Description-experience gap in choice deferral

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Abstract

Facing a large set of alternatives has previously been reported to lead to choice overload, including choice deferral. Recent studies, however, imply that choice deferral is more tightly associated with the difficulty in evaluating alternatives than with set size: when alternatives are difficult to evaluate, people often defer a choice. This implication is examined in the present study, using alternatives with probabilistic pay-offs in two paradigms: the description paradigm — with full probability and pay-off information provided at one time — and the sampling paradigm — with search revealing one pay-off at a time and repeated search required to derive probabilities and pay-offs. The results show that in both paradigms, choice deferral is less frequent when set size is large. Also, the difficulty in evaluating alternatives influences choice deferral in the description paradigm but not in the sampling paradigm: when a pay-off from an alternative can take many possible values, a choice is more likely deferred in the description paradigm. In the sampling paradigm, in contrast, information search is often insufficient for people to recognize the difficulty in evaluating alternatives. These results point to a description-experience gap in choice deferral.

Keywords: too much choice effect; choice overload; overchoice effect; tyranny of choice; information overload; choice deferral; choice set size; assortment size; risky choice; decision making

Description-experience gap in choice deferral

When making a choice, people often face a large set of alternatives to choose from. For example, one on-line retailer, amazon.com, now offers more than 3,000 jams. While it may be more likely for people to find a preferred jam in a large set than in a small set, some previous studies report that with more alternatives people are more likely to defer a choice (e.g., Iyengar, Huberman, & Jiang, 2004). Broadly, this effect is known as *choice overload*[1]. The existence of choice overload, however, is disputed, and its boundary conditions are a source of ongoing research (e.g., Greifeneder, Scheibehenne, & Kleber, 2010; Scheibehenne, Greifeneder, & Todd, 2010). In the present study, we investigate choice deferral in risky choice environments and demonstrate that factors contributing to choice deferral can vary depending on how information is presented.

Choice overload and choice deferral

Choice overload is typically associated with three types of behaviors: the first of these is reduced choice quality. When faced with a large set, people often show a reduced capacity to choose the most preferred alternative (Malhotra, 1982; Scammon, 1977). For example, Malhotra (1982) reported that people are less likely to choose the product best aligned with their individual preferences, when making a choice between 25 products, compared to when making a choice between 5 products. Second, perhaps as a consequence of reduced choice quality, people tend to show decreased satisfaction with their choices (Iyengar & Lepper, 2000). Third, and most relevant to the present study, people are more likely to defer a choice when confronted with a large choice set (Iyengar et al., 2004).

Choice set size as a determinant of choice deferral has, however, come under increasing scrutiny. A recent meta-analysis found that set size has a "virtually zero" effect size on decreased satisfaction and choice deferral (Scheibehenne et al., 2010). Scheibehenne

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[1]Choice overload is a synonym for *too-much-choice* and other terms including *choice paralysis*, *paradox of choice*, and *the tyranny of choice*.

et al. (2010) suggest that in some cases choice overload was potentially reliable, but that "to understand the effect that assortment size can have on choice, it will be essential to consider the interaction between the broader context of the structure of assortments — beyond the mere number of options available — and the decision processes that people adopt" (p. 421).

One factor that has since been investigated is the number of attributes (or features) associated with each alternative. Greifeneder et al. (2010) demonstrate that a growth in set size alone does not decrease satisfaction, but that increasing the number of attributes along which an alternative is described does. The number of attributes has also been shown to affect choice quality (Helgeson & Ursic, 1993) and choice deferral (Dhar, 1997). Dhar (1997), for example, presented participants with two consumer products (e.g., jams) at one time and asked them to make a choice. The results suggest that people are more likely to defer a choice when two products differ in four attributes rather than two attributes.

Crucially, alternatives become more difficult to evaluate as the number of attributes increases. Thus the findings from the previous studies indicate that people are more likely to defer a choice when alternatives are more difficult to evaluate. In the present study, implications of the difficulty in evaluating alternatives is examined using risky choice environments.

Risky choice

Studies with risky choice environments ask people to make choices between alternatives that deliver monetary pay-offs with a fixed probability. For instance, an alternative can be associated with a 10% probability of £3 and a 90% probability of £0. Risky choice has been studied with two separate, yet related, paradigms: the description paradigm and the sampling paradigm. In the description paradigm, pay-off and probability information are explicitly provided at one point in time.

