-tasks, I conducted another mixed-effects binary logistic regression on the data from the follow up experiment using stay*/switch* as the outcome variable. The best fitting model for these data was one which included condition, task preference, and run as predictors, The results indicated that each predictor had a significant main effect, trending in a similar direction to the results of the original experiment. The main takeaway here is that, just like in the original experiment, some of the switching behavior seen in the follow-up task can be explained by switching into the default task (staying*; Figure 4.4). Taken together, these results indicate that eliminating the cursor effort discrepancy did reduce switching behavior, but this factor alone cannot explain the disproportionate preference to switch over staying in the original experiment.

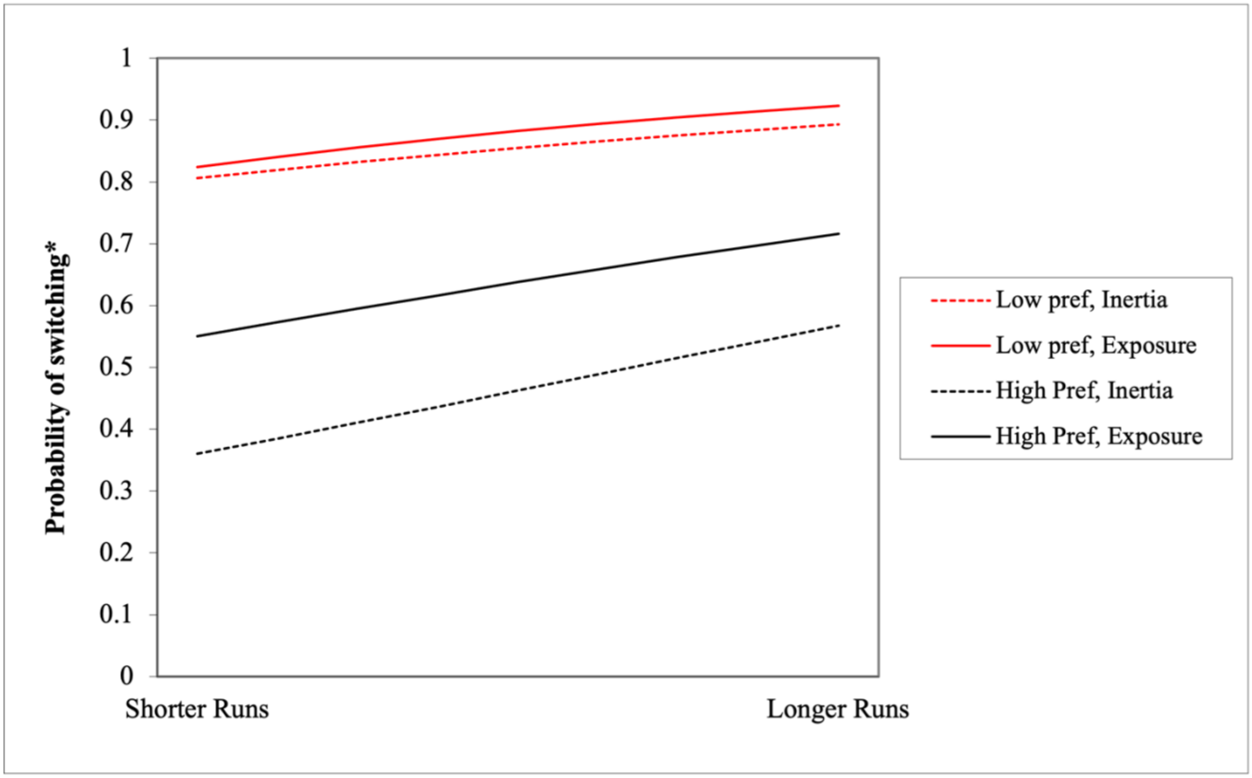


Figure 4.1. Monkeys' probability of switching in experimental follow up*. Monkeys in the follow up experiment switched* more for lower preferences tasks than higher preference tasks, for longer runs than shorter runs, and for the Exposure condition than Inertia condition.

5 EXPERIMENT 2: METHODS

Similar to Experiment 1, the purpose of Experiment 2 was to investigate whether status quo framing (through recent, prolonged exposure) could locally influence primates' choices, such that their preferences would shift according to which alternative was most recently presented as the status quo. Also like Experiment 1, I attempted to induce 'fuzzy preferences' between alternatives by using mechanisms that were approximately equal in difficulty, and baseline preference measures were gathered to determine the 'fuzziness' of these preferences. This experiment differed from Experiment 1 in that it required animals to manipulate apparatuses to obtain a food reward (i.e., a manual paradigm), rather than complete computerized tasks. Therefore, the goal of Experiment 2 was to explore the role of fluency (via recent exposure) on a status quo bias in a potentially more ecologically relevant paradigm (i.e., foraging for food) than Experiment 1, while still controlling for overall reinforcement history of presented alternatives.

5.1 Subjects and housing

Testing began with two pair-housed crowned lemurs (*Eulemur coronatus;* 2 males; ages 6 and 15) and two pair-housed pied tamarins (*Saguinus bicolor*; 1 male, age 3; 1 female, age 15) housed at Lincoln Park Zoo (Chicago, IL). However, for both pairs, one animal monopolized the testing sessions throughout the course of the experiment. Therefore, only data from one lemur (Lenny, male, 6) and one tamarin (Izabel, female, 15) were analyzed for this experiment.

Both pairs had access to two indoor enclosures at the Lincoln Park Zoo Primate House: a public-facing habitat (14.5 m^2) which includes artificial trees and branches and other enrichment items, and a behind-the-scenes holding area. The lemurs had access to both their holding area and public habitat at all times, except during morning preparation and cleaning of their public habitat. The pied tamarins were kept on their public habitat from approximately 9 am – 3 pm daily and were kept in their holding area for the rest of the day and overnight. A Hoffmann’s two-toed sloth (*Choloepus hoffmanni)* shared the public habitat with the tamarins, but the sloth did not interact with any of the testing apparatuses. Testing took place in the public habitat between the hours of 9 am and 11 am. The building opened to zoo guests at 10 am, but most observations were complete by 10:15, before many guests arrived.

A diet of fresh fruit, vegetables, and monkey chow was provided daily, and was accessible to the animals via hanging feeders or free piles (lemurs) or in bowls covered by mesh with mesh coverings (tamarins). The animals had access to water *ad libitum*.

This study did not interfere with standard animal care routines or diets, and animals’ participation in the experiment was entirely voluntary. Paired individuals were not separated from one another during the course of the experiment. The study was approved by the Lincoln Park Zoo Research Committee and adhered to United States legal requirements and principles laid out in the American Society of Primatologists' Principles for the Ethical Treatment of Nonhuman Primates.

5.2 Apparatus

To reduce interference with zookeepers' daily husbandry responsibilities, the apparatus designed for this study was created as a set of drop-and-go items that could be baited, placed, and left within the enclosure during the day and required little-to-no animal training. Either or both individuals could interact with the apparatuses at will throughout the day. All materials used in the construction of the apparatus were pre-approved by the Lincoln Park Zoo veterinary staff.

The apparatus used in this study consisted of small puzzle boxes. These puzzle boxes were 5 in^3 (approx.) hollow cubes. The bases of the cubes were constructed from black ABS plastic squares (Interstate Plastics), and two transparent polycarbonate plastic doors (Interstate Plastics) were mounted at either end of the cube with metal brackets and bolts. Eyebolts protruded from each of the two lateral sides of the boxes, so that they could be attached via snap hooks to eyebolts in the habitat. Six boxes were mounted at various locations in the habitat on each testing day.

The design for these boxes were inspired by the 'artificial fruit' social learning tasks (e.g., Whiten et al., 1997), where puzzle boxes could be opened in two different ways, and naïve subjects (humans and chimpanzees) observed an actor opening the boxes using one mechanism or the other. Both humans and chimpanzees were most likely to employ the method utilized by the observed actor on their first attempt, although the social learning effect was stronger for humans than chimpanzees. This case also presents a status quo that is established through ‘cultural norms.’ However in the present experiment, rather than testing the role of social influences on the instantiation of a status quo, I aimed to instead investigate how an individual’s recent exposure to one particular opening mechanism would influence that animals’ likelihood of choosing that option.

Three different puzzle box types (“artificial fruits”) were included in the study. The Lift boxes could be opened by pulling from the bottom of the door(s) in an upward motion (the doors could not move side to side; Figure 18)[4]. The Slide boxes could be opened by pulling the doors from left to right (the doors could not move up and down; Figure 5.1). The Lift-or-Slide Boxes included a Lift door on one side of the box and a Slide door on the other side of the box (Figure 5.1). Furthermore, the Lift-or-Slide boxes could be partitioned by sliding an ABS plastic square into a gap locating in the center of the top panel of the cube. This allowed for baiting of individual sides (i.e., rewarding only one opening mechanism or the other) in control/exposure conditions. This plastic partition protruded from the top of the box and was visible at a distance. Therefore, for visual consistency across conditions that included the Lift-or-Slide box (some of which require the box to be divided and some of which require the box be undivided), a plastic partition piece was included in all Lift-or-Slide box conditions. However, in conditions in which the box was meant to be open all the way through (i.e., not divided into two compartments), the plastic pieces used to partition the box included large cutouts along the bottom. These pieces protruded from the top of the box and appeared whole from the exterior, but the cutouts along the bottom of the pieces allowed the interior of the boxes to have an opening all the way through.

---

[4] Initially, the lift boxes were constructed so that the door could be swung forward by pulling from the side or bottom of the door. However, during the exposure phase, the lemurs consistently opened the Lift boxes by pulling at the door from the left side. This movement mirrored the movement they used to open the Slide boxes. To ensure that the animals had to use two distinct and differentiable motions to open the different box types, the Lift boxes were modified so that they could not be opened from the sides and instead had to be slid upwards. Tamarins were only ever exposed to the modified version of the Lift boxes.

The Lift-or-Slide boxes that included an intact partition will be abbreviated from this point forward as LSWB (lift-slide-with-barrier), and the Lift-or-Slide boxes with the cut-out piece will be abbreviated from this point forward as LSO (lift-slide-open).

All boxes were painted using Krylon Fusion All-in-One spray paint (the doors on all boxes were left unpainted and transparent). The Lift boxes were painted a light green color with narrow dark blue stripes[5], the Slide boxes were painted black, and the Lift-or-Slide boxes (and their partitions) were painted green on the Lift side and black on the Slide side. These colors were chosen because they were visually distinct both in color (even to dichromatic vision) and in brightness, and could potentially be used as distant visual cues about which opening mechanism(s) was available. Boxes were baited with half raisins for tamarins, and whole raisins for lemurs (or two half raisins during lemur exposure with LSWB boxes).

---

[5] The stripes were added after modifying the Lift mechanism, as described on the previous page.

