Attention and Dread: Experimental Evidence on Preferences for Information*

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Abstract

Recent models assume that the anticipation of future consumption can have direct utility-consequences. This gives rise to preferences over the timing and structure of information. Using a novel and purposefully simple set-up, we study the determinants of preferences for sooner versus later information. Our main results are as follows: We find that the majority of subjects prefer receiving information sooner. This preference, however, is not uniform but depends on context. When the environment allows subjects to not focus attention on (negative) consumption events, later information becomes more attractive. Finally, variations in prior beliefs do not seem to have strong effects on information preferences.

JEL classification: C91, D03, D12, D83

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1 Introduction

Imagine a private investor learning that the value of her assets doubled over night. Quite likely, a substantial portion of the total utility generated from this event will not arise from the actual increase in future consumption, but from the pleasureful anticipation of higher future consumption. Likewise, a manager fearing to be laid-off by her employer will probably experience disutility long before the actual act of dismissal, via negative anticipation. In other words, beliefs about future consumption or life outcomes are likely to be of direct relevance for utility. Indeed, Loewenstein (1987) provides survey-evidence consistent with this idea. Moreover, evidence from fMRI-studies as well as physiological measures underscore the utility-relevance of anticipating future outcomes.¹

A key implication of anticipatory utility is that it can shape information demand beyond a standard instrumental valuation of information (Loewenstein (1987), Caplin and Leahy (2001, 2004), Brunnermeier and Parker (2005), Epstein (2008), Kőszegi and Rabin (2009), Golman, Loewenstein and Gurney (2016), Golman and Loewenstein (2018), Ely et al. (2015)).² In this paper, we study the determinants of the demand for early versus delayed information in a controlled lab experiment where information is non-instrumental. We focus on two key dimensions, the role of attention and prior beliefs. Our findings reveal an important role of attention. While early information is overall preferred, later information becomes more attractive when the experimental environment allows subjects to not focus attention on the (negative) consumption event. Variations in prior beliefs do not seem to affect information preferences.

An investigation of information preferences presents several challenges, calling for a tightly controlled environment. First, the provision and timing of information needs to be precisely controlled. Second, information ideally should not be helpful to improve subsequent decision-making. In other words, “standard” instrumental motives for demanding information as early as possible should be shut down. Third, information needs to be meaningful to participants, in the sense that it plausibly triggers anticipatory utility. Our design accommodates all these features. In our experiment, subjects can choose how they want to be informed about the outcome of a lottery. Given that much of the debate related to anticipatory utility is focused on the anticipation of negative events and corresponding feelings of dread and fear (see, e.g. Loewenstein (1987), Oster et al. (2013), Ganguly and Tasoff (2017), Golman et al. (2016)), Li et al. (2021), we decided to implement a negative consumption event. The lottery determines whether

¹See for instance Berns et al. (2006) and Schmitz and Grillon (2012).
²Formalizations of anticipatory utility have been applied in different contexts, such as life-cycle consumption (Pagel (2017)) or portfolio choice (Pagel (2018)).
subjects will experience real and negative consumption - a series of electric shocks. Electric stimuli are ideally suited for our purposes, since existing evidence shows that they indeed trigger negative anticipatory feelings (see, e.g., Berns et al. (2006) and Schmitz and Grillon (2012)). In our set-up, information is of no instrumental value and in all experimental conditions we have full control over the timing of information provision.

We first ask how the level of attention on future consumption affects information demand. Recent work has focused on the role of attention for consumer choice and belief formation. Here, we ask whether attention is a critical factor for understanding information demand. Golman and Loewenstein (2018) formalize a connection between attention and information preferences. They model the intuition that incoming information potentially affects the level of attention on future consumption such that, given anticipatory utility, subjects might use the timing of information to steer attention away from unpleasant future consumption. In the presence of a distracting activity the role of information for managing attention becomes stark. Golman and Loewenstein (2018) predict that in such environments, later information becomes more attractive, as this allows individuals to manage their level of attention away from the unpleasant consumption event towards distracting activities. The key idea of our experiment is to exogenously add a distracting activity that allows subjects to draw attention away from the stimulus. In a between-subjects design, we manipulate the experimental environment by offering subjects a multiple choice general knowledge quiz during the experiment, and then measure if subjects prefer sooner or later information revelation.

Second, we ask if and how beliefs affect information preferences. Prior beliefs about the likelihood of events are an important contextual feature. Some contexts are typically associated with a low prior probability of the bad outcome realizing (e.g., medical diagnosis), while others are characterized by a low likelihood of the good outcome (e.g., casino gambling). Most models predict that the qualitative pattern of information preferences does not depend on prior beliefs. An exception is Epstein (2008). He models anticipatory feelings such as anxiety or hope in an axiomatic framework and shows that preferences for sooner or later revelation of uncertainty can depend on priors. More specifically, he formalizes the intuition that individuals prefer early information if the

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3Note that electric shocks are commonly used in a wide range of academic fields, in particular psychology and neurosciences (examples include Berns et al. (2006), Brooks et al. (2010), Schmitz and Grillon (2012), Cohn et al. (2015), Engelmann et al. (2019)). Our study was run in accordance with established ethical principles in academia and was authorized by the University of Bonn ethical committee. We provide more details about the electric stimuli in section 2.1 as well as Appendix A.