In contrast, in the sampling paradigm, people typically learn about pay-offs by

sampling pay-offs one-at-a-time over a series of samples. A sequence of samples from the alternative with a 10% probability of £3 and a 90% probability of £0, for example, could reveal £3, £0, and £0. In this sampling paradigm, people can sample each alternative as much as they like before making a choice. Thus, in both description and sampling paradigms, people make choices between alternatives with probabilistic pay-offs, and choices are influenced by the information people gather.

In these risky choice environments, choice deferral can potentially be induced with an increment in the number of possible pay-offs (i.e., branches). One branch corresponds to one possible pay-off and its associated probability. In the above example, the alternative has two possible pay-offs (i.e., £3 and £0) and hence has two branches.

The number of branches has been reported to influence choices in the description paradigm: when set size is large, an alternative with fewer branches is more often chosen, compared to when set size is small (Iyengar & Kamenica, 2010). This avoidance of alternatives with many branches implies a preference for alternatives that are easier to evaluate. Thus when faced with a choice between alternatives with many branches, people may avoid evaluating alternatives altogether and simply defer a choice. This explanation of choice deferral makes specific hypotheses for the sampling paradigm.

In the sampling paradigm, the number of branches in an alternative is only revealed by sampling. However, people often do not draw enough samples to realize exact probabilities of pay-off in two-branch alternatives (Fox & Hadar, 2006; Ungemach, Chater, & Stewart, 2009). Thus, people may also be unlikely to draw sufficient samples to recognize the number of branches per alternative. Although research has suggested that people draw more samples from alternatives with higher complexity in pay-offs (Lejarraga, Hertwig, & Gonzalez, 2012), we do not expect the number of samples to scale sufficiently with the number of branches for people to realize that an alternative has multiple branches. Moreover in previous study, we found that people sampled less per alternative in a larger set (Hills, Noguchi, & Gibbert, 2013; Noguchi & Hills, 2015), which may make it

less likely for people to realize the number of branches. Thus, we predict that an increase in the number of branches will influence choice deferral more readily in the description paradigm than in the sampling paradigm.

In the sampling paradigm, we hypothesize that an increase in the number of alternatives — a growth in set size — will reduce the frequency of choice deferral. This is a consequence of the statistical distribution of pay-offs over many alternatives: when multiple alternatives are sampled, it is likely that at least one of the alternatives deliver a large pay-off at a higher frequency than its underling probability (Noguchi & Hills, 2015). As a result, a few alternatives in a large set will appear much better than the others, making the alternative appear easier to evaluate.

In summary, we predict that a growth in set size is likely to reduce the frequency of choice deferral in the sampling paradigm. Also, an increment in the number of branches is more likely to increase the frequency of choice deferral in the description paradigm than in the sampling paradigm.

Method

In this section, we report how we determined sample size, all data exclusions (if any), all manipulations, and all measures in the study.

Participants

Seventy-two (63 females, 8 males, and 1 undisclosed) undergraduate students participated in the study. Prior to collecting the data, we decided to recruit all available students ($n = 88$) who were offered the chance to participate in an experiment for a course credit at the University of Warwick. Out of the 88, 16 students did not participate. The students' age ranged from 18 to 33, with a mean of 19.1.

Design

The experiment employed a 2 (between-participants, set size: small or large) × 2 (between-participants, paradigm: description or sampling) × 2 (within-participant, branch: two or four) design. Participants were randomly assigned to each of the between-participant conditions.

Apparatus

Alternatives were independently and randomly generated for each trial for each participant with the following procedure. First, an expected pay-off was determined with a random draw from a normal distribution whose mean was 1.00 with standard deviation 0.30. This normal distribution was truncated to ensure that no alternative was assigned to a negative expected pay-off. In generating an alternative with four branches, for example, a random draw from the normal distribution might be 1.20. This 1.20 is treated as the expected pay-off for this alternative.

The expected pay-off was then randomly divided into two (two branch condition) or four (four branch condition) pay-offs, with a constraint that one of the branches was assigned to 0.00. This division was conducted by multiplying the expected value with multinomial probabilities randomly drawn from Dirichlet distribution whose concentration parameters were all 1.00. Continuing the above example, 1.20 is randomly divided into four numbers: for instance, 0.62, 0.41, 0.17, and 0.00.

Then, the probability of each pay-off within a alternative was independently determined with a random draw from another Dirichlet distribution whose concentration parameters were all 1.00. For example, independently drawn random numbers from a Dirichlet distribution may be .34, .13, .08, and .45.