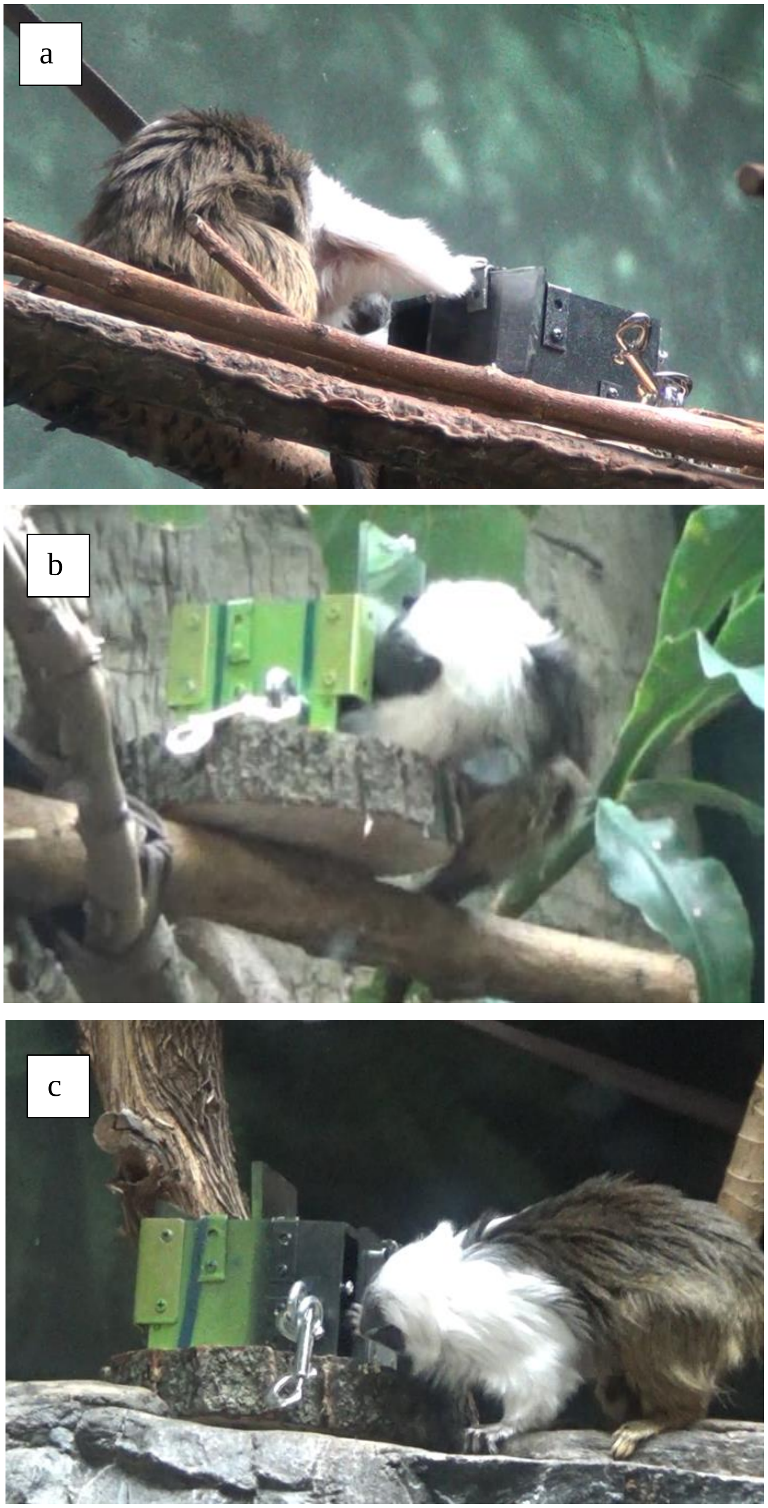


Figure 5.2. *Izabel opening a slide box (a), a lift box (b), and the slide side of a lift-or-slide (LSO or LSWB) box (c).*

5.3 General procedure

During normal morning husbandry procedures, before the zoo opened and while animals were in their holding cells off-exhibit, the zoo keepers baited and placed six boxes in six locations around the habitat(s). Keepers also baited other puzzle feeders and free-feeding locations within the habitat to ensure the animals received their full diet (raisins were reserved for the testing boxes).

Multiple video cameras, mounted on tripods, and a researcher were stationed on the public side of the habitat to record behavioral data. The researcher remained on-site to take live behavioral observations until all puzzle boxes were exhausted, or one hour had passed since the animals gained access to the boxes, whichever came first. Observations typically started between 9:00 and 9:30 am, and often ended before the building became open to the public at 10 am. The researcher recorded the identity of the individual who opened the box, the method in which the box is opened, and the approach angle (i.e., left or right).

Because it was not possible to separate the pairs for testing, it was initially planned to treat each pair as a single unit for methodological and analysis purposes. However, in both pairs, one individual dominated the testing session and monopolized the majority of the boxes. Therefore, all data from the secondary individual in each pair were ultimately dropped, and analyses were conducted for only one lemur and one tamarin.

5.4 Exposure phase

Before experimentation began, the animals were exposed to each of the box types (Lift, Slide, LSWB), and were given approximately equal experience with both opening mechanisms. At first introduction of each of the box types, the doors were propped open; over the course of the exposure phase, the boxes were adjusted until the animals could open them from a closed position. During the exposure phase, the LSWB was baited on both sides, in order to give the animals experience with opening a single box both ways. The exposure phase continued until both lemurs and the single tamarin who was engaging with the boxes had (a) been rewarded at all box types (Lift, Slide, LSWB); (b) been rewarded by using both mechanisms at least once on the LSWB boxes; (c) been rewarded for using both opening mechanisms (Lift, Slide) from an *unpropped* position at least twice; (d) had approached and opened boxes at every location from both sides at least once; and (e) the lift to slide opening ratio was approximately equal.

During the exposure phase, both lemurs were engaging with the boxes. Because the lemurs could not be separated, opening experience was balanced across the pair as a unit, but was not necessarily balanced for each individual. In total, the lemurs collectively experienced 32 rewarded lifts and 37 rewarded slides[6]. Only one tamarin, Izabel, was ever observed opening the puzzle boxes during the exposure phase, so exposure was controlled for her individually. She was observed to have experienced 25 rewarded lifts and 26 rewarded slides during the course of the exposure phase. Because Izabel was the only animal in the habitat who was engaging with the boxes, boxes that were not exhausted before the experimenter left but were exhausted by the end of the day (as reported by keepers) were assumed to be opened by Izabel, although this may not have been true. Including these assumed openings, Izabel experienced 33 rewarded lifts and 32 rewarded slides. Either way, this was a large enough number of rewarded lifts to ensure she had near equally exposure to both methods.

---

[6] Lemurs' experience was initially balanced for the slide mechanism and the original lift mechanism. After changing the lift mechanism (so that the door could not be pulled forward, only upwards), the lemurs experienced a run of exposure days with the new lift boxes, to balance for their pre-existing experience with the slide boxes. The experience with the original lift boxes was not included in data analyses.

5.5 Experimental phase

The purpose of this experiment was to determine whether introducing a status quo option would influence animals' action patterns. Specifically, I tested whether, after local exposure to one type of opening mechanism, the animals would continue to utilize that mechanism when provided with both options or if they would revert to their baseline preferences rather than the established status quo. This study was closely related to studies on habit strength and behavioral inflexibility (see Section 2.2). Habitual acts and behavioral inflexibility are examples of a status quo bias, reinforced by associative learning, reward history, and/or cultural norms within a group. However, this study differed from experiments on habit and behavioral inflexibility, because in this experiment, the animals started with equal exposure and training on all available options, and they had experience opening lift-or-slide puzzle boxes both ways.

First, animals' baseline preference rates for opening mechanism were gathered. Next, a status quo was introduced for several days, and the animals were tested on their opening mechanism preference. Then, the opposite mechanism was introduced as the status quo for several days, and the animals were tested on their opening mechanism preference again. The mechanism presented as the status quo was switched from week to week determine if the most recent status quo would influence animals' behavioral patterns, or if they would show consistent patterns that were unaffected by an established status quo.

5.5.1 Baseline condition

First, baseline measures of animals' opening preference on the LSO box were gathered (see Table 5.1). Following successful completion of the exposure phase, the animals experienced three consecutive days with no puzzle box exposure. On the fourth and fifth days, six lift-or-slide boxes were introduced into the enclosure (Table 5.1). Unlike the training phase, there was no barrier within the box on these days (i.e., LSO boxes); animals were only rewarded once, for whichever mechanism they chose to open the box first. The animals' choices on Days 4 and 5 (i.e., to lift or to slide) were recorded and used for baseline analyses.

On the sixth and seventh days, six more lift-or-slide boxes were reintroduced to the enclosure; on these days, the boxes included the full partition, separating each side (i.e., LSWB boxes). Each box was only be baited on one side of the barrier (the side that the animals chose against on Days 4 and 5), to control for opening experience. For example, if the animals chose to lift for all six boxes on Day 4 and slide for all six boxes on Day 5, then all boxes on Day 6 would have been baited on the slide side and all boxes on Day 7 would have been baited only on the lift side (See Table 9). This condition lasted for two consecutive weeks, such that the animals had 24 collective opportunities to open the LSO box using the method of their choosing, but also experienced a matched number of forced trials of opening a LSWB box using the other method[7]. This provided a baseline ratio for each animal's opening preference but also equated for experience, to help reduce the possibility of habit formation. The orientation of the boxes was balanced so that the Lift and Slide sides were each presented equally on either side at each location during the LSO preference testing days.

---

[7] Although efforts were made to control opening experience, several factors precluded me from being able to perfectly balance experience. For example, some days one or more LSO boxes had not yet been opened by the end of the observation hour. Only boxes that were opened during the hour-long observation period were matched on LSWB days; this means that any LSO boxes opened after the observation hour were not balanced with an LSWB box on the control day, and some control days only included four or five boxes instead of all six. Additionally, because animals were never separated, there was no way to control for opening experience for each animal individually. Finally, one lemur control day (following the second week of SQB testing [Section 5.5.2]) was cancelled due to inclement weather; the relevant LSO day for the lemurs included three slide openings, two lift openings, and one unopened box.

Table 5.1. One week of baseline condition testing. Days 1-3 in this condition act as a control (i.e., non-status-quo establishment) for Days 1-3 in Phase 2 of the experiment (i.e., status-quo establishment). Procedure described above will repeat for two consecutive weeks.

