Click Or Skip: The Role Of Experience In Easy-Click Checking Decisions

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Web Appendix 1, presents a comparison of the performance of reliance on small samples one stage and two stage naïve sampler model with different sample sizes. Web Appendix 2, presents all studies screenshots.

ABSTRACT

New websites and smartphone applications provide easy-click checking opportunities that can help consumers in many domains. However, this technology is not always used effectively. For example, many consumers skip checking "Terms and Conditions" links even when a quick evaluation of the terms can save money, but check their smartphone while driving even thought this behavior is illegal and dangerous. Four laboratory experiments clarify the significance of one contributor to such contradictory deviations from effective checking. Studies 1, 2, and 3 show that, like basic decisions from experience, checking decisions reflect underweighting of rare events, which in turn is a sufficient condition for the coexistence of insufficient and too much checking. Insufficient checking emerges when most checking efforts impair performance even if checking is effective on average. Too much checking emerges when most checking clicks are rewarding even if checking is counterproductive on average. This pattern can be captured with a model that assumes reliance on small samples of past checking decision experiences. Study 4 shows that when the goal is to increase checking, interventions which increase the probability that checking leads to the best possible outcome can be far more effective than efforts to reduce the cost of checking.

Keywords: Checking decisions, clicking decisions, decision from experience, decision-description gap, incentives

INTRODUCTION

In July 2008, birdwatchers at Gibraltar Point, a nature reserve on the east coast of England, were surprised to see a 32-ton truck trying to maneuver in a narrow lane. It emerged that the driver had left Turkey a few days earlier for the British territory of Gibraltar off the south coast of Spain (Simpson 2008). His 1600-mile mistake appears to reflect a failure to check that the target destination was entered correctly in his navigation device. A single click on the "show route" button before he set off would have prevented the mistake – making this detour a striking example of insufficient checking. Yet there is also evidence for the opposite bias, namely too much checking. In one tragic example, three teenage girls were killed in March 2016 in Corpus Christi, Texas, when the driver of their car lost control and veered into oncoming traffic; the driver, also a teenager, was checking her smartphone's GPS at the time (Karedes et al. 2016).

Smartphones in general, and the access they provide to social media, email and messaging services as well as navigation apps, provide by far the most important example of excessive or misplaced checking; in the USA, in 2013 alone, 3,154 people were killed and an estimated 424,000 injured in motor vehicle crashes involving distracted drivers (NHTSA 2013). But the problem of both insufficient and too much checking is not unique to either smartphones or navigation apps. Insufficient checking is clearly seen in the observation that the proportion of people who check e-license agreements before accepting them is below 1% (Bakos, Marotta-Wurgler, and Trossen 2014). Or to take a seemingly mundane pair of examples, many children overuse calculators to check the answers to math homework problems even when this behavior impairs their mastery of basic math operations, while many adults trust their limited mental

calculation skills and do not check bills using calculators even when this behavior could save them money.

Notice that the checking decisions described above are quite distinct from the focus of classical studies of consumer search behavior. The classical research concentrates on situations in which checking is effective but demands high cognitive effort (Payne 1976; Payne, Bettman and Johnson 1988; Bettman, Luce, and Payne 1998; Campos, Doxey, and Hammond 2011; Levi, Chan, and Pence 2006; Stark and Choplin 2009). In contrast, the current examples involve "easy-click" checking: situations in which checking is easy, and likely to reduce cognitive effort. In many cases a single click on the checking button produces information that leads towards the best choice.

The current research tries to clarify the conditions that trigger deviations from optimal easy-click checking. Our interest in easy-click checking stems from the observation of a steady growth in new websites and smartphone applications that allow easy, often single-click checking. These applications help consumers choose in an increasing number of domains. Given the right app, a single click can reveal whether other retailers offer a better price for a given product, or which route is the fastest under present traffic conditions. For example, while using KAYAK's easy-click search engine, in search of an example for the current article, one of us found that he could have saved $200 on his next trip; he saw that he had exhibited under-checking, and now plans to check more in the future. Moreover, wisely designed websites and apps appear to facilitate coordination and help eliminate social inefficiencies. For example, apps that allow single-click checking of the estimated waiting time in nearby emergency rooms can improve the efficiency of emergency health care provision. Yet, as our examples demonstrate, the effect of these potentially useful technologies is not always positive. The current research aims to clarify

the conditions that trigger deviations from optimal easy-click checking and thereby help improve the impact of such devices.

When considering what might contribute to the coexistence of insufficient and too much checking, a number of factors that have been shown to impact consumer decisions come to mind. First, impatience (Hoch and Loewenstein 1991) may be at work. When expected outcomes are positive, people tend to prefer getting a reward now over later even when this tendency impairs the expected return. Thus, both the limited checking of e-license agreements and too much checking of smartphones while driving can be a reflection of the effort to finish the process (in the case of an e-license) or get the desired information (in the case of smartphones) as soon as possible.

A second well-established contributor involves the role of boredom and the tradeoff between importance and interest. In many situations people understand that boring activities can be important, but prefer more interesting activities (Hirschman 1980; Barkan, Danziger, and Shani 2016). Thus, they skip the boring e-license agreements, and choose the interesting clicks on smartphones.

Third, overconfidence can lead consumers to feel that they already know all possible pitfalls. This may lead them both to skip e-license agreements (Fischhoff, Slovik, and Lichtenshtein 1977), and to overestimate their ability to control their car while checking their smartphone (Krueger and Mueller 2002).

The present research explores the role of yet another factor. Specifically, we propose that many easy checking decisions, like basic decisions from experience (see demonstration in figure 1), reflect the underweighting of rare events. This hypothesis predicts insufficient checking when checking is very important in rare cases (and therefore wise on average), but most often these

checking efforts waste time and add nothing (as in the example of the "show route" key after entering a new destination to a navigation application). Too much checking is predicted when checking is highly costly in rare cases and counterproductive on average, but most checking efforts are rewarding (as in the case of checking the smartphone while driving).

Insert figure 1 about here

The underweighting of rare events hypothesis is potentially important as it predicts high sensitivity to an observable – and, crucially, easy to change – feature of the environment: the probability that each checking effort is reinforced (leads to a better payoff than the payoff from skipping checking). With a better understanding of the role played by this factor, mechanisms can be designed to reduce deviations from optimal checking. In contrast, the predictions of the other explanations for deviations from optimal checking depend on subjective variables that are harder to measure and manipulate (impatience, boredom, and overconfidence). A second attractive feature of the current hypothesis is the observation that the tendency to underweight rare events in decisions from experience is rather general, and appears to reflect a basic property of learning processes (Erev and Haruvy 2016). This pattern has been documented in basic consumer behavior tasks (Danziger, Hadar, and Morwitz 2014), in distinct experimental paradigms (Hertwig and Erev 2009), in different cultures (Di Guida, Erev, and Marchiori 2015), and even with different species (Shafir et al. 2008).

The first part of the current analysis examines whether the tendency to underweight rare events implies a sufficient condition for the co-existence of insufficient and too much checking when checking a single option. It studies easy-click checking decisions in abstract environments that eliminate the role of the three known contributors to the contradictory deviations from

optimal checking. In addition, we also examined how initial propensities were moderated during the course of experience.