Finally, the expected pay-offs were divided by the probability of pay-off to derive the pay-off amount for each branch. Continuing the above example, the alternative is associated with a .34 probability of 1.82 (= 0.62/0.34), a .13 probability of 3.15

(= 0.41/0.13), a .08 probability of 2.13 (= 0.17/0.08), and a .45 probability of 0.00.

The probability and the amount of pay-off are both rounded to the nearest two decimals, and each alternative for the same trial was independently generated with the same procedure.

Procedure

Participants were instructed that their payments would depend on their choices during the experiment. The experiment asked participants to make 10 choices in total, 5 of which were choices between alternatives with two branches and the other 5 were choices between four branches. The five two-branch trials and the five four-branch trials were randomly interleaved for each participant.

Each trial displayed 2 alternatives (small set size) or 35 alternatives (large set size) as an array of boxes on a screen. Example screen-shots are provided in Figure 1. The set size of 2 and 35 alternatives are reported to induce changes in search behavior and subsequent choices in Hills et al. (2013) and Noguchi and Hills (2015). Participants were asked to sample the alternatives as many times as they wanted and then decide whether to choose an alternative to purchase for £1.00 or to defer a choice and keep £1.00.

Every time an alternative was sampled, information about the alternative was presented for 1,000ms. In the description paradigm, the information displayed the probability and pay-off amount (e.g., 55%, £2.19). In the sampling paradigm, the information presented was a random draw with replacement from the pay-off distribution associated with that alternative. For example, when an alternative with a 55% probability of £2.19 was sampled in the sampling paradigm, about 55 in 100 samples on average displayed £2.19, otherwise £0.00. After sampling, if participants decided to purchase an alternative, participants were then asked to indicate the alternative whose draw they wished to purchase.

Previous studies with the description paradigm, however, typically presents

information on alternatives without requiring mouse clicks (e.g., Hertwig, Barron, Weber, & Erev, 2004). Unlike previous studies, the present study uses the click-based procedure for both paradigms for two reasons. First, the present design reduces the influence of differences in search costs. If the description paradigm presents information without requiring clicks, the search costs will be lower than in the sampling paradigm, where each alternative needs to be clicked. Second, the click-based procedure allows us to explore information search patterns. However, even with the click-based procedure in the description paradigm, participants had to click an alternative only once to gain information on all the possible pay-offs and the associated probabilities.

Participants did not learn about the pay-offs from their purchases until the end of the experiment, when one of the 10 trials was randomly selected. If a participant purchased a draw in the randomly selected trial, the participant was paid the pay-off they earned from the purchase. If the participant did not purchase a draw in the randomly selected trial, the participant was paid £1.00. The payment ranged from £0.00 to £2.39, and its mean was £0.61.

Results

Figure 2 presents the proportion of choice purchase as a function of paradigm (description or sampling), set size (small or large) and branches (two or four). Figure 2 shows that the proportion of choice purchase increases with a growth in set size in both paradigms — choice deferral decreased with a growth in set size. Moreover, an increment in the number of branches reduced the proportion of choice purchase, but only in the description paradigm. In the description condition, choices are most likely to be purchased when a set size is large and the number of branches is few. In the sampling paradigm, however, the number of branches does not appear to influence choice purchase. Thus, the results indicate that choice overload is least likely in a large set with easy-to-evaluate alternatives.

Mixed-effect logistic regressions[2] suggest a significant effect of set size on choice purchase: $\chi^2(1) = 10.12$, $\beta = 0.86$, $p < .01$, $\Delta AIC = 8.12$. In addition, an interaction effect indicates that an effect of branch significantly depends on paradigm: $\chi^2(1) = 11.48$, $\beta = 1.32$, $p < .001$, $\Delta AIC = 9.48$. In the description paradigm, choice is significantly less likely to be purchased in the four branch condition than in the two branch condition: $\chi^2(1) = 14.82$, $\beta = -1.33$, $p < .001$, $\Delta AIC = 12.82$. In the sampling paradigm, branch has a non-significant effect: $\chi^2(1) = 0.17$, $\beta = 0.10$, $p = .68$, $\Delta AIC = 1.83$. The other interaction and main effects are non-significant: $ps > .28$.