Day	*Apparatus*	*Purpose*
1	None	Omit status quo
2	None	Omit status quo
3	None	Omit status quo
4	LSO	Preference measure
5	LSO	Preference measure
6	LSWB	Control for opening experience from Day 4
7	LSWB	Control for opening experience from Day 5

5.5.2 Status quo condition

In this phase of the experiment, to induce a status quo, the animals were repeatedly exposed to one opening mechanism but not the other, and then tested on their preferred opening method when both options were again made available on puzzle boxes that could be opened either way (See Table 5.2). Because both animals demonstrated a preference for the Slide mechanism during the Baseline phase, the Lift mechanism was introduced first as the status quo for both species. On Days 1-3, the animals were provided only the lift boxes in their enclosure, such that they had 18 opportunities to open the boxes (six apparatuses available per day) using one specific method. On Day 4, the animals were provided with the LSO box, and they could have used either method in order to obtain the treat inside the box. Day 4 included the critical data that were used for analyses. Day 5 was meant to control for the experience in Day 4 by forcing the opposite choices with an interior barrier, as described in the previous section[8]. Animals did not receive any testing apparatuses on Days 6 and 7, to minimize possible carry-

---

[8] For the same reasons previously described, opening experience was balanced as much as possible but could not be perfectly controlled. Additionally, the lemur who was excluded from analyses for lack of participation early in the experiment showed increased interest as testing went on, particularly with Slide boxes. Therefore, the lemur ultimately included in analyses (Lenny) had fewer opportunities to open the Slide boxes during the status quo establishment phase than he did the Lift boxes during the status quo establishment phase. Since there is no theoretically valid or agreed-upon number of exposures that would constitute a status quo establishment, and because Lenny experienced exclusive exposure to the Slide mechanism during these exposure phases, and because there was no evidence that Lenny experienced a stronger status quo bias for Lift than for Slide, I did not have reason to believe that this discrepancy had any meaningful impact on the results.

over effects from week to week.

The second week of testing followed the same procedure as the first week, except that the ‘status quo’ was switched. That is, for Days 8-10, only slide boxes were provided in the animals’ enclosure. Then, on Day 11, I measured the animals’ opening preference with both options available (LSO boxes). Finally, I attempted to control for the test-day experience by rewarding only the alternative opening method the following day (LSWB boxes). The animals then received two “Recovery days” to reduce any established biases. Status quo testing continued for a total of six consecutive weeks, alternating which method was presented as the status quo each week, so that each option was presented as the status quo three times.

The orientation of the LSO boxes across locations was consistent throughout the experiment on preference testing days, so that potential side biases would not act as a confound. Slides and Lifts were equally distributed on preferred sides (preferred sides were determined based on proportional approaches to boxes from either side during the Exposure phase) on preference testing days (i.e., LSO boxes). Furthermore, any location for which the box was opened exclusively on one side during the testing week (e.g., Days 1-4) was baited on the opposite side on the control day (e.g., Day 5, LSWB boxes).

Table 5.2. Example of two weeks of status quo condition testing. Procedure will repeat across six consecutive weeks, so that each opening method is presented as the status quo three times.

Day	*Apparatus*	*Purpose*
1	Lift Box	Establish status quo
2	Lift Box	Establish status quo
3	Lift Box	Establish status quo
4	LSO Box	Preference measure
5	LSWB Box	Control for opening experience from Day 4
6	None	Recovery day
7	None	Recovery day
8	Slide Box	Establish status quo
9	Slide Box	Establish status quo
10	Slide Box	Establish status quo
11	LSO Box	Preference measure
12	LSWB Box	Control for opening experience from Day 11
13	None	Recovery day
14	None	Recovery day

6 EXPERIMENT 2: RESULTS

To investigate the possibility of a status quo bias, I measured the proportion of box openings in which the animals chose to lift or slide the LSO box following either (a) no status quo exposure [i.e., baseline condition], (b) exposure to a lift status quo, and (c) exposure to a slide status quo.

Although both Sokkwi and Lenny participated in the Exposure phase and met the criteria to move into the testing phase, Sokkwi did not open any boxes during the 2-week baseline period. Furthermore, Sokkwi’s engagement with the boxes waned as the Exposure phase went on, such that in the final weeks he was rarely opening any boxes, and seemed particularly averse to opening the Lift boxes (despite showing evidence of his ability to do so). For these reasons, Sokkwi was excluded from further data analyses. Izabel’s pairmate, Raimundo was only observed successfully opening boxes and retrieving rewards in the final week of Test phase, so subsequent analyses excluded Raimundo’s data. Only Lenny and Izabel’s data were included in final analyses.

6.1 Testing for a status quo bias

Both Lenny and Izabel opened more boxes using the slide mechanism (16 slides each) than the lift mechanism (6 lifts each) during the baseline condition, although two-tailed binomial probability tests revealed that this difference was not significantly different from a 50-50 chance ($p = .052$) for either animal.

Out of 15 total observed box openings following a *lift* status quo, Lenny chose to lift six times (40%) and slide nine times (60%). Out of 14 total box openings following a *slide* status quo, Lenny chose to lift seven times (50%) and slide seven times (50%). A Chi Square Test of Independence revealed that there was not a significant difference in Lenny's lift:slide ratio across the Baseline condition, the lift status quo condition, and the slide status quo condition ($X^2(2) = 1.96$, $p = .375$). In other words, Lenny did not show evidence of a status quo bias: his behavior did not significantly differ between the two different status quo conditions, suggesting that exposure to one status quo or the other did not influence his choice to lift or slide. His preferences across the two experimental conditions were not significantly different from his baseline preferences, suggesting that introducing a status quo was not enough to override or enhance his previously established preferences.

Out of the 13 total observed box openings following the *lift* status quo, Izabel chose to lift five times (38%) and slide eight times (62%). Out of the 14 total observed box openings following the slide status quo, Izabel chose to lift six times (43%) and slide eight times (57%). Similar to Lenny, a Chi Square Test of Independence revealed that there was not a significant difference in Izabel's lift:slide ratio across the Baseline condition, the lift status quo condition, and the slide status quo condition ($X^2(2) = 1.03$, $p = .598$), indicating that introducing a status quo did not significantly influence Izabel's choices to lift or slide.

6.2 Exploring the role of side biases

Because Lenny and Izabel did not show evidence of a status quo bias, I wanted to explore whether their behavior could be explained by a side bias. In support of this possibility, binomial probability tests revealed that approach angle influenced Lenny and Izabel's choices. Collapsed across the three conditions (Baseline, Lift status quo, Slide status quo), Lenny chose to open the box on his preferred side 38 times out of the 51 recorded box openings (75%), which was significantly different from a 50% chance ($p < .001$). Izabel chose to open the box on her preferred side 32 out of the 48 recorded box openings (67%), which was also significantly different from a 50% chance ($p = .029$).

Consequently, I conducted two binary logistic regressions, one for each animal, that included the mechanism available on the subject's preferred side (Lift available or Slide available) and the status quo condition (LiftSQ or SlideSQ) as categorical fixed factors, and mechanism chosen (Lift or Slide) as a binary outcome variable. Analyses were conducted in R (R Core Team, 2022), using the lme4 function (Bates et al., 2015). Including both factors in one model allowed me to investigate the relative influence of one factor while controlling for the other. I compared models using the Akaike information criterion with correction (AICc) values (Symonds & Moussalli, 2011) with the package AICcmodavg (Mazerolle, 2020). The best fitting models for Lenny's data and Izabel's data were ones that included only the approach predictor.

The resulting analyses indicated there was a significant effect of preferred side for Lenny but not for Izabel (Table 6.1). Lenny's odds of using the slide mechanism were ~16 times higher when a slide mechanism was on his preferred side compared to when a lift mechanism was on his preferred side ($p = .004$). The magnitude of this effect speaks to the strength of Lenny's side bias throughout the study. Izabel's odds of using the slide mechanism were nearly six times higher when a slide mechanism was on her preferred side compared to when a lift mechanism was on her preferred side, but this was not statistically significant (*p* = .059). However, given the limited power of the study considering small number of trials collected (*n* = 27), Izabel's six-fold increase in odds of sliding when slide was on the preferred side could be cautiously interpreted as evidence of a side bias.

Table 6.1. Lenny and Izabel's odds of choosing the slide mechanism when slide was on their preferred side. Abbreviations: OR, odds ratio.

	Lenny			Izabel		
Mech. on preferred side	*OR*	*95% CI*	p	*OR*	*95% CI*	p
Lift *(Reference level)*	-	-	-	-	-	-
Slide	15.75	[2.77 – 137.33]	.004	5.78	[1.06 – 46.74]	.059

In summary, neither Lenny nor Izabel exhibited a status quo bias in response to the experimentally manipulated status quo utilized in this study. A side bias could itself be evidence of a status quo bias, such that the animals may have instantiated their own status quo of approach angle by repeatedly utilizing certain paths or navigational patterns when maneuvering about their habitat. Indeed, throughout the course of the experiment, no measures were taken to control which sides of the boxes the animals were rewarded on. Therefore, during 'status quo establishment' days, as the animals gained repeated experience with opening the boxes using one mechanism (lift or slide), they may have also gained repeated experience with opening the boxes from one particular side. And although the mechanistic status quo was experimentally manipulated to alternate from week to week, no such experimental manipulation was in place for approach angle; therefore, the animals could have been continuously rewarded for opening the same side of the box throughout the entirety of the experiment. A future study could potentially reduce this confound by experimentally controlling the reinforcement rate for the opening mechanisms and the sides of the box simultaneously, or by utilizing uniform opening mechanisms and including approach angle as the experimentally manipulated status quo. However, it is likely animals' side biases are borne out of more general habitual navigational patterns in a familiar environment rather than reinforcement history specific to the boxes they encountered, in which case it may be more advantageous to test animals in unfamiliar environments where they are less likely to have established routes. From a practical application perspective, the results of this study emphasize the importance of considering the orientation of items placed in animal habitats, because animals' navigational habits can greatly influence the way in which they are willing to interact with items in their environment.

7 DISCUSSION

Across multiple experiments that used very different approaches and different species, primates in this study did not show evidence of a status quo bias (at least for the experimentally-manipulated status quo). However, null results must always be calibrated against the various methods by which it is possible to test a phenomenon. We know already that a status quo bias can manifest in many different ways in humans, some of which (habits, behavioral perseveration, the endowment effect) have already been documented in nonhuman primates. Therefore, a lack of a significant finding here does not mean that nonhuman primates are universally impervious to a status quo bias. On the contrary, we know that several primate species demonstrate a disproportionate preference for food items already in their possession compared to food items that are available upon making a trade (e.g., Brosnan et al., 2007); that they will continue using the same foraging methods even after observing others utilize a more efficient approach (e.g., Davis et al., 2016); and develop habits that influence their choices (Thorndike, 1911), all of which exemplify a preference to maintain the current state of affairs -- i.e., a status quo bias. However, the contexts presented in these experiments, which included providing monkeys with a ‘default’ choice and prolonged exposure to one alternative [Experiment 1] or recent experience engaging in one behavior [Experiment 2], did not evoke a status quo bias. Explanations and implications of these results are discussed below.

7.1 Experiment 1

The monkeys on the computer tasks did not demonstrate any evidence of a status quo bias; instead, they demonstrated (a) a preference to make choices from the SELECT menu, even when they chose a task that was already available as the default; (b) a preference for opting into their more preferred tasks over their less preferred tasks and (c), an aversion to engaging with one single task for extended runs, even if it was a highly preferred task. Although each of these findings contradict a status quo bias, they do give interesting insights about monkeys’ behaviors, and I will discuss each in turn below.