The second part considers situations in which consumers can check which of two options is better, and clarifies the implications of the current analysis. It shows that when our goal is to increase checking, providing small bonuses which increase the probability that checking is rewarding is much more effective than an intervention which reduces the cost of checking.

CHECKING A SINGLE OPTION

The current section focuses on environments with only one option where the consumer is asked whether to check or to skip checking, for example whether to read the license agreement or not. It seems useful to distinguish between two parameters that feed into this decision: the cost of checking, which most likely involves time and the bonus one gets from the act of checking. The most likely direct bonuses involve the elimination of mistakes or pitfalls or possibly helps soothing one's consciences. Abstractly described the consumer is asked to:

Skip checking: Avoid checking and get the default outcome.

Check: Check and get the default outcome, plus a bonus for checking, minus a checking cost.

The current section focuses on three numerical examples of checking problems of this type that differ with respect to the assumed distribution of the default outcomes, and the nature of the cost and the bonus. The three problems are presented below:

Short e-contracts. The first numerical example abstracts the problem faced by a consumer who tries to rent a car on the internet, and is asked to choose between "Accept Terms"

and "Terms and Conditions." The "Terms and Conditions" screen is short and easy to understand, and a quick glance clarifies whether the terms include hidden charges that can be avoided (e.g., by avoiding a default unnecessary insurance). As described in table 1, the probability of hidden charges in the current example is .1, and the default outcome for the consumer is a loss of 11 points if there are hidden charges, and +2 points otherwise. The bonus from checking is the cancelation of the hidden charges if they exist; formally, the bonus equals 11 points if there are hidden charges, and 0 otherwise. The checking cost is 1 point. Thus, the outcome when checking is -1 point if there are hidden charges, and +1 point otherwise. These incentives imply that the expected value of skipping checking is .7 (i.e., -11 x .1 + 2 x .9), while checking leads to a higher expected value of .8 (i.e., - 1 x .1 + 1 x .9). Yet, checking is the best choice (helps avoid the hidden costs) in only a tenth of the cases; in the other 90% of cases checking is unnecessary and merely diminishes the final payoff.

Checking incoming text messages while driving. The second row in table 1 abstracts a problem faced by a person who hears the buzz of an incoming text message while driving to a meeting. Skipping checking maintains the status quo (provides 0 with certainty). Checking is dangerous and illegal, but provides a bonus (it eliminates uncertainty and satisfies curiosity). In the current example, the bonus from checking is +1, and the cost is -10 in the rare cases where checking creates a problem (e.g., a fine or accident), and 0 otherwise. The probability of a problem is .1. The overall effect of checking is a payoff of +1 in 90% of the trials, and a loss of 10 otherwise. Thus, the expected value from checking is negative, -.1 (i.e., -10 x .1 + 1 x .9). With these expected values, skipping checking is clearly superior to checking. However, while checking is not worthwhile on average, it is the best choice in 90% of the cases.

Attractive deals. The problem abstracted in the third row of table 1 involves a consumer who is looking for a hotel room, and finds what seems to be a highly attractive deal. Accepting the first offer without checking implies an 11-point gain 10% of the time (when this option is truly superior) and a low payoff of only 1 otherwise. The checking bonus is +1, expressing that the consumer feels this is the right thing to do, enjoys doing it, or foresees the need to justify her choice to her partner. The cost of checking is the loss of the first offer (when it was truly superior). The outcome given checking is therefore +1 if the initial offer was outstanding, and +2 otherwise. Thus, the expected value from checking is 1.9 (1 x .1 + 2 x .9), and not checking implies a higher expected value of 2 (11 x .1 + 1 x .9). Yet checking is the best choice in 90% of the cases.

Hypotheses and the naïve sampler model

Insert table 1 about here

We based our predictions of the tendency to underweight rare events on the observation that the magnitude of this bias (relative to maximization) can be predicted with a simple "naïve sampler" model (Erev and Roth 2014). This model was originally developed to capture behavior in the clicking paradigm described in figure 1. It assumes random choice in the first trial, and reliance on a small sample of past experiences in subsequent trials. Specifically, at trial $t > 1$, consumer i samples (randomly, with replacement) k_{it} times from the t-1 previous trials, and selects the strategy that led to the best average payoff in the sample. The sample size k_{it} (a natural number) changes between consumers, and between trials. The distribution of these values over consumers and trials is assumed to be uniform between 1 and K. Thus, the model has only

one free parameter: The value of K. Erev and Roth's (2014) estimation is K = 9. Using this estimate the right column in table 1 presents the predictions of this model. As can be seen, the "naïve sampler" model predicts insufficient checking in problem 1 (a checking rate of only 34% when checking is optimal), and too much checking in problems 2 and 3 (a checking rate of 64% when checking is counterproductive). Maximizing expected returns predicts a very high checking rate in problem 1 and very low checking rates in problems 2 and 3.

Although we only formalized the predictions following these two models, other assumptions are also possible. In particular, one might assume that the availability of a checking option might affect the decision process. For example, it might make salient that one can reduce ambiguity, and for that reason may trigger ambiguity aversion (Ellsberg 1961). This hypothesis predicts a bias (relative to the prediction of the naïve sampler model) to favor checking over skipping. Alternatively, the mere presentation of the option to check may increase the weighting of rare events, and for that reason will increase maximization. If so, the observed checking rate will fall between the naïve sampler predictions and the predictions following maximization. Another justification for this prediction comes from the assumption that the option to check clarifies the risk. Previous studies of decisions under risks (Kahneman and Tversky 1979) highlight overweighting of rare events; in the current examples, overweighting of rare events implies maximization. In summary, in the current context the predictions of the "underweighting of rare events" hypothesis contradicts the predictions of the "maximization, ambiguity aversion, or prospect theory-like overweighting of rare events" hypothesis.

Experimental paradigm

Studies 1 through 3 were designed to compare the two hypotheses listed above. Forty-eight participants faced each of the three abstract problems for 100 trials. The sample sizes were chosen to ensure that the underweighting of rare events (naïve sampler) predictions presented in table 1 fall outside the 99% confidence interval of around .5 (random choice), assuming a between-subjects standard deviation of .3 (the average standard deviation in previous studies of decisions from experience that focus on mean choice rate over 100 trials). The 99% confidence interval with n = 48 is $.5 \pm (.3/6.93)(2.7)$; that is, [0.38, 0.62].

All participants were paid volunteers, mainly students at the university where the studies were conducted. They were recruited through an email ad announcing a monetary payment for participating in a study.

The instructions and experimental tasks were presented on a computer screen, and are summarized in figure 2 (the demo versions of the studies and additional screenshots are available in the web appendix, https://sites.google.com/site/checkpapersite/). Notice that the description of the first choice in each trial was limited to the general implication: "Check" or "Continue." The participants received no additional prior information – neither a description of the payoff distributions, nor the specific cost of checking. Rather, they had to infer this information on their own from the feedback received after each choice. The feedback was complete: It included information concerning the outcomes of the chosen strategy (the obtained payoff) and the unchosen strategy (the forgone payoffs). We chose to provide full feedback to simulate natural situations in which consumers learn whether checking can help.