In previous studies, we found that larger set sizes increase the likelihood that people encounter large pay-offs in the sampling paradigm (Hills et al., 2013; Noguchi & Hills, 2015). We also found this result in the present experiment: the maximum amount of pay-off which participant saw while sampling alternatives tends to be greater in the large sets than in the small sets: $\chi^2(1) = 30.76$, $\beta = 1.81$, $p < .001$, $\Delta AIC = 28.76$. In addition, this maximum sample pay-off is a significant predictor of choice purchase: a choice is more likely to be purchased when the maximum sample pay-off is larger ($\chi^2(1) = 28.68$, $\beta = 1.44$, $p < .001$, $\Delta AIC = 26.74$). This effect of the maximum sample pay-off does not significantly differ between the large and the small sets or between the two and the four branch conditions: $ps > .07$. Thus, the increased frequency of choice purchase in the large sets is likely due to the differences in the maximum sample pay-offs people see.

We also examined the counter-part effects in the description paradigm: whether choice purchase is predicted by the maximum expected pay-off participants saw. The maximum expected pay-off within a trial was larger in the large sets than in the small sets: $\chi^2(1) = 55.22$, $\beta = 0.25$, $p < .001$, $\Delta AIC = 53.22$ — which is a consequence of the pay-off design, with each expected pay-off chosen from the normal distribution. However, this maximum expected pay-off did not significantly predict choice purchase: $\chi^2(1) = 3.69$,

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[2]All the mixed-effect regressions we report here include maximal random factors: by-participant intercept and slopes. We assess statistical significance by examining model fit with chi-square tests.

$\beta = 1.35$, $p = .055$, $\Delta AIC = 1.69$. This effect of the maximum expected pay-off does not significantly differ between the large and the small sets or between the two and the four branch conditions: $ps > .80$. Thus, the increased frequency of choice purchase is not likely due to the differences in the maximum expected pay-offs people see.

Sampling pattern

Our experimental design allows us to explore patterns of information search in both description and sampling paradigms. As we did not have specific hypotheses to test, we only describe the patterns with 95% confidence intervals below.

Figure 3 shows the mean numbers of samples per alternative. In the description paradigm (the left panel in Figure 3), participants tend to sample more in the four branch than in the two branch condition. The numbers of samples per alternative, however, decreases for both branch conditions with a growth in set size.

In the sampling paradigm, in contrast, the differences between the two and the four branch conditions appear small. The small differences indicate that participants might have not noticed that alternatives in the four branch condition are associated with the large number of possible pay-offs than alternatives in the two branch condition. Indeed in the sampling paradigm, the number of possible pay-offs participants saw in one alternative is typically below two in both branch conditions: the means are 1.13 (95% CI [1.07, 1.20]) and 1.28 (95% CI [1.15, 1.42]) for the two and the four branch conditions in the small sets, and 1.02 (95% CI [1.01, 1.04]) and 1.05 (95% CI [1.03, 1.07]) for the two and the four branch conditions in the large sets. These sampling patterns highlight that the number of branches is not readily apparent to participants in the sampling paradigm, leading to similar proportions of choice deferral in both branch conditions.

In addition, Figure 4 illustrates the mean number of alternatives sampled in a large set. Here, the error bars largely overlap, indicating that the differences between the paradigms is small.

Lastly, we note that the mean number of samples per alternative and the number of alternatives sampled do not significantly predict choice purchase in the large sets: $\chi^2(1) = 0.24$, $\beta = 0.01$, $p = .62$, $\Delta AIC = 1.76$; and $\chi^2(1) = 3.64$, $\beta = 0.98$, $p = .06$, $\Delta AIC = 1.64$, respectively. These effects do not differ between the paradigms or the branch conditions: $ps > .09$.

Discussion

Previous studies on choice overload have suggested that a growth in set size reduces choice quality, decreases satisfaction, and increases the frequency of choice deferral. These effects were initially attributed to large set sizes, but empirical evidence suggest that the picture is more subtle. In the present study, we found that choice deferral is mediated by set size, number of possible pay-offs, and presentation format.

First, our results indicate that choice deferral is less frequent in a large set for both description and sampling paradigms. This less frequent deferral shows that a growth in set size alone does not necessarily lead to choice deferral.