7.1.1 Monkeys preferred to make choices from the SELECT menu

Monkeys demonstrated a tendency to switch into a task (i.e., by choosing it from the SELECT menu), even when that task was already available as the default option. This pattern of behavior indicates there was something inherently preferable about making a ‘switch’ response over a ‘stay’ response that was separate from the tasks themselves. One possibility was that ‘staying’ cost more time and effort on a trial-by-trial basis than switching, due to the extra cursor navigation required on the choice trials that followed a ‘stay’ behavior (where the cursor generated in the cursor space and had to be moved up into the task space) compared to the forced runs that followed a ‘switch’ behavior (were the cursor generated in the task space). Monkeys included in a follow up study that controlled cursor effort did demonstrate a 11-12% lower probability of switching after shorter runs compared to the original study. However, the probability of switching after longer runs was approximately equal for both experiments (~92%

for high preference tasks and ~97% for low preference tasks). Furthermore, the switches observed in the follow up study were not exclusively switches into a new task: after incorporating switches-into-default as stay* responses and comparing this to switches-into-non-default-tasks (switches*), the analyses showed that monkeys were staying* and switching* at similar rates in both the follow up and the original experiment. Overall, this indicates that while the cursor effort discrepancy did have some impact on switching behavior, it is not the whole or only explanation, as monkeys were still choosing to switch at high rates (and switch into tasks that were already available as the default) even when cursor effort was balanced.

Another reason monkeys may have been choosing to switch-to-default rather than stay-with-default is because a switch behavior would automatically launch the monkeys into a continuous run of that task between 5 to 40 trials in length, whereas a stay behavior would only provide between 1 to 5 trials of that task. So, if monkeys wanted to maximize trials of a certain task, the logical response would be to switch into that task to receive more trials. The greatest maximization could be achieved by staying with the task until the last available stay trial and then switching, but that may have required a level of mechanistic comprehension and working memory beyond the monkeys' capacities. The results also indicate an upper limit to the number of trials monkeys wanted to engage with any one task (even one that is highly preferred) since they were more likely to stay* following a shorter run of a single task than a longer run, and even *more* likely to stay* following a run of a mix of tasks. Together, this points to intelligent choices on the monkeys' part, as it signals that they were aware of whether they just completed a long block versus a shorter block, or an Inertia block versus an Exposure block, and made choices that tended to give them more trials of their preferred task, but only so long as they had not done too many trials of that task already. A future study could explore monkeys' responses when the default task is removed as a choice from the menu, ruling out the possibility of opting into longer runs of that task by switching. If they then showed staying rates that were comparable to the staying* rates of the original experiment, it would suggest that monkeys were switching-to-default simply to maximize time spent in the task they wanted to be in (i.e., high preference, but conditional on a certain level of variety). However, if the monkeys continue to show a strong tendency to switch, even when they are not able to switch into their preferred task, it may indicate monkeys enjoy switching for the sake of switching.

Monkeys' disproportionate preference for switching could also result from a more general preference for choosing from the SELECT menu. Extensive research has demonstrated that animals highly value having choice and control, insofar as they will choose for the sake of choosing (i.e., outside of any real benefit of making a choice; e.g., Beran et al., 2007; Perdue & Brown, 2018). Although staying with a default task or choosing from the SELECT menu could both be considered active choices by the animals, choosing from the SELECT menu may have evoked a greater *perception of control* (see Perlmuter & Monty, 1977) than choosing to stay with the current task, and therefore made it the more valuable alternative. In other words, the appeal of control may have outweighed the appeal of any reduction in cognitive effort that may have been associated with sticking with the default option. One way to test this would be to more extensively train the monkeys to choose one of two symbols (stay or switch) that either then put them back into the task (stay), or then gave them the SELECT menu, or some random new task. This would allow a determination of whether being able to go into the SELECT menu had its own level of appeal when that menu appeared onscreen that may have overridden any status quo bias that might have existed.

A preference for active choice over inaction or default action, as shown by the monkeys in this study, would directly counteract a status quo bias, so the intersection of these two potential decision-making influencers (preference for control versus preference for a status quo) would be interesting to explore further. As an inherent consequence of living in captivity, the monkeys included this study have limited ability to make choices in their daily lives. And, although they spend hours every day (voluntarily) engaging with computer tasks, they rarely get the opportunity to choose *which* tasks they get to engage with. Therefore, given the opportunity to make a choice (i.e., from a SELECT menu), these monkeys may be less willing to give up that control (by sticking with the default option) than monkeys who regularly get to make such choices (i.e., hypothetical monkeys who have unlimited access to a SELECT menu), or who generally experience more autonomy, such as monkeys in the wild. Humans in Western and industrialized cultures, after all, are accustomed to having virtually limitless options available to them at all time (think Amazon.com); maybe the unlimited access to such endless alternatives makes the opportunity to make a ‘default’ response more appealing, or at least more acceptable. In other words, perhaps there could be a difference in the susceptibility to status quo bias based on experiential history of choice and control, or based on personality differences in need for control. This is merely speculation, and an interesting area for further research.

A final potential explanation for monkeys’ high switching preference is that monkeys prefer variety over monotony; this idea is discussed in more detail in section 7.1.3.

7.1.2 Monkeys chose their more preferred task over their less preferred tasks

Monkeys also showed a clear preference for their more preferred tasks over their less preferred tasks. This is not a surprising finding in and of itself, as one would expect anyone to choose the things they prefer more over the things they prefer less. In this study, a concerted effort was made to roughly equate the four tasks so that one was not objectively better than the others. I did this by including only simple, psychomotoric tasks that always ended in reward (i.e., they were impossible to 'get wrong'). All monkeys included in the final analyses were willing to engage with all of the tasks, even though completing trials was voluntarily and they have historically refused to complete trials of tasks they strongly dislike. Additionally, no monkey chose exclusively one task throughout the entirety of the experiment; and, across the ten individuals in the study, every task was represented at least once in both the high preference category and the low preference category, indicating that there was not a universally disliked task. Despite this, task preference had a large influence on choice behavior in this study.

The psychological inertia theory (Gal, 2006) posits that a status quo bias emerges when people have fuzzy, ill-defined preferences, and therefore are not motivated to make a change from a default option unless it is clearly inferior to the other alternatives. Although efforts were made to balance all tasks, and monkeys demonstrated willingness to engage with all tasks, their preferences were consistent, clear, and well-defined in this study. It is quite difficult to make monkeys demonstrate totally equivalent preferences across tasks (e.g., Englund & Beran, 2021). Perhaps, then, the methodology utilized in this experiment was not an effective or ecologically valid approach to measure fuzzy preferences, particularly for monkeys with many years (in some cases, decades) of experience in problem-solving and optimizing outcomes on computerized cognitive tasks such as the ones utilized here. Maybe it is the case that monkeys are generally less likely than humans to experience 'fuzzy preferences,' especially people in rich, industrialized countries who are often tasked with making rather arbitrary decisions (e.g., choosing which brand of face lotion out of dozens of available options). If so, it may also follow that monkeys may be less susceptible to a status quo bias, or at least when they are faced with fewer opportunities to make choices among fuzzy preferences. However, to my knowledge no study has explored whether monkeys may develop stronger or more consistent preferences than humans, and such a comparison would be difficult to quantify or interpret.

In past experiments (e.g., Englund & Beran, 2022), I have succeeded in equating task preferences by creating custom versions of each task for every monkey, where each task had three difficulty-levels (also titrated for each monkey individually), and each new trial of a task included one of the randomly generated difficulty levels. A future version of this study could include such customized parameters in order to ensure equivalence for all included tasks, which would allow for a better test of the effect of fuzzy preferences on a status quo bias. However, it is important to note that other studies have demonstrated that a status quo bias can persist even when there is a clearly inferior option (e.g., Suri et al., 2013). Therefore, it was plausible that a status quo bias could have emerged in this experiment, even if monkeys experienced a hierarchy of task preference.

7.1.3 Monkeys exhibited a preference for variety

Even though there was a clear distinction in behavior for higher preference and lower preference tasks, monkeys did not exclusively stick with their higher preference tasks. In fact, they showed an increased tendency to switch to a new task after runs of a single task type (even when it was a high preference task) compared after runs of a mix of task types; and, the longer the run, the higher the probability of switching. This suggests that there was an upper limit to the number of trials monkeys wanted to engage with any one task. In other words, monkeys specifically preferred variety over the status quo, which directly contradicts the hypothesis of this study.

Research on the mere exposure effect (Zajonc, 1968) indicates that simple, unreinforced exposure to a stimulus increases preference for that stimulus. This has been evidenced for a range of stimuli, including abstract shapes, food, sounds, faces, and people. More exposure to an option makes it more familiar and more accessible in memory (Bargh et al., 1988), which in turn ultimately leads to better judgment of that option (Higgens et al., 1977). Animals also demonstrate a mere exposure effect (see Hill, 1978). The mere exposure effect and its downstream processes have been proposed as the main mechanisms that lead to a bias for the status quo, because exposure to an option makes it automatically receive attention (whereas other options may be accidentally or intentionally ignored), more accessible in memory (thereby blocking the processing of alternatives), and become the anchor to which all other options are compared (Eidelman & Crandall, 2009).

Research has also demonstrated that, eventually, the mere exposure effect counteracts itself: after too much exposure to one stimulus, people tend to like it less (Bornstein et al., 1990). This is presumably what happened to the monkeys in this study: after extended exposure to one task, monkeys became under-stimulated (bored) and wanted to switch to something new. Little research has discussed the influence of overexposure, or boredom, on a status quo bias, but this study underscores its importance. A status quo bias may be more likely to develop after repeated *minimal* exposure to the same alternative, but it may decrease after *extended* exposure to that alternative. Samuelson and Zeckhauser (1988) use a hypothetical example of a man who orders the same lunch every day for 26 years as a model of status quo bias. However, we can imagine that that same person would not enjoy having that sandwich for every breakfast, lunch, and dinner every day. Indeed, doing so would likely make that person averse to the sandwich. For the monkeys in this experiment, even five consecutive trials of their higher preference task led to a

14% increase in switching* probability than runs of a variety of tasks. This speaks to monkeys' strong preference for variety over monotony (see Addessi et al., 2010), and draws attention to the importance of considering variety and duration of exposure when discussing the status quo bias.

Importantly, many status quo bias studies with humans use descriptions rather than direct exposure to establish a status quo, such that an alternative is *described* as being the existing state of affairs, rather than people experiencing it directly. This may be an important distinction between human and nonhuman animals' susceptibility to the status quo bias. Although humans and nonhuman animals may experience an initial increase and then decrease in a status quo bias a function of exposure to the status quo option, language may enable humans, but not nonhuman animals, to be able to conceptualize a long-standing status quo without ever personally experiencing it.