The payment consisted of a show-up fee of about $7, plus (minus) about 0.5 US cent for each point won (lost). We chose to use monetary incentives rather than time-saving incentives, which are more common in natural single-click problems, as previous research shows limited

differences between time and money in the context of decisions from experience (Munichor, Erev, and Lotem 2006). Another difference between natural easy-check problems and the current task involves the short interval between the repetitions used here: all 100 trials were run in one session that lasted less than half an hour, and the participants could press the "next" key immediately after seeing the outcome of the last choice. We chose to allow short intervals to facilitate efficient data collection, as previous research shows that the tendency to underweight rare events is robust to the between-trials interval. Danziger et al. (2014) document underweighting of rare events even when the consumers made only one choice per day.

Insert figure 2 about here

Study 1: Checking decisions when the expected benefit of checking is high but the probability that checking is the best decision is low

Study 1 examines the first problem of table 1. It simulates, for example, accepting a short contract that in most cases will not entail any potential pitfalls, but in rare cases may involve avoidable charges.

Procedure. At each trial the participants faced only one product (E), and were asked to choose between accepting the product without checking it (by selecting "Continue") or first checking it by selecting "Check" (all other buttons were inactive). The positions of the "Check" and "Continue" buttons (top vs. bottom) were counterbalanced (here and in all other studies). Thus, at the initial stage of each trial the participants were asked to select whether to check or to continue without checking by clicking on the respective button. After they clicked on "Continue" or "Check," the product (E) button was activated and had to be clicked.

If a participant initially selected "Continue" her payoff was 2 points 90% of the time and -11 otherwise. If she first selected "Check" her payoff was 1 (2 – 1) 90% of the time and -1 (0 – 1) otherwise. Thus, checking came at a cost of 1, but prevented the rare large loss. The feedback after each trial presented the payoff from checking, and the payoff from selecting E without checking (see the bottom-left screen of figure 2). Note that this design requires the same number of clicks (3) per trial independent of the selected strategy, and that participants had to infer on their own the cost and benefit from checking. It also eliminates the role of the three known contributors to the contradictory deviations from optimal checking.

Results and Discussion. The problem 1 curve in the left-hand side of figure 3 presents the mean checking rates in the very first trial (block 0), and then in four blocks of 25 trials (all the results data for this and subsequent studies are available in the web appendix). The initial (first trial) checking rate, 71% (SD = 46%), is significantly higher than 50% (*t(47)= 3.14, p<.01),* but feedback reverses this pattern and leads to insufficient checking. The checking rates in the second and third trials are 54% and 23% respectively. The mean checking rate over all 100 trials is 41% (SD = 26%). This value is significantly lower than 50% (*t(47) = -2.43, p<.02).* That is, feedback led the participants to favor the Continue option, which led to the best payoff in most trials, over the checking option, which maximized the expected return.

The right-hand chart in figure 3 presents the predictions of the naïve sampler model with K = 9. The model fails to capture the very first trial, but it captures the behavior observed in the other 99 trials well. That is, the information that one of the keys implies checking had a large initial effect, but no effect on consumers' subsequent behavior.

Insert figure 3 about here

In order to explore the role of individual differences, we computed the mean checking rate of each participant over the 100 trials. The solid white bars in figure 4 present the observed distribution of checking rates in study 1. The median checking rate is 0.35. We also estimated the K values that best fit each participant under the naïve sampler model. The median K value is 9, and the range is 1 to "at least 55." Thus, the range is larger than predicted by the basic model. The existence of large individual differences is consistent with the results of previous studies of information gathering (e.g., Jacoby, Chestnut, and Fisher 1978).

Insert figure 4 about here

Study 2: Checking decisions that impair the status quo outcome when the probability that checking is the best decision is high

This study examines problem 2 in table 1. It simulates a situation, like checking the smartphone while driving, in which checking changes the status quo and impairs the expected return, but the probability that it is the best choice is high.

Procedure. The experimental instructions and screens were identical to those of study 1, with the only difference in the payoff distribution. The outcome of "continue" was always 0 (neither a gain nor a loss), whereas the payoff from checking was +1 point 90% of the time and -10 points otherwise (10% of the time).

Results and Discussion. The curve labeled "incoming message" in figure 3 summarizes the main results of study 2. The initial checking rate, 73% (SD = 45%), is significantly higher than 50% *(t(47) = 3.53, p<.001)*. This value is similar to the initial checking rate observed in study 1, but feedback had a very different effect in the current setting. Even though checking

impairs the expected return here, the mean checking rate with feedback, 64.43% (SD = 24%), is significantly higher than 50% ($t(47) = 4.13, p<.001$). The observed checking rate curve shows some reduction in counterproductive checking with experience, and high agreement with the prediction of the naïve sampler model. As in study 1, analysis of the distributions of checking rates (horizontal line in figure 3) and estimated K values show large individual differences. The median K value is 8.

Study 3: Checking decisions that reduce the expected benefit when the probability that checking is the best decision is high

The current experiment focuses on problem 3 of table 1. It simulates a situation where a seemingly good offer can be accepted or further investigated, with the risk of losing it.

Procedure. The experimental instructions and screens were again as in study 1, but with different payoff distributions. Participants who selected Continue received a +1 payoff 90% of the time and +11 otherwise. Selecting Check increased the payoff by 1 unit in cases where not checking would have led to the +1 payoff, but in the other 10% of cases checking led to a loss of a great offer. The implied payoff distribution is thus +2 points 90% of the time and +1 otherwise.

Results and Discussion. The "attractive deal" curve in figure 3 summarizes the main results of study 3. The results replicate the pattern documented in study 2: A high initial checking rate (75%, SD = 44%, significantly higher than 50%, $t(47) = 3.96, p<.0001$), and a limited reaction to feedback: the observed overall checking rate, 63.89% (SD = 26%), was still significantly higher than 50% ($t(47) = 3.71, p<.001$). As predicted by the naïve sampler model, the results also show very slow learning toward maximization. Analysis of individual differences

(black rectangles in figure 4) shows the robustness of the pattern described above, with the median k_i value at 9.

Summary of studies 1-3

The description of the keys as "Check" and "Continue" presumably led the participants in studies 1, 2 and 3 to initially prefer the checking option. In all three studies, checking rates in the very first trial were higher than 70%. That is, most participants behaved as if they held a prior belief that checking was wise. Yet this belief did not have a large effect on the observed checking rates in subsequent trials. As study 1 demonstrated, after three trials with feedback, the single-click checking decisions examined here reflected underweighting of rare events like basic decisions from experience (a similar pattern was observed in studies 2 and 3).

TWO OPTIONS AND THE IMPACT OF COST REDUCTIONS AND BONUSES

The current section is designed to achieve two goals. The first goal is to extend our analysis to address easy-check opportunities that compare, and identify the better of, two options. Under the current abstraction of problems of this type, the consumer is asked to choose between:

Skip 1: Avoid checking and get the outcome of option 1

Skip 2: Avoid checking and get the outcome of option 2

Check: Check which option is better (1 or 2), and get the best option plus a bonus, minus a cost.

As illustrated in the right-hand side of figure 2, the availability of more than one option implies a two-stage choice task. The consumer has first to decide whether to check, and when she chooses to skip checking, she then has to choose between the two options.