For the description paradigm, this result is consistent with previous studies suggesting that people are more likely to find an alternative they prefer in a large set than in a small set, if they have sufficiently well-defined preferences (Chernev, 2003; Scheibehenne et al., 2010). These studies indicate that participants in the present study may have preferences for alternatives with certain quality (e.g., a high probability of pay-off), which are more readily found in a large set. In this vein, previous research (Payne, Bettman, & Johnson, 2003) has shown that in a large set, people are likely to consider only a subset of information, and thus in the present study, participants' preferences might have been based on a subset of branches in a large set. These non-compensatory preferences potentially explain why overall quality of alternatives (i.e., expected pay-off) is only a non-significant predictor of choice deferral.

In the sampling paradigm, in contrast, the less frequent deferral is due to the

increased likelihood of encountering large pay-offs in a large set. Previously, we saw that this increased likelihood biases choices towards alternatives with rare large pay-offs (Hills et al., 2013; Noguchi & Hills, 2015). The present results further indicate that this bias in choice is not a result of forced choice — people appear to develop preferences for alternatives with large pay-offs sufficiently enough to purchase an alternative.

Second, we found that choice deferral is associated with the number of possible pay-offs. As the number of pay-offs increases, alternatives become more difficult to evaluate. This increased difficulty has been shown to lead people to make a choice which is easier to evaluate (Iyengar & Kamenica, 2010), or to simplify information to ease evaluation (Lejarraga, 2010). The present results demonstrate that the increased difficulty leads to choice deferral in the description paradigm, but not in the sampling paradigm. In the sampling paradigm, information search tends to be insufficient for people to recognize the number of possible pay-offs. The insufficient search is one of the major factors which contribute to the description-experience gap in risk-taking (Hertwig et al., 2004; Ungemach et al., 2009), but in the present study, we show that the insufficient search also contributes to the description-experience gap in choice deferral.

To conclude, the present study highlights the concern raised by Scheibehenne et al. (2010) by suggesting that choice deferral can be a function of interactions between multiple factors. Here, we investigate and found a relationship between choice deferral and set size, choice complexity, and information presentation format (i.e., the description or sampling paradigm).

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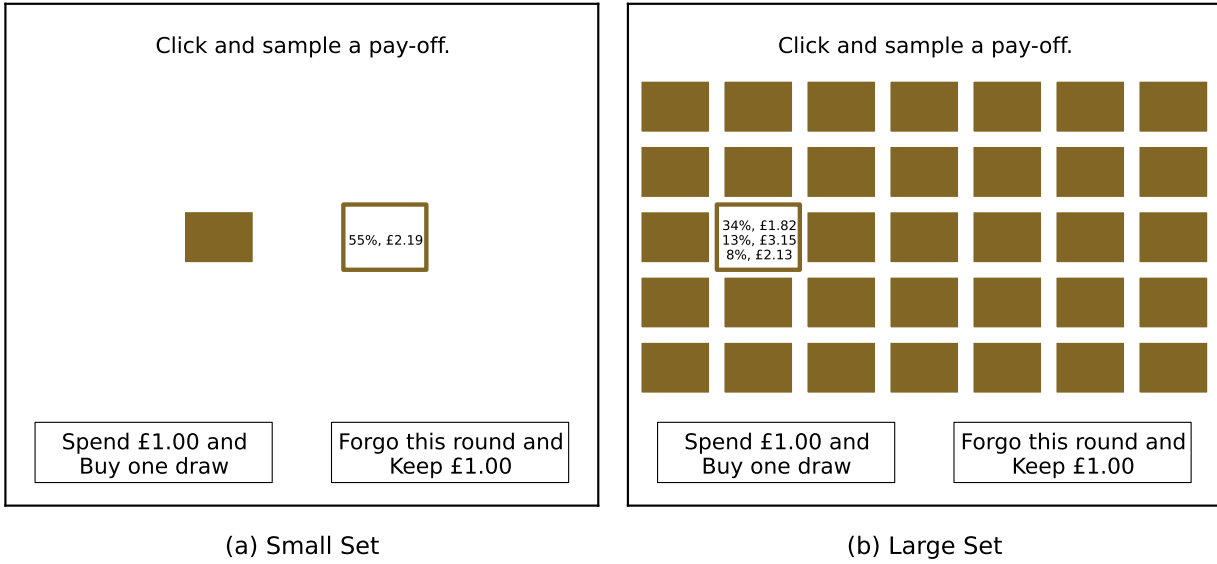
(a) Small Set   (b) Large Set