In support of this theory, there is evidence that humans are susceptible to a mere existence effect (Eidelman et al., 2009) such that people will infer goodness from (being told about something's) existence, without ever experiencing it. Furthermore, the longer that option is said to have existed, the more favorably it is judged (Eidelman et al., 2010). In this way, a mere existence bias may enable humans to experience a preference for an option borne out of familiarity in the same way that an early exposure effect does, but because they are not directly exposed to it, people are shielded from the boredom effects that come with too much experience with one option. Because nonhuman animals lack language, it is hard to imagine a situation where they may know about the existence of something without ever experiencing it. Therefore, nonhuman primates' status quo bias may only be evoked by some (but not too much) exposure to an option, whereas humans could experience a status quo bias anytime they were informed about an existing state of affairs. Finally, even in cases where humans do have extensive experience to a particular item, they may develop sentimental value for that item (Shu & Peck, 2011) in a way that nonhuman primates would not (as discussed in Brosnan et al., 2007), and this emotional attachment can reduce the possibility of an ‘overexposure’ effect and increase the probability status quo bias. Together, this could explain the widespread nature of a status quo bias in humans and the difficulty in testing and uncovering such a bias with nonhuman primates.

A future study could attempt to induce a status quo bias but avoid overexposure by minimally exposing monkeys to the tasks during testing days. That is, after a familiarization period where monkeys learn each of the tasks, on subsequent testing days, monkeys could be presented with only one or two trials of the task before being faced with a forced trial. This paradigm would specifically reveal whether monkeys would be more willing to stick with a task they just experienced for a brief time, even if it was less preferred, or if they would demonstrate a similar resistance to a status quo bias as exhibited in this study by choosing to automatically switch into a more preferred task.

7.2 Experiment 2

The crowned lemur and pied tamarin failed to develop a status quo bias for opening mechanism due to strong side biases: one animal showed a statistically significant side bias, and the other showed a numerically present side bias. These side biases could be considered byproducts of a status quo bias, resulting from self-instantiated approach angle status quos borne out of habitual navigation patterns. However, this finding does not add anything new to the literature, as there already exists extensive evidence demonstrating that animals develop habits that can be hard to untrain or overcome (Dickinson, 1985; Thorndike, 1911). The goal of the present manual experiment at the zoo was to determine whether a status quo bias would emerge even *after* balancing reinforcement history for both behaviors, and thereby reducing the likelihood of (strong) habit formation. It seems that though I may have succeeded in reducing habit formation for opening mechanism, I failed to reduce habit formation for approach preference, and this habit ultimately won out over any potential influence of the experimentally manipulated status quo establishment. It is a testament to the strength and pervasiveness of habits, and future studies should attempt to control for side biases, or take the opportunity to experimentally manipulate approach angle as the status quo.

7.3 Final comments

Past research has provided indirect evidence of status quo biases in nonhuman primates as evidenced through behavioral perseveration, endowment effects, and habitual behavior. We also know that nonhuman primates, like humans, can be neophobic and risk averse, which would promote the likelihood they maintain the current state of affairs. In the present experiments, I explored whether primates would exhibit a status quo bias beyond the influence of reinforcement history, when there were no switching costs or risks, and in tasks that did not involve an endowment or exchange. With the paradigms used in this study, the monkeys and lemurs did not exhibit a status quo bias for the experimentally manipulated status quo. This was in part due to methodological limitations (i.e., Experiment 2), where I failed to control for factors that eventually led to habitual behavior. However, in Experiment 1, monkeys exhibited behavioral patterns that directly contradicted the predictions in line with a status quo bias. The monkeys in this study showed a strong preference to make an active choice from the menu rather than to continue with a more passive option. They demonstrated rational rather than biased behavior by optimizing time in their more preferred tasks and minimizing time in their less preferred tasks, and they exhibited a decreased preference for options to which they had prolonged exposure. Perhaps, then, reinforcement history and switching costs could be the main driving factors for status-quo-bias-like behaviors in nonhuman animals, and without these factors they are likely to make rational decisions; but more research would be necessary to explore this possibility.

Future studies could examine whether monkeys would ever be willing to *give up* the opportunity to make a choice from a menu in favor of continuing with an option that they do not select from a menu, and if so, what contexts or experiences would lead to that preference. Additionally, a similar paradigm could be run again, but where task preference is more carefully equated, to gain a better understanding of the role of fuzzy preferences on status quo biases in nonhuman animals. Subsequent studies would have to greatly reduce the amount of exposure to any one task, as monkeys in this experiment demonstrated an overexposure effect for consecutive trials of the same task, even when it was a high preference task. Another potential fruitful line of research could be investigating different species of primates or other non-primate taxa and their propensity to demonstrate a status quo bias. The species included in this study were very similar to humans in that they live in groups with complex social dynamics, have varied diets, and evolved to inhabit heterogenous environments; therefore, they are accustomed to making complex choices and experiencing a certain amount of variety. Perhaps animals with less varied ecologies would be less likely to experience overexposure, for example, and therefore may be more prone to a status quo bias.

One implication of this study is the importance of considering the role of overexposure as it relates to the status quo bias; specifically, it demonstrates a clear case in which a status quo bias could be reduced. Research on the mere exposure effect shows that too much exposure leads to a decrease in preference for a task, and this effect would likely trickle down to diminish a person’s susceptibility to a status quo bias at increased exposure to one particular option -- yet this is rarely discussed in the status quo bias literature. These findings also underscore important differences in how human and animals may experience a status quo. Humans and animals alike can experience a status quo via direct exposure with a default option, and they may be influenced by factors such as reinforcement history or switching costs. However, humans are uniquely subject to the mere existence effect, such that they can experience a status quo through conceptualizing it, but never encountering it directly. Humans may also be more likely than animals to encounter choice scenarios for which they have fuzzy preferences, particularly in present day industrialized societies that provide virtually limitless alternatives with arbitrary differences. These factors, in addition to other human-unique qualities (e.g., market experience, rich sense of self, complex societal expectations, personal accountability for choices, and so on) could make humans more susceptible to a status quo bias, or at least more likely to encounter situations in which a status quo bias is likely to emerge, than nonhuman animals. However, more research is needed to gain a better understanding of how some of these other factors (e.g., limited exposure, fuzzy preferences, personal history of choice/autonomy, etc.) could influence nonhuman animals’ susceptibility to a status quo bias.

REFERENCES

Aarts, H., Verplanken, B., & van Knippenberg, A. (1997). Habit and information use in travel mode choices. *Acta Psychologica*, *96*, 1–14. https://doi.org/10.1016/S0001-6918(97)00008-5

Addessi, E., Mancini, A., Crescimbene, L., Ariely, D., & Visalberghi, E. (2010). How to spend a token? Trade-offs between food variety and food preference in tufted capuchin monkeys (Cebus apella). *Behavioural Processes*, *83*(3), 267–275.

Addessi, E., Beran, M. J., Bourgeois-Gironde, S., Brosnan, S. F., & Leca, J.B. (2020). Are the roots of human economic systems shared with non-human primates? *Neuroscience & Biobehavioral Reviews*, *109*, 1–15. https://doi.org/10.1016/j.neubiorev.2019.12.026

Allais, M. (1953). Le comportement de l'homme rationel devant le risque, critique des postulates et axiomes de l'école Américaine. *Econometrica*, *21*, 503–546. https://doi.org/10.2307/1907921

Anderson, C. J. (2003). The psychology of doing nothing: Forms of decision avoidance result from reason and emotion. *Psychological Bulletin*, *129*, 139–167. https://doi.org/10.1037/0033-2909.129.1.139

Apicella, C. L., Azevedo, E. M., Christakis, N. A., & Fowler, J. H. (2014). Evolutionary origins of the endowment effect: Evidence from hunter-gatherers. *American Economic Review*, *104*, 1793–1805. https://doi.org/10.1257/aer.104.6.1793

Arkes, H. R., & Blumer, C. (1985). The psychology of sunk cost. *Organizational Behavior and Human Decision Processes*, *35*, 124–140. https://doi.org/10.1016/0749-5978(85)90049-4

Asch, S. E. (1956). Studies of independence and conformity: I. A minority of one against a unanimous majority. *Psychological Monographs: General and Applied*, *70*, 1–70. https://doi.org/10.1037/h0093718

Ashby, N. J. S., & Teodorescu, K. (2019). The effect of switching costs on choice-inertia and its consequences. *PLOS ONE*, *14*, e0214098. https://doi.org/10.1371/journal.pone.0214098

Atkinson, M. M. (2011). Lindblom's lament: Incrementalism and the persistent pull of the status quo. *Policy and Society*, *30*, 9–18. https://doi.org/10.1016/j.polsoc.2010.12.002

Barber, S. J., Thomas, M., Seliger, J., Tellez, I., Kireeva, D., & Suri, G. (2018). *Age differences in psychological inertia* [Poster]. Cognitive Aging Conference, Atlanta, GA.

Bargh, J. A., Lombardi, W. J., & Higgins, E. T. (1988). Automaticity of chronically accessible constructs in person × situation effects on person perception: It's just a matter of time. *Journal of Personality and Social Psychology*, *55*, 599–605. https://doi.org/10.1037/0022-3514.55.4.599

Basalla, G. (1988). *The evolution of technology*. Cambridge University Press.

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, *67*, 1-48. https://doi.org/10.18637/jss.v067.i01

Battalio, R. C., Kagel, J. H., & MacDonald, D. N. (1985). Animals' choices over uncertain outcomes: Some initial experimental results. *The American Economic Review*, *75*, 597–613.

Beran, M., Klein, E., Evans, T., Antworth, R., & Chan, B. (2007). Perceived control, motivation, and task performance in capuchin monkeys. In P. R. Zelick (Ed.), *Issues in the Psychology of Motivation* (pp. 173–187). Nova Science Publishers, Inc.

Beran, M. J. (2017). To err is (not only) human: Fallibility as a window into primate cognition. *Comparative Cognition & Behavior Reviews*, *12*, 57–81. https://doi.org/10.3819/CCBR.2017.120006

Bernoulli, D. (1954) Exposition of a new theory on the measurement of risk. *Econometrica, 22*, 23-36. (Original work published 1738).