The additional goal of the current section is to clarify the practical implications of the current results. To achieve this goal we examine two possible interventions designed to increase checking in situations where consumers do not check enough. The first and most natural class comprises interventions that reduce the cost of checking. The most obvious implementation of reducing the cost of checking is to reduce the effort required (e.g., by creating a single-click checking option), or to minimize the time delay between clicks and answers. Such methods seem highly effective according to the mainstream economic analysis that assumes a homo economicus. Likewise, if a negative cost-benefit analysis is responsible for insufficient checking, as is often assumed (e.g., Kuksov 2004), reducing the costs should increase the checking rate.

The second class pertains to reinforcement strategies or a checking bonus (see also Schurr, Rodensky, and Erev 2014). One example is the WAZE rank and point system (https://wiki.waze.com/wiki/Your_Rank_and_Points): Users of this social navigation system earn points for driving with the application. Another example involves health insurance companies that reward customers for undergoing certain medical checkups via rebates on their insurance premiums. Likewise, they could reward the use of apps that check functions such as blood pressure or that help diabetes patients check the glucose level of foods.

Although both strategies, reducing costs and offering rewards, seem efficient, our analysis suggests that checking is more influenced by the probability that checking is the wisest choice than by its costs. Thus, increasing this probability, for example through rewards for checking, should be more effective at inducing checking than reducing costs.

The three two-option problems presented in table 2 illustrate the current predictions. Problem 4HiC (high cost) abstracts a situation in which a consumer is faced with a risky long-shot option (high gain, but low probability of success) and can decide between three strategies: pursuing it, not pursuing it, or checking its feasibility beforehand. In the current numerical example, the long-shot option provides a gain of 10 (a "treasure") with probability .1 and a loss of 1 otherwise (90% of the time). Not pursuing it maintains the status quo (a payoff of 0 with certainty). The cost of checking in the current example is .2 with p = .75; 1.4 otherwise, and checking does not provide a direct bonus (bonus = 0). Thus, the payoff distribution given checking is 9.8 with p = .075 (.75 x .1, when the cost is low and the treasure exists); 8.6 with p = .025 (.25 x .1, high cost and the treasure exists); -.2 with p = .675 (.75 x .9, low cost and no treasure); and -1.4 with p= .225 (.25 x .9, high cost and no treasure). The expected value from checking is .5 (9.8 x .075 + 8.6 x .025 - .2 x .675 − 1.4 x .225). The expected value from Skip1 (pursuing without checking) is .1 (10 x .1 -1 x .9), and the expected value from Skip2 is 0. That is, checking maximizes expected returns. Yet, at each trial, one of the skipping options provides a higher payoff than checking: Skip1 is the best choice when the treasure exists (payoff of 10), and Skip2 is the best choice when the treasure does not exist (payoff of 0).

Insert table 2 about here

Problem 4LoC is identical to problem 4HiC with the exception that the cost of checking is reduced to one-fifth, namely .04 with probability .75 and .28 otherwise. This change increases the expected value to .9, but does not change the fact that in no trial is checking the best choice.

Problem 4B is another variant of problem 4HiC; it is identical to 4HiC with the exception that checking provides a bonus of .4. This change increases the expected value to .9, and also

makes checking the best choice in 75% of the trials. That is, checking is equally effective in expectation in problems 4LoC and 4B, but the proportion of trials in which checking provides the best possible payoff is much higher in problem 4B.

Hypotheses

The naïve sampler model, used above to derive the predictions of the underweighting of rare events hypothesis, was developed to address one-stage choice tasks. In this regard, the analysis of the current problems allows us to extend the naive sampler model. We consider two generalizations of this model to the current two-stage task. The "one-sample" generalization assumes that consumers use the same sample of past experiences in the two stages. In contrast, the "two-sample" generalization assumes that consumers first select (mentally) their favorite alternative to checking (Skip1 or Skip2) based on one sample of k_{it} previous trials, and then take the average of the better first sample and a second (independent) sample to compare checking to their favorite skip option. Thus, the estimated value of the best "skip checking" option is the mean of two independent samples (of size k_{it1} and k_{it2} respectively) and the benefit from checking is estimated based on one sample. As demonstrated in the right-hand column of figure 5, in the current context, the two models provide similar predictions of the mean checking rates. They predict low checking rates in the basic problem (checking rate around 30% in problem 4HiC), a limited effect of the cost reduction (checking rate around 36% in problem 4LoC), and a larger effect of bonuses (checking rate above 50% in problem 4B). Thus, both models support the hypothesis that if our goal is to increase checking, adding a bonus for checking will be more effective than dividing the checking costs.

The two sampling models differ with respect to the predicted behavior of the agents who choose to skip checking. The one-sample model predicts a very low rate of Skip1 (risky, pursue without checking) choices, while the two-sample model predicts a weaker preference for Skip2 over Skip1. The intuition is simple: the probability that the risky skipping option has the highest average payoff within a single sample is very low. For example, consider a subject who uses the one-sample model with a sample of size 5 in problem 5LoC: If the sample does not include any treasure, the predicted choice is Skip1 (safe skipping is the only option that avoids losses). If the sample includes exactly one treasure, the predicted choice is Check: it saves 4 (1 in four trials), and the maximal cost is only 1.4 (.28 x 5). Only if the sample includes at least four treasures does the model predict risky skipping. The two-sample model predicts a higher rate of risky skipping because it allows for the possibility that the first sample (used to only compare the skipping options) includes a treasure, while the second sample (used to evaluate the benefit from checking) does not.

Study 4: The impact of cost reduction and checking bonus in long-shot problems

Study 4 examines problems 4HiC, 4LoC and 4B.

Procedure. The experiment used a within-subject design. Each of the 40 participants first faced problem 4HiC, and then in counter-balanced order problems 4LoC and 4B. Each participant saw each problem for 100 trials (for a total of 300 trials). After trials 100 and 200, the participants were informed that they would proceed to a new problem. The main motivation for this design choice was to allow a within-consumer evaluation of the impact of the two

interventions. The experimental instructions and screens are presented on the right side of figure 2.

Results and Discussion. Figure 5 summarizes the main results. Dividing the checking cost by 5 increased the checking rate from 17.7% (SD = 38%) in problem 4HiC to 27.3% (SD = 45%) in problem 4LoC. Although this difference is significant ($t(39) = -3.058, p< .05$), both rates are significantly lower than 50% ($t(39) = -8.96, p < .0001$ in 4HiC, $t(39) = -4.70, p< .0001$ in 4LoC). The failure of the substantial cost reduction to increase the checking rate above 50% is in line with our prediction, since even at reduced costs checking is outperformed by one of the skipping options in all trials.

The addition of a bonus that increases the proportion of trials in which checking provides the best possible payoff (problem 4B) was more effective. It increased the checking rate to 60% (SD = 49%). This rate is significantly higher than the checking rate in problem 4LoC $t(39) = 5.66, p< .0001$), and is marginally higher than 50% ($t(39) = 1.74, p< .1$). This pattern is consistent with the hypothesis that checking decisions reflect high sensitivity to the probability that checking leads to the best possible payoff, and can be predicted with the naïve sampler model. The checking rate in the very first trial was 73% in the first problem (4HiC), but only 46% and 38% in the first trials of the second problem (4HiC and 4B respectively), although participants were informed that they were dealing with a new problem. These rates suggest that experience in problem 4HiC (where checking increased the expected return, but was never the best strategy) eliminated the initial tendency to check in the problems that were played subsequently.