Figure 1. Example screen-shot for the description paradigm. The left panel illustrates the screen right after one alternative is clicked in the few branch condition, and the right panel illustrates the screen in the many branch condition. Font-size is enlarged for illustration purposes.
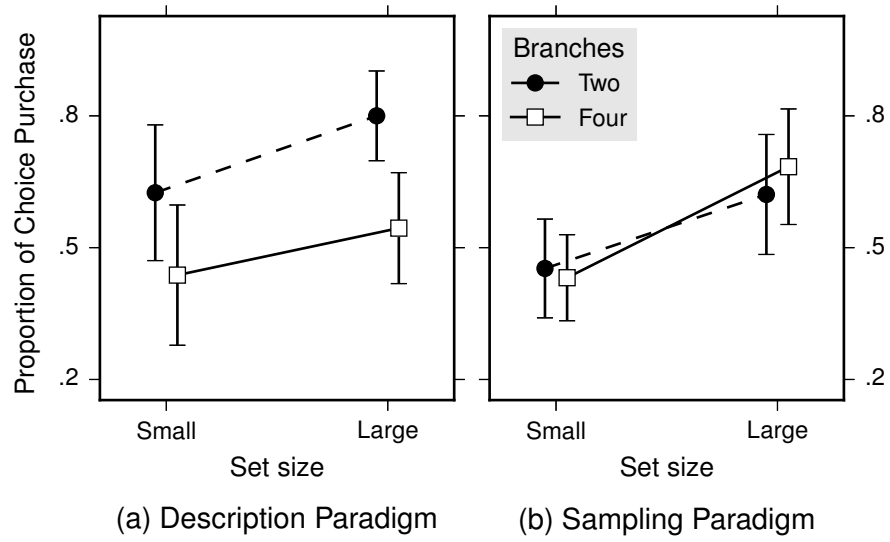
Figure 2. Proportion of choice purchase. Error bar represents 95% confidence interval.
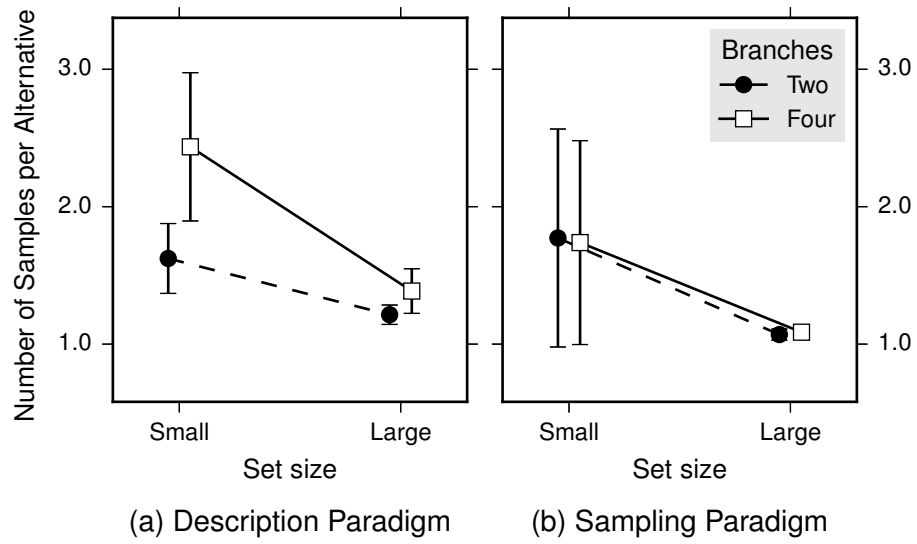
Figure 3. Mean number of samples per alternatives. Error bar represents 95% confidence interval.
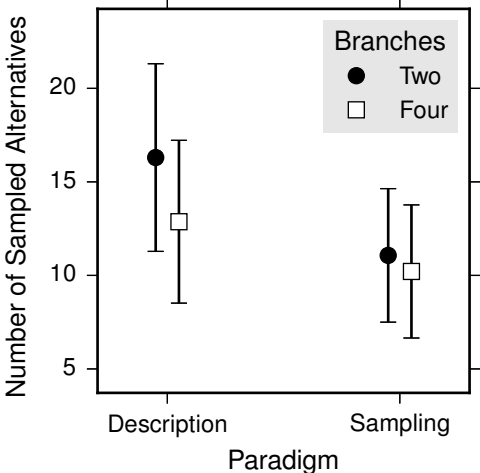
Figure 4. Mean number of sampled alternatives. Error bar represents 95% confidence interval.