Betsch, T., Haberstroh, S., Glöckner, A., Haar, T., & Fiedler, K. (2001). The effects of routine strength on adaptation and information search in recurrent decision making. *Organizational Behavior and Human Decision Processes*, *84*, 23–53. https://doi.org/10.1006/obhd.2000.2916

Blanchard, T. C., Wolfe, L. S., Vlaev, I., Winston, J. S., & Hayden, B. Y. (2014). Biases in preferences for sequences of outcomes in monkeys. *Cognition*, *130*, 289–299. https://doi.org/10.1016/j.cognition.2013.11.012

Bond, R., & Smith, P. B. (1996). Culture and conformity: A meta-analysis of studies using Asch's (1952b, 1956) line judgment task. *Psychological Bulletin*, *119*, 111–137. https://doi.org/10.1037/0033-2909.119.1.111

Bornstein, R. F., Kale, A. R., & Cornell, K. R. (1990). Boredom as a limiting condition on the mere exposure effect. *Journal of Personality and Social Psychology, 58*, 791–800. https://doi.org/10.1037/0022-3514.58.5.791

Brehm, J. W. (1956). Postdecision changes in the desirability of alternatives. *The Journal of Abnormal and Social Psychology*, *52*, 384–389. https://doi.org/10.1037/h0041006

Breiman, L., Friedman, J. H., Olshen, R. A., & Stone, C. J. (1993). *Classification and regression trees*. Chapman & Hall. https://doi.org/10.1201/9781315139470

Brosnan, S. F. (2006a). Nonhuman species' reactions to inequity and their implications for fairness. *Social Justice Research*, 153–185. https://doi.org/10.1007/s11211-006-0002-z

Brosnan, S. F. (2006b). At a crossroads of disciplines. *Social Justice Research, 19*, 218–227. https://doi.org/10.1007/s11211-006-0003-y

Brosnan, S. F., Jones, O. D., Lambeth, S. P., Mareno, M. C., Richardson, A. S., & Schapiro, S. J. (2007). Endowment effects in chimpanzees. *Current Biology, 17*, 1704–1707. https://doi.org/10.1016/j.cub.2007.08.059

Brosnan, S. F., & Jones, O. D. (in press). Using an evolutionary approach to improve predictive ability in the social sciences: Property, the endowment effect, and law. *Evolution and Human Behavior*. https://doi.org/10.1016/j.evolhumbehav.2023.01.001

Chen, M. K., Lakshminarayanan, V., & Santos, L. R. (2006). How basic are behavioral biases? Evidence from capuchin monkey trading behavior. *Journal of Political Economy*, *114*, 517–537. https://doi.org/10.1086/503550

Chen, M. K., & Santos, L. R. (2006). Some thoughts on the adaptive function of inequity aversion: An alternative to Brosnan's social hypothesis. *Social Justice Research*, *19*, 201–207. https://doi.org/10.1007/s11211-006-0004-x

Coase, R. (1960). The problem of social cost. *Journal of Law & Economics*, *1*, 1–44.

Crandall, C. S., Eidelman, S., Skitka, L. J., & Morgan, G. S. (2009). Status quo framing increases support for torture. *Social Influence*, *4,* 1–10. https://doi.org/10.1080/15534510802124397

Crane, A. L., Brown, G. E., Chivers, D. P., & Ferrari, M. C. O. (2020). An ecological framework of neophobia: From cells to organisms to populations. *Biological Reviews*, *95*, 218–231. https://doi.org/10.1111/brv.12560

Csikszentmihalyi, M. (2000). *Beyond boredom and anxiety*.Jossey-Bass.

Davidai, S., Gilovich, T., & Ross, L. D. (2012). The meaning of default options for potential organ donors. *Proceedings of the National Academy of Sciences, 109*, 15201–15205. https://doi.org/10.1073/pnas.1211695109

Davies, M., & White, P. A. (1994). Use of the availability heuristic by children. *British Journal of Developmental Psychology*, *12*, 503–505. https://doi.org/10.1111/j.2044-835X.1994.tb00651.x

Davis, S. J., Schapiro, S. J., Lambeth, S. P., Wood, L. A., & Whiten, A. (2019). Behavioral conservatism is linked to complexity of behavior in chimpanzees (*Pan troglodytes*): Implications for cognition and cumulative culture. *Journal of Comparative Psychology*, *133*, 20–35. https://doi.org/10.1037/com0000123

Davis, S. J., Vale, G. L., Schapiro, S. J., Lambeth, S. P., & Whiten, A. (2016). Foundations of cumulative culture in apes: Improved foraging efficiency through relinquishing and combining witnessed behaviours in chimpanzees (*Pan troglodytes*). *Scientific Reports, 6*, 35953. https://doi.org/10.1038/srep35953

de Wit, S., Corlett, P. R., Fletcher, P. C., Dickinson, A., & Aitken, M. R. (2009). Differential engagement of the ventromedial prefrontal cortex by goal-directed and habitual behavior toward food pictures in humans. *Journal of Neuroscience, 29*, 11330–11338. https://doi.org/29(36):11330 –11338

Dean, L. G., Vale, G. L., Laland, K. N., Flynn, E., & Kendal, R. L. (2014). Human cumulative culture: A comparative perspective. *Biological Reviews*, *89*, 284–301. https://doi.org/10.1111/brv.12053

Dean, M., Kıbrıs, Ö., & Masatlioglu, Y. (2017). Limited attention and status quo bias. *Journal of Economic Theory*, *169*, 93–127. https://doi.org/10.1016/j.jet.2017.01.009

Diamond, A., & Kirkham, N. (2005). Not quite as grown-up as we like to think: Parallels between cognition in childhood and adulthood. *Psychological Science*, *16*, 291–297. https://doi.org/10.1111/j.0956-7976.2005.01530.x

Dickinson, A. (1985). Actions and habits: The development of behavioural autonomy. *Philosophical Transactions of the Royal Society of London Series B, Biological Sciences*, *308*, 67–78**.** https://doi.org/10.1098/rstb.1985.0010

Drayton, L. A., Brosnan, S. F., Carrigan, J., & Stoinski, T. S. (2013). Endowment effects in gorillas (*Gorilla gorilla*). *Journal of Comparative Psychology*, *127*, 365–369. https://doi.org/10.1037/a0031902

Ebbesen, E., & Konečni, V. (1975). Decision making and information integration in the courts: The setting of bail. *Journal of Personality and Social Psychology*, *32*, 805–821. https://doi.org/10.1037/0022-3514.32.5.805

Edwards, W. (1954). The theory of decision making. *Psychological Bulletin*, *51*, 380–417. https://doi.org/10.1037/h0053870

Egan, L. C., Bloom, P., & Santos, L. R. (2010). Choice-induced preferences in the absence of choice: Evidence from a blind two choice paradigm with young children and capuchin monkeys. *Journal of Experimental Social Psychology*, *46*, 204–207. https://doi.org/10.1016/j.jesp.2009.08.014

Egan, L. C., Santos, L. R., & Bloom, P. (2007). The origins of cognitive dissonance. Evidence from children and monkeys. *Psychological Science*, *18*, 978–983. https://doi.org/10.1111/j.1467-9280.2007.02012.x

Eidelman, S., & Crandall, C. S. (2009). A psychological advantage for the status quo. In J. T. Jost, A. C. Kay, & H. Thorisdottir (Eds.), *Social and psychological bases of ideology and system justification* (pp. 85–106). Oxford University Press. https://doi.org/10.1093/acprof:oso/9780195320916.003.004

Eidelman, S., & Crandall, C. S. (2012). Bias in favor of the status quo. *Social & Personality Psychology Compass*, *6*, 270–281. https://doi.org/10.1111/j.1751-9004.2012.00427.x

Eidelman, S., Crandall, C. S., & Pattershall, J. (2009). The existence bias. *Journal of Personality and Social Psychology*, *97*, 765–775. https://doi.org/10.1037/a0017058

Eidelman, S., Pattershall, J., & Crandall, C. S. (2010). Longer is better. *Journal of Experimental Social Psychology*, *46*, 993–998. https://doi.org/10.1016/j.jesp.2010.07.008

Ellsberg, D. (1961). Risk, ambiguity, and the Savage axioms. *Quarterly Journal of Economics*, *75*, 643–699. https://doi.org/10.2307/1884324

Englund, M. D., & Beran, M. J. (2022). No evidence of the choice overload effect in a computerized paradigm with rhesus macaques (*Macaca mulatta*) and capuchin monkeys (*Sapajus apella*). *Behavioural Processes*, *194*, 1–6. https://doi.org/10.1016/j.beproc.2021.104545

Evans, J. St. B. T., & Stanovich, K. E. (2013). Dual-process theories of higher cognition: Advancing the debate. *Perspectives on Psychological Science*, *8*, 223–241. https://doi.org/10.1177/1745691612460685

Evans, T. A., Beran, M. J., Chan, B., Klein, E. D., & Menzel, C. R. (2008). An efficient computerized testing method for the capuchin monkey (*Cebus apella*): Adaptation of the LRC-CTS to a socially housed nonhuman primate species. *Behavior Research Methods*, *40*, 590–596. https://doi.org/10.3758/BRM.40.2.590

Feldman, G., Kutscher, L., & Yay, T. (2020). Omission and commission in judgment and decision making: Understanding and linking action-inaction effects using the concept of normality. *Social & Personality Psychology Compass*, *14*, 1–15. https://doi.org/10.1111/spc3.12557

Festinger, L. (1957). *A theory of cognitive dissonance*. Stanford University Press.

Festinger, L., & Carlsmith, J. M. (1959). Cognitive consequences of forced compliance. *The Journal of Abnormal and Social Psychology*, *58*, 203–210. https://doi.org/10.1037/h0041593

Fleming, S. M., Thomas, C. L., & Dolan, R. J. (2010). Overcoming status quo bias in the human brain. *Proceedings of the National Academy of Sciences of the United States of America*, *107*, 6005–6009. https://doi.org/10.1073/pnas.0910380107

Flemming, T. M., Jones, O. D., Mayo, L., Stoinski, T., & Brosnan, S. F. (2012). The endowment effect in orangutans. *International Journal of Comparative Psychology*, *25*, 285–298.

Frank, T. (2007). *What's the matter with Kansas?: How conservatives won the heart of America*. Picador.

Friedman, M., & Savage, L. J. (1948). The utility analysis of choices involving risk. *Journal of Political Economy*, *56*, 279–304. https://doi.org/10.1086/256692

Gal, D. (2006). A psychological law of inertia and the illusion of loss aversion. *Judgment and Decision Making*, *1*, 23–32.

Gal, D., & Rucker, D. D. (2018). The loss of loss aversion: Will it loom larger than its gain? *Journal of Consumer Psychology*, *28*, 497–516. https://doi.org/10.1002/jcpy.1047

German, T. P., & Barrett, H. C. (2005). Functional fixedness in a technologically sparse culture. *Psychological Science*, *16*, 1–6. https://doi.org/10.1111/j.0956-7976.2005.00771.x

Gigerenzer, G., & Gaissmaier, W. (2011). Heuristic decision making. *Annual Review of Psychology*, *62*, 451–482. https://doi.org/10.1146/annurev-psych-120709-145346

Gigerenzer, G., Todd, P. M., & The ABC Research Group. (1999). Fast and frugal heuristics: The adaptive toolbox. In G. Gigerenzer, P. M. Todd, & The ABC Research Group (Eds.), *Simple heuristics that make us smart* (pp. 3–34). Oxford University Press.