Analyses of choice rates for the risky alternative to checking (Skip1, pursue without checking) highlight a clear advantage of the two-sample over the one-sample generalization of the naïve

sampler model. The observed rates are 24% (SD = 18%) in 4HiC, 18% (SD = 17%) in 4LoC, and 14% (SD = 19%) in 4B. Thus, the results favor the assumption that participants first mentally selected a preferred no-checking strategy based on one sample, and then added a second sample to compare it to the checking option.

Insert figure 5 about here

Analysis of the distribution of individual checking rates, summarized in figure 6, shows large individual differences, as observed in all previous studies, and suggests low median K values (2, 3 and 5 in problems 4HiC, 4LoC and 4B respectively).

Insert figure 6 about here

GENERAL DISCUSSION

Recent technological developments have increased the impact of easy checking opportunities on consumer behavior. New websites and smartphone applications allow easy checks that will lead to better choices, and in some cases also facilitate social coordination and market efficiency. However, these easy-click checking opportunities are not always used effectively. For example, in many cases consumers forego easy and effective checks that would have proved beneficial, while in other cases they waste time and attention on unnecessary checks than may result in highly negative consequences.

Previous research suggests that the contradictory deviations from optimal checking can be the product of impatience, an effort to minimize boredom, or overconfidence. The current

analysis highlights the significance of a fourth contributor. It shows that the coexistence of insufficient and too much easy-click checking can be the product of a tendency to underweight rare events. Studies 1, 2 and 3 show that underweighting of rare events is a sufficient condition for the contradictory deviations. In addition, they show that the magnitude of the deviations from optimal checking can be predicted by the assumption that consumers rely on small samples of their past experiences. Study 4 clarifies the practical implications of the current analysis. It shows that when our goal is to increase checking, providing small bonuses which increase the probability that checking will provide the best possible payoff is far more effective than equally costly interventions that reduce the cost of checking.

Relationship to previous studies of search behavior. The easy-click checking problems studied here differ from the focus of previous studies of search behavior in an important way. Most previous studies focus on situations in which checking is cognitively difficult and adds information that can be used by consumers to improve their final decisions. In contrast, the current investigation focuses on situations in which checking is easy and often already suggests the best choice.

Nevertheless, there are reasons to believe that the behavioral differences between the two classes of search behavior problems may not be large; the tendency to underweight rare events can also be important in the context of more demanding data collection tasks (see Teodorescu and Erev 2014). An obvious similarity of effortful reading to easy clicking comes from the analysis of e-license agreements (Marotta-Wurgler 2007; Bakos et al. 2014). The results show that the tendency not to click on Terms and Conditions is only one form of insufficient checking. When the Terms and Conditions screen is long, the consumers who try to read them tend to give up after a few seconds. Similarly, consumers do not carefully read instructions and product labels

(Campos et al. 2011; Cowburn and Stockley 2005; Grunert and Wills 2007; Levi et al. 2006), and experience teaches them that ignoring these materials typically carries no negative consequences.

The similarity between easy-click checking decisions and more demanding examples of checking behaviors is also suggested by the findings of previous studies that showed excessive data collection. Zwick et al. (2003) documented over-checking in their apartment search task when the cost of searching was high, and the optimal strategy prescribed limited search. It turns out that in this setting, some checking beyond the optimal stopping point is rewarding in most cases (but leads lo large losses in rare cases). Thus, as in Studies 2 and 3, the indications for over-checking can be reflections of underweighting of rare events.

Easy-click checking decisions are particularly likely to be similar to other easy checking decisions in the real world where a quick glance substitutes for the click. For example, one of us recently failed to check the name of the airline for his next flight, and for that reason wasted 10 minutes running to the wrong side of the airport (and almost missed his flight). This mistake could have been avoided by an easy-click check (the boarding pass was on his smartphone), but a few months previously the same person committed the same mistake when he had a printed ticket in his pocket, and the mistake involved his failure to look at it.

Easy-click checking and other decisions from experiences. The current analysis suggests that easy-click checking decisions are very similar to other decisions from experience. The similarity is particularly clear in studies 1-3 which examine checking of a single option. Behavior in these studies is almost perfectly predicted with the naïve sampler model developed to capture the basic properties of decisions from experience. Good ex-ante predictions are obtained, here as in previous studies, with the assumption that subjects use ''one stage'' sample

model of one to about nine past experiences. The tendency to rely on small samples implies deviations from maximization because most small samples do not include the rare events, and can be the product of cognitive limitations, or of a sophisticated attempt to discover patterns (Plonsky, Teodorescu, and Erev 2015).

In addition, the current analysis contributes to our understanding of decisions from experience in two ways. The main contribution involves the extension of the investigation to address choice tasks that include two separate stages. The participants in study 4 could make up to two binary decisions in each trial: an initial decision between "Check" and "Continue," and for those who selected the latter, a choice between two options (A and B). There are two natural ways to generalize models of decisions from experience, like the naïve sampler model, to address common settings of this type. The simplest generalization assumes that both choices are made based on the same sample of past experiences. Our results favor a different generalization. Specifically, they suggest that consumers behave as if they take two independent samples: the first sample is used to select the favorite option without checking, and a second sample, which is averaged with the first sample, is then used to decide if this favorite option should be checked. Additional analyses, reported in a web appendix (https://sites.google.com/site/checkpapersite/), show that the advantage of the two-stage model is robust to the choice of parameter (the value of K). In addition, these analysis show that the best ex-post fit of the current results is obtained with a "two stage" model with K = 9. We believe that the advantage of the two-stage assumption reflects a general property of multi-stage decisions among multiple alternatives, and plan to continue exploring it in future research.

A second contribution concerns the joint effect of the initial reaction to the task and the impact of experience. All four studies reveal a high initial tendency to favor checking. The

checking rate in the first trial was higher than 70% in all cases. Yet when the probability that checking was the best choice was low (study 1, and conditions 4HiC and 4LoC in study 4), this tendency was reversed by three or fewer trials with feedback. There are two simple explanations for this quick reversal. The first involves the possibility that the first check satisfied subjects' curiosity about the interface. This pattern can also be an overgeneralization from situations in which checking once is sufficient and does not need to be repeated. A second explanation assumes that the quick reversal reflects a general property of consumer learning and is not unique to checking behavior. The later explanation is supported by the observation of a similar quick reversal in the context of decisions among fully described gambles (Lejarraga and Gonzalez 2011). This possibility of a general pattern is potentially important, as many studies of consumer and other behaviors focus on the way people react to new stimuli with which they do not have direct past experience, yet the results are often overgeneralized to repeated-choice settings in which consumers can rely on feedback. We hope that the current observation will facilitate evaluations of the conditions under which few experiences with feedback can mask the impact of prior beliefs and initial behavioral tendencies.

Potential implications. The current results can be used to shed light on the value of distinct methods to reduce deviations from optimal checking and facilitate the positive effect of applications and websites that allow easy-click checking. The most direct implication involves the relative effectiveness of two natural methods to increase checking. Study 4 compares the effect of a bonus for checking versus reducing the cost of checking in cases where both approaches have the same effect on the expected benefit from checking. Reducing the cost of checking by 80% increased the checking rate by only 9 percentage points (from 17.7% in problem 4HiC to 27.3% in problem 4LoC), while providing a bonus increased the checking rate

by 42 percentage points (from 17.7% in problem 4HiC to 60% in problem 4B). Our analysis suggests that this advantage of bonuses occurs when the bonus is provided with high probability (independently of the final choice among the products), and for that reason increases the probability that checking is the best choice even in small samples.

A related implication involves negotiating. For example, everyday-low-price firms that want to increase price comparisons can enhance this behavior by promising "price matching." This promise implies a clear negotiation rule (if you can convince us that you have a better outside offer, we will match it), and it increases the probability that checking is the best choice. Specifically, if the benefit from the best outside offer is small (e.g., lower than the travel cost to the store that offers it), the price matching policy increases the probability that checking is rewarding (compared to checking when there is no price matching policy).

Another implication of the current analysis involves checking in the medical context. Recent research suggests that doctors tend to perform and recommend many unnecessary tests that significantly increase the cost of health care and impair their patients' well-being. The common explanations for this observation focus on a problematic incentive structure that triggers free riding, and misunderstanding of the data (see Wegwarth and Gigerenzer 2013). The current analysis highlights another possible contributor to this problem. It is possible that some unnecessary tests are performed, with good intentions, because they tend to be the best choice. For example, it is possible that doctors recommend certain tests (e.g., CT to a patient suffering from a headache) because the typical outcome is reinforcing (the patient is happy to learn that the scan shows no tumor, or the patient is happy that a treatable problem was found). We hope that better understanding of this possibility can help reduce over-testing.

Limitations and future research. The main shortcoming of our experimental analysis is its focus on simple problems. We considered situations in which participants' checking decisions and subsequent actions had only a small monetary impact, and the participants faced the same problem repeatedly with immediate full feedback. In contrast, many natural checking dilemmas involve the gain or loss of time, an environment that tends to be dynamic (e.g., the benefit from each checking decision may depend on the time passed since the previous check), and feedback that is not always complete (in many cases the consumer does not know the outcomes that she could have obtained from the foregone options). Given the rise in single-click checking opportunities and their potential impact on consumer behavior, it is clear that future research should examine single-click checking decisions in more natural settings than the situations examined here. Yet we believe that the current clarification of the significance of the tendency to underweight rare events, and the reliance on small sample abstraction of this tendency, can be a useful starting point for further theory building and a more thorough understanding of easy-click checking.

DATA COLLECTION

The first author supervised the collection of data for all studies by research assistants at the Technion – Israel Institute of Technology Minerva Lab. Studies 1 and 2 were done in spring of 2013, study 3 in spring 2014 and study 4 in winter 2013. The first and last authors jointly discussed the data while the first author mainly analyzed it.

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TABLE 1: THREE NUMERICAL EXAMPLES OF 1-OPTION CHECKING PROBLEMS

Example	Incentive structure	Expected value (EV)	Probability that checking is the best choice	Predicted checking rates	
				EV Maximi zation	Naïve sampler (K=9)
1. **Check short e-contracts for hidden charges**	P(hidden charges) = .1 **Skip:** -11 if hidden charges; 2 otherwise	.7			
	Check: cost = 1, bonus = 11 if hidden charges; 0 otherwise payoff: -1 if hidden charges; 1 otherwise	.8	.1	100%	34%
2. **Check incoming messages while driving**	P(problem) = .1 **Skip:** 0 with certainty	0			
	Check: cost = 11 if problem; 0 otherwise, bonus = 1 payoff: -10, .1; 1 otherwise	-.1	.9	0%	64%
3. **Continue searching after finding an apparently outstanding deal**	P(outstanding) = .1 **Skip:** 11 if *outstanding*; 1 otherwise	2.0			
	Check: cost = 11 if outstanding; 0 otherwise, bonus = 1 payoff: 1 if outstanding; 2 otherwise	1.9	.9	0%	64%

Table 2: THREE LONG-SHOT PROBLEMS

Example	Incentive Structure	Expected value (EV)	Probability that checking is the best choice	Predicted choice rates		
				EV Maximization	Naïve sampler (K=9)	
					1 sample	2 samples
4HiC	Long shot with high cost checking P(treasure) =.1					
	Skip1: +10 if treasure, -1 otherwise	.10		0%	7%	24%
	Skip2: 0 with certainty	0		0%	64%	44%
	Check: cost = .2 with p = .75; 1.4 otherwise bonus = 0 payoff: 9.8 with p = .075, 8.6 with p = .025; -.2 with p = .675, -1.4 otherwise	.50	0	100%	29%	32%
4LoC	Long shot with reduced cost checking P(treasure) =.1					
	Skip1: +10 if treasure, -1 otherwise	.10		0%	1%	19%
	Skip2: 0 with certainty	0		0%	64%	44%
	Check: cost = .04 with p = .75; .28 otherwise bonus = 0 payoff: 9.96 with p = .075, 9.72 with p = .025; -.04 with p = .675, -.28 otherwise	.90	0	100%	35%	37%
4B	Long shot with bonus for checking P(treasure) =.1					
	Skip1: +10 if treasure, -1 otherwise	.10		0%	1%	18%
	Skip2: 0 with certainty	0		0%	34%	24%
	Check: cost = .2 with p = .75; 1.4 otherwise bonus = .4 payoff: 10.2 with p = .075, 9 with p = .025; .2 with p = .675, -1 otherwise	.90	.75	100%	65%	58%

Note: The four outcome payoff distributions given checking reflects the joint impact of the two possible checking costs, and the two possible values of the longshot alternatives.

FIGURE 1. BASIC DECISION FROM EXPERIENCE DEMONSTRATION
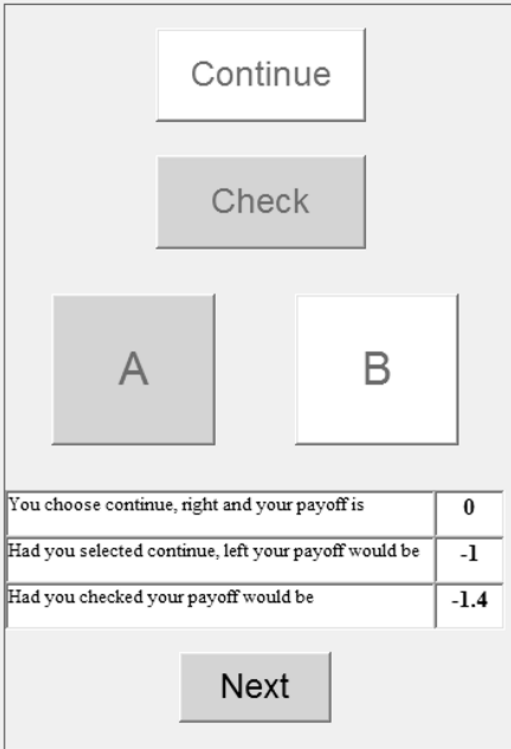
The current experiment includes many trials.
Your task, in each trial, is to click on one of the two keys presented on the screen. Each click will be followed by the presentation of both keys' payoffs. Your payoff for the trial is the payoff of the selected key.

The instructions screen in Nevo and Erev's (2012) study of decisions from experience using the "clicking paradigm". The participants did not receive a description of the payoff distributions. The feedback after each choice included the payoff from the payoff distributions associated with each of the two keys. One key always paid zero (the status quo payoff). The other, "action", key was a bad (negative expected value) gamble that led to a loss of 10 in 10% of the trials, and to a gain of 1 in the other trials (expected value = -.1). The experiment lasted 100 trials. The choice rate for the bad gamble was 58%.