Godefroid, M.-E., Plattfaut, R., & Niehaves, B. (2022). How to measure the status quo bias? A review of current literature. *Management Review Quarterly*. https://doi.org/10.1007/s11301-022-00283-8

Goldstein, D. G., & Gigerenzer, G. (2002). Models of ecological rationality: The recognition heuristic. *Psychological Review*, *109*, 75–90. https://doi.org/10.1037/0033-295X.109.1.75

Gopnik, a., Griffiths, T. L., & Lucas, C. G. (2015). When younger learners can be better (or at least more open-minded) than older ones. *Current Directions in Psychological Science*, *24*, 87–92. https://doi.org/10.1177/0963721414556653

Gruber, T. (2016). Great apes do not learn novel tool use easily: Conservatism, functional fixedness, or cultural influence? *International Journal of Primatology*, *37*, 296–316. https://doi.org/10.1007/s10764-016-9902-4

Gualtieri, S., & Denison, S. (2018). The development of the representativeness heuristic in young children. *Journal of Experimental Child Psychology*, *174*, 60–76. https://doi.org/10.1016/j.jecp.2018.05.006

Gunaydin, G., Selcuk, E., Yilmaz, C., & Hazan, C. (2018). I have, therefore I love: Status quo preference in mate choice. *Personality and Social Psychology Bulletin*, *44*, 589–600. https://doi.org/10.1177/0146167217746339

Harmon-Jones, E., & Mills, J. (1999). An introduction to cognitive dissonance theory and an overview of current perspectives on the theory. In Harmon-Jones & J. Mills (Eds.), *Cognitive dissonance: Progress on a pivotal theory in social psychology* (pp. 3–21). American Psychological Association. https://doi.org/10.1037/10318-001

Hartman, R. S., Doane, M. J., & Woo, C.-K. (1991). Consumer rationality and the status quo. *The Quarterly Journal of Economics*, *106*, 141–162. https://doi.org/10.2307/2937910

Heath, M. (2009). Cognition in Aristotle's Poetics. *Mnemosyne*, *62*, 51–75. https://doi.org/10.1163/156852508X252876

Higgins, E. T., Rholes, W. S., & Jones, C. R. (1977). Category accessibility and impression formation. *Journal of Experimental Social Psychology*, *13*, 141–154. https://doi.org/10.1016/S0022-1031(77)80007-3

Hill, W. F. (1978). Effects of mere exposure on preferences in nonhuman mammals. *Psychological Bulletin*, *85*, 1177–1198. https://doi.org/10.1037/0033-2909.85.6.1177

Hintze, A., Olson, R. S., Adami, C., & Hertwig, R. (2015). Risk sensitivity as an evolutionary adaptation. *Scientific Reports, 5*, 8242. https://doi.org/10.1038/srep08242

Hrubesch, C., Preuschoft, S., & van Schaik, C. (2008). Skill mastery inhibits adoption of observed alternative solutions among chimpanzees (*Pan troglodytes*). *Animal Cognition*, *12*, 209. https://doi.org/10.1007/s10071-008-0183-y

Hull, C. L. (1943). *Principles of behavior: An introduction to behavior theory*. Appleton-Century.

Jacobs, J. E., & Potenza, M. (1991). The use of judgment heuristics to make social and object decisions: A developmental perspective. *Child Development*, *62*, 166–178. https://doi.org/10.2307/1130712

Jaeger, C. B., Brosnan, S. F., Levin, D. T., & Jones, O. D. (2020). Predicting variation in endowment effect magnitudes. *Evolution and Human Behavior*, *41*, 253–259. https://doi.org/10.1016/j.evolhumbehav.2020.04.002

James, W. (1890). *The principles of psychology*. Henry Holt and Company.

Jones, O. D. (2001). Time-shifted rationality and the Law of Law's Leverage: Behavioral economics meets behavioral biology. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.249419

Jost, J. T. (2006). The end of the end of ideology. *American Psychologist*, *61*, 651–670. https://doi.org/10.1037/0003-066X.61.7.651

Jost, J. T., & Banaji, M. R. (1994). The role of stereotyping in system-justification and the production of false consciousness. *British Journal of Social Psychology*, *33*, 1–27. https://doi.org/10.1111/j.2044-8309.1994.tb01008.x

Kagel, J. H., MacDonald, D. N., & Battalio, R. C. (1990). Tests of "fanning out" of indifference curves: Results from animal and human experiments. *The American Economic Review*, *80*, 912–921. https://www.jstor.org/stable/2006716

Kahneman, D., Knetsch, J. L., & Thaler, R. H. (1990). Experimental tests of the endowment effect and the Coase theorem. *Journal of Political Economy*, *98*, 1325–1348. https://doi.org/10.1086/261737

Kahneman, D., Knetsch, J. L., & Thaler, R. H. (1991). The endowment effect, loss aversion, and status quo bias. *Journal of Economic Perspectives*, *5*, 193–206. https://doi.org/10.1257/jep.5.1.193

Kahneman, D., & Tversky, A. (1973). On the psychology of prediction. *Psychological Review*, *80*, 237–251. https://doi.org/10.1037/h0034747

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica: Journal of the Econometric Society*, *47*, 263–292. https://doi.org/10.2307/1914185

Kahneman, D., & Tversky, A. (1982). The psychology of preferences. *Scientific American*, *246*, 160–173. https://doi.org/10.1038/scientificamerican0182-160

Kakinohana, R. K., Pilati, R., & Klein, R. A. (2023). Does anchoring vary across cultures? Expanding the Many Labs analysis. *European Journal of Social Psychology*, *53*, 585–594. https://doi.org/10.1002/ejsp.2924

Kanngiesser, P., Santos, L. R., Hood, B. M., & Call, J. (2011). The limits of endowment effects in great apes (*Pan paniscus*, *Pan troglodytes*, *Gorilla gorilla*, *Pongo pygmaeus*). *Journal of Comparative Psychology*, *125*, 436–445. https://doi.org/10.1037/a0024516

Keltner, D., & Robinson, R. J. (1997). Defending the status quo: Power and bias in social conflict. *Personality and Social Psychology Bulletin*, *23*, 1066–1077. https://doi.org/10.1177/01461672972310007

Knetsch, J. L. (1989). The endowment effect and evidence of nonreversible indifference curves. *The American Economic Review*, *79*, 1277–1284. https://doi.org/10.1017/CBO9780511803475.010

Kristensen, A. R., Jørgensen, E., & Toft, N. (2009). *Herd management science I: Basic concepts*. University of Copenhagen, Department of Large Animal Sciences.

Lakshminaryanan, V., Keith Chen, M., & Santos, L. R. (2008). Endowment effect in capuchin monkeys. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *363*, 3837–3844. https://doi.org/10.1098/rstb.2008.0149

Langer, E. J., & Rodin, J. (1976). The effects of choice and enhanced personal responsibility for the aged: A field experiment in an institutional setting. *Journal of Personality and Social Psychology*, *34*, 191–198. https://doi.org/10.1037/0022-3514.34.2.191

Lehman, H. C. (1947). The exponential increase of man's cultural output. *Social Forces*, *25*, 281–290.

Lehner, S. R., Burkart, J. M., & van Schaik, C. P. (2011). Can captive orangutans (*Pongo pygmaeus abelii*) be coaxed into cumulative build-up of techniques? *Journal of Comparative Psychology*, *125*, 446–455. https://doi.org/10.1037/a0024413

Leotti, L. A., Iyengar, S. S., & Ocsher, K. N. (2010). Born to choose: The origins and value of the need for control. *Trends in Cognitive Sciences*, *14*, 457–463. https://doi.org/10.1016/j.tics.2010.08.001

Luchins, A. S. (1942). Mechanization in problem solving: The effect of Einstellung. *Psychological Monographs*, *54*, 1–95. https://doi.org/10.1037/h0093502

Marshall-Pescini, S., & Whiten, A. (2008). Chimpanzees (*Pan troglodytes*) and the question of cumulative culture: An experimental approach. *Animal Cognition*, *11*, 449–456. https://doi.org/10.1007/s10071-007-0135-y

Masatlioglu, Y., & Ok, E. A. (2014). A canonical model of choice with initial endowments. *The Review of Economic Studies*, *81*, 851–883. https://doi.org/10.1093/restud/rdt037

Mazerolle, M. J. (2020). Model selection and multimodel inference using the AICcmodavg package. *R Package Version 2.3-1*. https://cran.r-project.org/package=AICcmodavg.

McDermott, R., Fowler, J. H., & Smirnov, O. (2008). On the evolutionary origin of prospect theory preferences. *The Journal of Politics*, *70*, 335–350. https://doi.org/10.1017/S0022381608080341

Miller, K. J., Ludvig, E. A., Pezzulo, G., & Shenhav, A. (2018). Realigning models of habitual and goal-directed decision-making. In R. Morris, A. Bornstein, & A. Shenhav (Eds.), *Goal-directed decision making* (pp. 407–428). Elsevier. https://doi.org/10.1016/B978-0-12-812098-9.00018-8

Miller, K. J., Shenhav, A., & Ludvig, E. A. (2019). Habits without values. *Psychological Review*, *126*, 292–311. https://doi.org/10.1037/rev0000120

Mrkva, K., Johnson, E. J., Gächter, S., & Herrmann, A. (2020). Moderating loss aversion: Loss aversion has moderators, but reports of its death are greatly exaggerated. *Journal of Consumer Psychology*, *30*, 407–428. https://doi.org/10.1002/jcpy.1156

Nakamura, J. & Csikszentmihalyi, M. (2001). The concept of flow. In C. R. Snyder & S. J. Lopez (Eds.), *Handbook of positive psychology* (pp. 89–105). Oxford University Press.

Neipp, J., & Zeckhauser, R. (1985). Persistence in the choice of health plans. In R. Scheffler & L. Rossiter (Eds.), *Advances in health economics and health services research* (Vol. 6, pp. 47-72). JAI Press.

Novemsky, N., & Kahneman, D. (2005). The boundaries of loss aversion. *Journal of Marketing Research*, *42*, 119–128. https://doi.org/10.1509/jmkr.42.2.119.62292

O’Brien, L. T., & Crandall, C. S. (2005). Perceiving self-interest: Power, ideology, and maintenance of the status quo. *Social Justice Research*, *18*, 1–24. https://doi.org/10.1007/s11211-005-3368-4

Perdue, B., & Brown, E. (2018). Irrational choice behavior in human and non-human primates. *Animal Cognition*, *21*, 227–234. https://doi.org/10.1007/s10071-017-1156-9

Perlmuter, L. C., & Monty, R. A. (1977). The importance of perceived control: fact or fantasy? Experiments with both humans and animals indicate that the mere illusion of control significantly improves performance in a variety of situations. *American Scientist*, *65*, 759–765.