FIGURE 2. INSTRUCTIONS AND EXPERIMENTAL TASKS

	STUDIES 1, 2 AND 3	STUDY 4
Instructions	Your goal in this experiment is to maximize your profits from your product choices. You can evaluate the products by selecting the "check" key, or continue without checking. Your payoff at the end of the experiment is $7 plus a share of the cumulative payoff from your choices.	
The screen at the beginning of each trial		
The feedback screen		

The top images present the screens seen by participants in studies 1, 2 and 3 (left) or study 4 (right) at the beginning of each trial. Each trial involved three key presses: "check" or "continue," a "product" (a letter key), and "next." The images at bottom present the feedback screens seen by a participant in study 1 after clicking on "check" and selecting the "E" button (left), and by a participant in study 4HiC after clicking on "continue" and selecting the "B" button (right).

FIGURE 3. THE MEAN CHECKING RATES IN STUDIES 1, 2, AND 3 (LEFT) AND THE PREDICTIONS OF THE NAÏVE SAMPLER MODEL
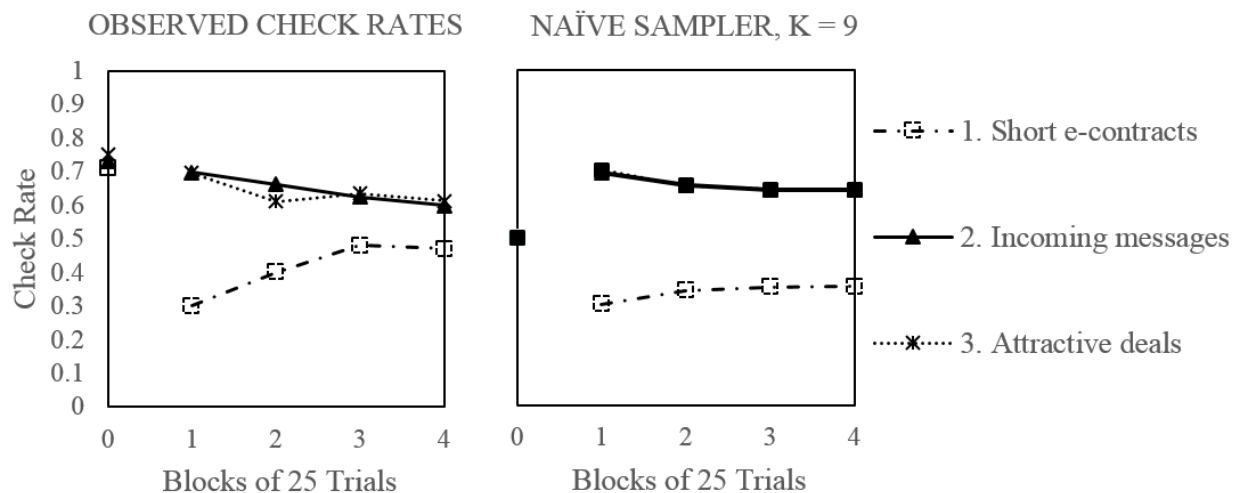
The experimental results are presented on the left, the figure on the right present the predictions of the naïve sampler model. The left most point in each panel presents the choice rate in the very first trial. The curves show all 100 trials in four blocks of 25 trials. Note that the model makes identical predictions for problems 2 and 3.

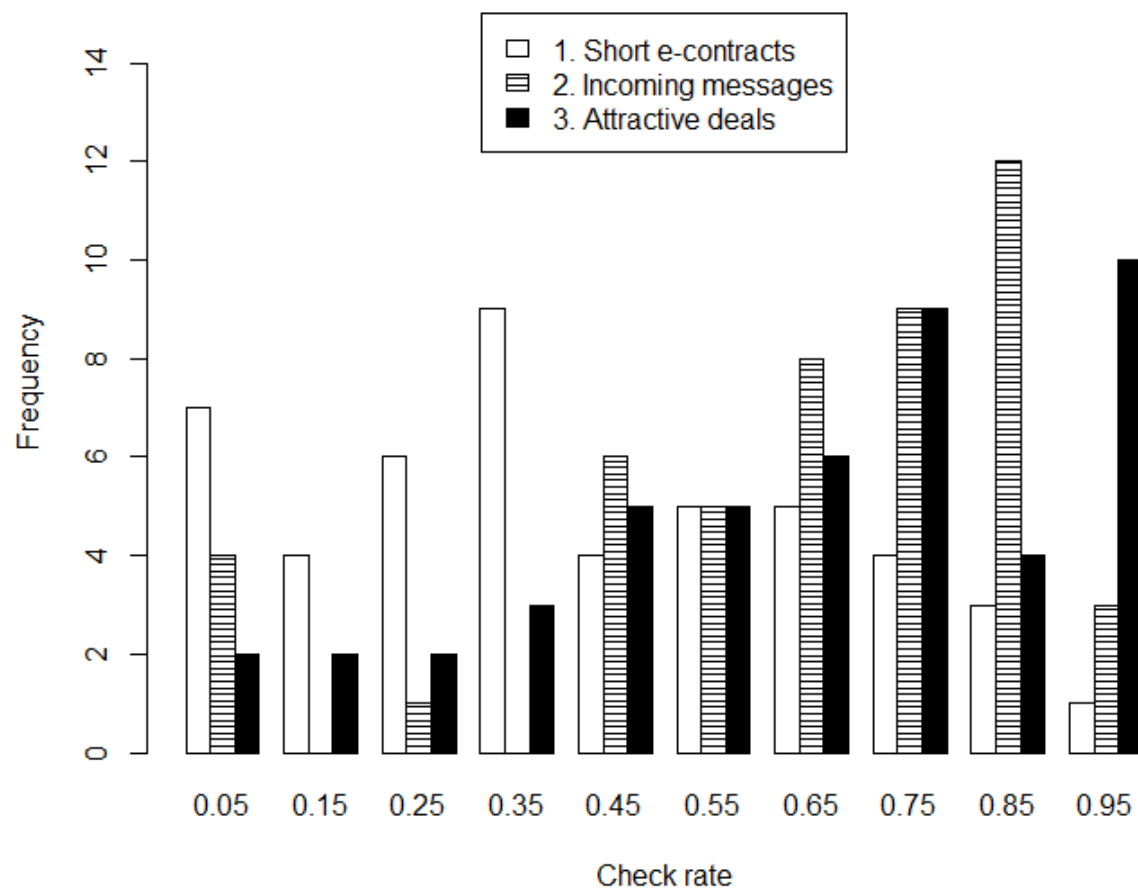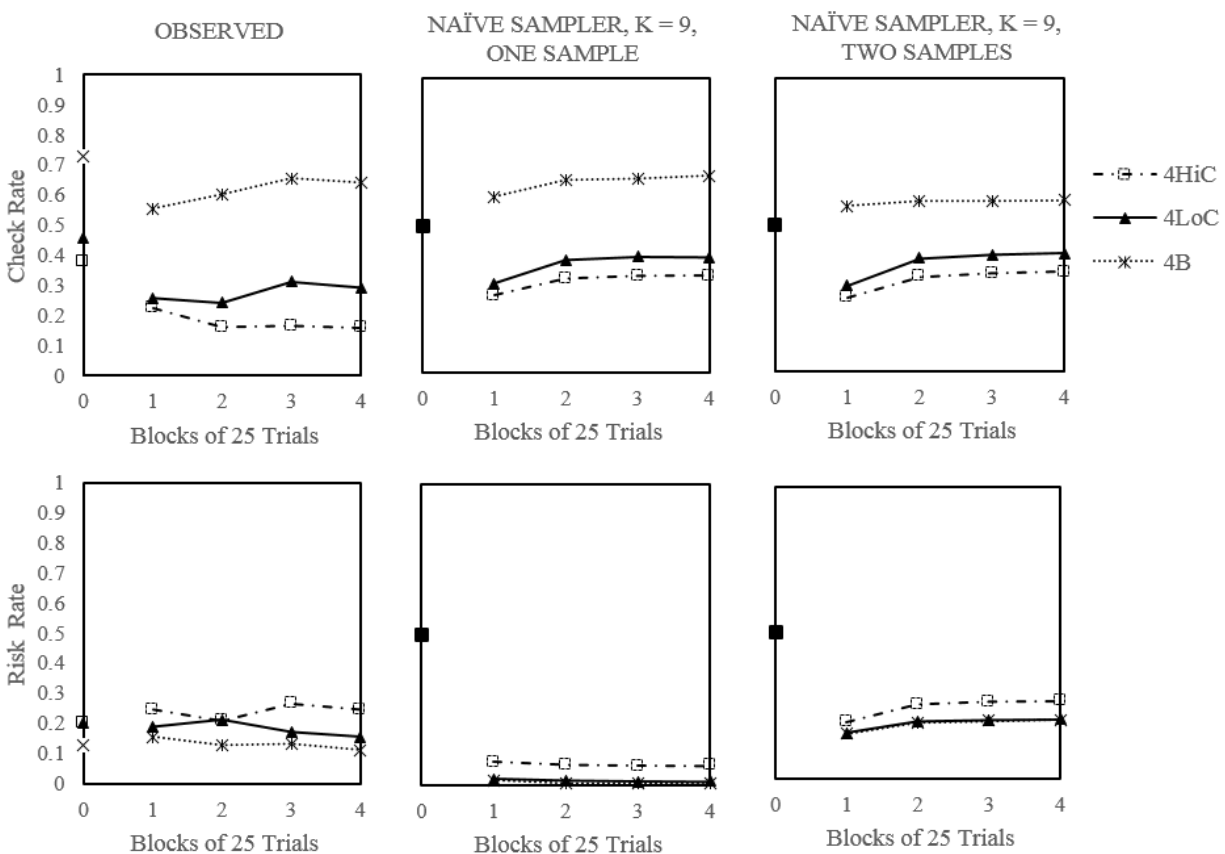FIGURE 4. INDIVIDUAL DIFFERENCES IN CHECKING RATES

FIGURE 5. THE OBSERVED and PREDICTED CHECKING and RISK (SKIP1) RATES IN PROBLEMS 4HiC, 4LoC and 4B

The experimental results are presented on the left, the figures on the right present the predictions of two versions of the naïve sampler model. The left most point in each panel presents the choice rate in the very first trial. The curves show all 100 trials in four blocks of 25 trials. The checking rates are presented in the upper panel. The lower panel presents the choice rates of the risky option (Skip1, pursue without checking).

FIGURE 6. INDIVIDUAL DIFFERENCES IN CHECKING RATES
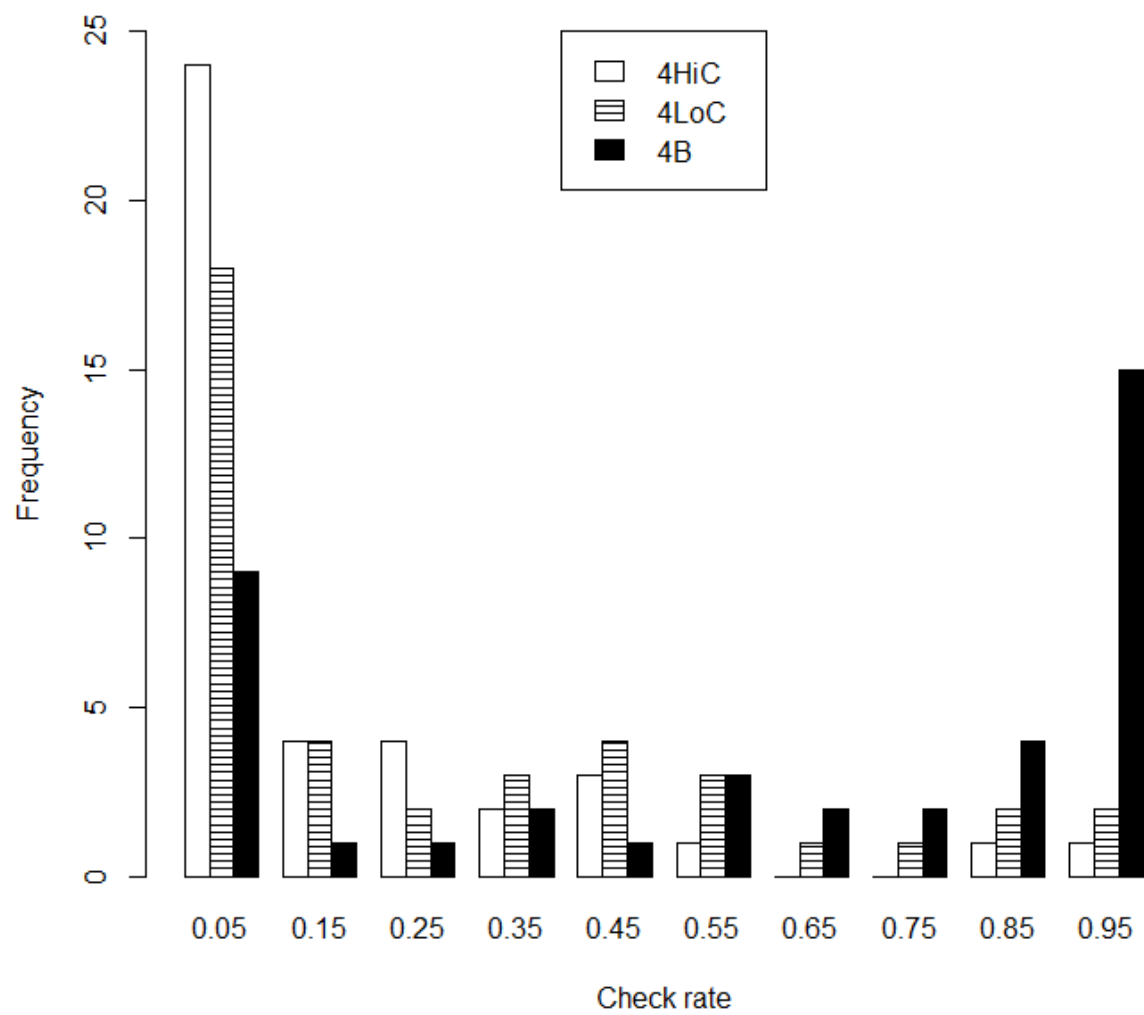
Heading List

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