Pope, S. M., Fagot, J., Meguerditchian, A., Watzek, J., Lew-Levy, S., Autrey, M. M., & Hopkins, W. D. (2020). Optional-switch cognitive flexibility in primates: Chimpanzees' (Pan troglodytes) intermediate susceptibility to cognitive set. *Journal of Comparative Psychology*, *134*, 98–109. https://doi.org/10.1037/com0000194

Pope, S. M., Meguerditchian, A., Hopkins, W. D., & Fagot, J. (2015). Baboons (*Papio papio*), but not humans, break cognitive set in a visuomotor task. *Animal Cognition*, *18*, 1339–1346. https://doi.org/10.1007/s10071-015-0904-y

R Core Team. (2022). R: A language and environment for statistical computing. https://www.R-project.org

Rachlin, H., Logue, A., Gibbon, J., & Frankel, M. (1986). Cognition and behavior in studies of choice. *Psychological Review*, *93*, 33–45. https://doi.org/10.1037/0033-295X.93.1.33

Reason, J. T. (1979). Actions not as planned: The price of automatization. In G. Underwood & R. Stevens (Eds.), *Aspects of consciousness* (pp. 67–89). Academic.

Richardson, W. K., Washburn, D. A., Hopkins, W. D., Savage-Rumbaugh, S. E., & Rumbaugh, D. M. (1990). The NASA/LRC computerized test system. *Behavior Research Methods, Instruments, & Computers*, *22*, 127–131. https://doi.org/10.3758/BF03203132

Ritov, I., & Baron, J. (1992). Status-quo and omission biases. *Journal of Risk & Uncertainty*, *5*, 49–61. https://doi.org/10.1007/BF00208786

Robinson, R. J., & Keltner, D. (1996). Much ado about nothing? Revisionists and traditionalists choose an introductory English syllabus. *Psychological Science*, *7*, 18–24. https://doi.org/10.1111/j.1467-9280.1996.tb00661.x

Rosati, A. G., & Hare, B. (2011). Chimpanzees and bonobos distinguish between risk and ambiguity. *Biology Letters*, *7*, 15–18. https://doi.org/10.1098/rsbl.2010.0927

Rosati, A. G., & Hare, B. (2012). Decision-making across social contexts: Competition increases preferences for risk in chimpanzees and bonobos. *Animal Behaviour, 84*, 869–879. https://doi.org/10.1016/j.anbehav.2012.07.010

Rosati, A. G., & Hare, B. (2013). Chimpanzees and bonobos exhibit emotional responses to decision outcomes. *PLOS ONE, 8*, e63058. https://doi.org/10.1371/journal.pone.0063058

Ruh, N., Cooper, R. P., & Mareschal, D. (2010). Action selection in complex routinized sequential behaviors. *Journal of Experimental Psychology: Human Perception and Performance*, *36*, 955–975. https://doi.org/10.1037/a0017608

Samuelson, W., & Zeckhauser, R. (1988). Status quo bias in decision making. *Journal of Risk and Uncertainty*, *1*, 7–59. https://doi.org/10.1007/BF00055564

Santos, L., & Lakshminarayanan, V. (2008). Innate constraints on judgment and decision-making? Insights from children and nonhuman primates. In P. Carruthers, S. Laurence, & S. Stich (Eds.), *The innate mind, Volume 3: Foundations and the future* (pp. 293–310). Oxford University Press. https://doi.org/10.1093/acprof:oso/9780195332834.001.0001

Santos, L. R., & Rosati, A. G. (2015). The evolutionary roots of human decision making. *Annual Review of Psychology*, *66*, 321–347. https://doi.org/10.1146/annurev-psych-010814-015310

Schooler, L. J., & Hertwig, R. (2005). How forgetting aids heuristic inference. *Psychological Review*, *112*, 610–628. https://doi.org/10.1037/0033-295X.112.3.610

Schweitzer, M. (1994). Disentangling status quo and omission effects: An experimental analysis. *Organizational Behavior and Human Decision Processes*, *58*, 457–476. https://doi.org/10.1006/obhd.1994.1046

Seligman, M. E., & Maier, S. F. (1967). Failure to escape traumatic shock. *Journal of Experimental Psychology*, *74*, 1–9. https://doi.org/10.1037/h0024514

Shin, J., & Ariely, D. (2004). Keeping doors open: The effect of unavailability on incentives to keep options viable. *Management Science, 50*, 575–586. https://doi.org/10.1287/mnsc.1030.0148

Shu, S. B., & Peck, J. (2011). Psychological ownership and affective reaction: Emotional attachment process variables and the endowment effect. *Journal of Consumer Psychology*, *21*, 439–452. https://doi.org/10.1016/j.jcps.2011.01.002

Silberberg, A., Roma, P. G., Huntsberry, M. E., Warren-Boulton, F. R., Sakagami, T., Ruggiero, A. M., & Suomi, S. J. (2008). On loss aversion in capuchin monkeys. *Journal of the Experimental Analysis of Behavior*, *89*, 145–155. https://doi.org/10.1901/jeab.2008.89-145

Simon, H. A. (1955). A behavioral model of rational choice. *The Quarterly Journal of Economics*, *69*, 99–118. https://doi.org/10.2307/1884852

Slovic, P., Finucane, M. L., Peters, E., & MacGregor, D. G. (2007). The affect heuristic. *European Journal of Operational Research*, *177*, 1333–1352. https://doi.org/10.1016/j.ejor.2005.04.006

Smith, H. D. (1999). Use of the anchoring and adjustment heuristic by children. *Current Psychology*, *18*, 294–300. https://doi.org/10.1007/s12144-999-1004-4

Smith, J. D., Church, B. A., Beran, M. J., & Washburn, D. A. (2018). Meta-Cognition. In J. Vonk & T. Shackelford (Eds.), *Encyclopedia of Animal Cognition and Behavior* (pp. 1–18). Springer International Publishing. https://doi.org/10.1007/978-3-319-47829-6_1822-1

Spina, R. R., Ji, L.-J., Guo, T., Zhang, Z., Li, Y., & Fabrigar, L. (2009). Cultural differences in the representativeness heuristic: Expecting a correspondence in magnitude between cause and effect. *Personality and Social Psychology Bulletin*, *36*, 583–597. https://doi.org/10.1177/0146167210368278

Suri, G., Sheppes, G., Schwartz, C., & Gross, J. J. (2013). Patient inertia and the status quo bias: When an inferior option is preferred. *Psychological Science*, *24*, 1763–1769. https://doi.org/10.1177/0956797613479976

Sunstein, C. R. (2004). Precautions Against What? The availability heuristic and cross-cultural risk perceptions. *SSRN Electronic Journal*, *57*. https://doi.org/10.2139/ssrn.578303

Symonds, M. R. E., & Moussalli, A. (2011). A brief guide to model selection, multimodel inference and model averaging in behavioural ecology using Akaike's information criterion. *Behavioral Ecology and Sociobiology*, *65*, 13–21. https://doi.org/10.1007/s00265-010-1037-6

Thaler, R. (1980). Toward a positive theory of consumer choice. *Journal of Economic Behavior & Organization*, *1*, 39–60. https://doi.org/10.1016/0167-2681(80)90051-7

Thorndike, E. (1898). Animal intelligence: An experimental study of the associative processes in animals. *Psychological Monographs: General and Applied*, *2*, 1–109.

Thorndike, E. (1911). *Animal intelligence: Experimental studies*. Macmillan.

Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science*, *185*, 1124–1131. https://doi.org/10.1126/science.185.4157.1124

Tykocinski, O. E., Pittman, T. S., & Tuttle, E. E. (1995). Inaction inertia: Foregoing future benefits as a result of an initial failure to act. *Journal of Personality and Social Psychology*, *68*, 793–803. https://doi.org/10.1037/0022-3514.68.5.793

Vale, G. L., Davis, S. J., van de Waal, E., Schapiro, S. J., Lambeth, S. P., & Whiten, A. (2017). Lack of conformity to new local dietary preferences in migrating captive chimpanzees. *Animal Behaviour*, *124*, 135–144. https://doi.org/10.1016/j.anbehav.2016.12.007

von Neumann, J., & Morgenstern, O. (1947). *Theory of games and economic behavior* (2nd ed.). Princeton University Press. https://doi.org/10.1515/9781400829460

Washburn, D. A., Hopkins, W. D., & Rumbaugh, D. M. (1991). Perceived control in rhesus monkeys (*Macaca mulatta*): Enhanced video-task performance. *Journal of Experimental Psychology: Animal Behavior Processes*, *17*, 123–129. https://doi.org/10.1037/0097-7403.17.2.123

Watson, S. K., Lambeth, S. P., Schapiro, S. J., & Whiten, A. (2018). Chimpanzees prioritise social information over pre-existing behaviours in a group context but not in dyads. *Animal Cognition*, *21*, 407–418. https://doi.org/10.1007/s10071-018-1178-y

Watzek, J., Pope, S. M., & Brosnan, S. F. (2019). Capuchin and rhesus monkeys but not humans show cognitive flexibility in an optional-switch task. *Scientific Reports*, *9*, 13195. https://doi.org/10.1038/s41598-019-49658-0

West, S., Jett, S. E., Beckman, T., & Vonk, J. (2010). The phylogenetic roots of cognitive dissonance. *Journal of Comparative Psychology*, *124*, 425–432. https://doi.org/10.1037/a0019932

Whiten, A., Custance, D., Gomez, J.-C., Teixidor, P., & Bard, K. (1996). Imitative learning of artificial fruit processing in children (Homo sapiens) and chimpanzees (Pan troglodytes). *Journal of Comparative Psychology*, *110*, 3–14. https://doi.org/10.1037/0735-7036.110.1.3

Whiten, A., McGuigan, N., Marshall-Pescini, S., & Hopper, L. M. (2009). Emulation, imitation, over-imitation and the scope of culture for child and chimpanzee. *Philosophical*

Transactions of the Royal Society B: Biological Sciences, *364*, 2417–2428. https://doi.org/10.1098/rstb.2009.0069

Willig, R. D. (1976). Consumer’s surplus without apology. *The American Economic Review*, *66*, 589–597.

Wood, W., Quinn, J. M., & Kashy, D. A. (2002). Habits in everyday life: Thought, emotion, and action. *Journal of Personality and Social Psychology*, *83*, 1281–1287. https://doi.org/10.1037//0022-3514.83.6.1281

Wood, W., & Rünger, D. (2016). Psychology of habit. *Annual Review of Psychology*, *67*, 289–314. https://doi.org/10.1146/annurev-psych-122414-033417

Wu, G., Zhang, J., & Gonzalez, R. (2004). Decision under risk. In D. J. Koehler & N. Harvey (Eds.), *Blackwell handbook of judgment and decision making* (pp. 399–423). Blackwell Publishing Ltd. https://doi.org/10.1002/9780470752937.ch20

Xiao, Q., Piara, M., Lam, C. S., & Feldman, G. (2021). Revisiting the status quo bias: Replication of Samuelson and Zeckhauser (1988). *Metapsychology*, *5*, 1–21. https://doi.org/10.15626/MP.2020.2470

Zajonc, R. B. (1968). Attitudinal effects of mere exposure. *Journal of Personality and Social Psychology*, *9*, 1–27. https://doi.org/10.1037/h0025848