5Karlsson et al. (2008) and Tasoff and Madaras (2009) also provide models of attention with anticipatory utility.
good outcome is very likely ex-ante while preferring delayed information when the bad outcome is very likely. In our experiments, we systematically manipulate beliefs by varying the actual prior probability of the consumption event between-subjects and study the demand for sooner versus later information.

Our findings can be summarized as follows. The large majority of subjects prefer sooner to later information. Importantly, however, this preference is not uniform across contexts. In the presence of a distracting activity, later information becomes more attractive, and a much larger fraction of subjects prefer delayed information. This suggests that subjects can indeed manage attention via information demand and use information avoidance to steer attention away from unpleasant anticipation. Finally, choices between early and late resolution do not seem to strongly depend on the ex-ante likelihood of the consumption event. Hence, information demand seems to be rather insensitive to changes in how likely the realization of the good (bad) outcome is.

Our findings contribute to a small but growing empirical literature on information preferences. Chew and Ho (1994) and Ahlbrecht and Weber (1996) are early examples that use hypothetical scenarios to examine preferences for different resolutions of uncertainty. More recently, several papers emerged that study preferences for non-instrumental information with real incentives in different paradigms. A key focus of this literature has been on sooner versus later information revelation (see, e.g., Eliaz and Schotter (2010), Kocher et al. (2009), Zimmermann (2015), Masatlioglu et al. (2017), Ganguly and Tasoff (2017), Nielsen (2020)).\footnote{Additional focus has been on clumped versus piecewise information and preferences for skewed information structures (e.g., Zimmermann (2015) and Masatlioglu et al. (2017)). In this paper we also study clumped versus piecemeal information. Broadly in line with Köszegi and Rabin (2009) and in contrast to Zimmermann (2015), subjects seem to prefer information in one piece. Appendix B provides details and summarizes results.} While most papers identify a preference for early resolution of uncertainty, Ganguly and Tasoff (2017) identify information avoidance, in line with field evidence presented in Oster et al. (2013) and Karlsson et al. (2008).\footnote{Van Winden et al. (2011) study investment decisions and how they are influenced by a delay in the resolution of risk. They show a significant effect of the delay of non-instrumental information and provide evidence that this is driven by (anticipatory) emotions. Meissner and Pfeiffer (2022) quantify preferences for early resolution of uncertainty with real consumption.} Importantly, however, in these studies, information can be avoided alltogether, whereas in our experiment subjects can only choose when they are informed. In a cleverly designed experiment, Nielsen (2020) unifies parts of the existing evidence by showing that the framing of uncertainty matters for preferences for early versus late resolution.\footnote{Engelmann et al. (2019) show that subjects exploit “wiggle room” to form optimistically biased beliefs about the likelihood of a negative event happening. This would suggest that in environments where subjects can easily bias their beliefs, they have a preference for delayed resolution of uncertainty.} Our study differs from and adds to these studies in several important ways.
First, in our experiment, information is on a precisely controlled consumption event, while in most previous studies information has been about monetary earnings.\(^9\) Second, rather than documenting preferences for early or late resolution of uncertainty, we focus on the determinants of such preferences. To the best of our knowledge, we are the first to study the role of attention as well as prior beliefs for preferences for information about future consumption.\(^10\)

Results from our attention treatments highlight the role of context for information preferences. This contrasts theoretical accounts such as Kreps and Porteus (1978), Grant et al. (1998) or Kőszegi and Rabin (2009) who formalize stable information preferences that are independent of attention. Our results indicate that preferences for sooner or later information are not uniform. In environments that cause high attention on future consumption events, individuals seem to prefer to be informed right away. Instead, if the context allows subjects to not constantly think about future outcomes (and when the nature of the future event is such that individuals prefer not to think about it), more individuals prefer receiving information later. The latter seems particularly likely when attention can be focused on alternative activities (as is the case in our attention treatment) or when the consumption event lies in the distant future. This provides a potential explanation for why many people prefer not to be informed about possible negative events such as diseases, and therefore avoid being tested. For example, there is evidence that many people at risk of developing Huntington disease in the future prefer not to be tested (see Oster et al. (2013)). Not being tested might allow individuals to not think about and anticipate negative future outcomes.\(^11\)

More generally, our results contribute to a recent theoretical literature that is incorporating attention and focus into economic decision-making (e.g., Gennaioli and Shleifer (2010), Bordalo et al. (2012), Bordalo et al. (2013), Kőszegi and Szeidl (2013) and Bushong et al. (2021) and Bordalo et al. (2016)). In these models, attention is shaped by the environment, for instance the set of available alternatives. Our findings underscore the importance of attention for anticipatory utility and support the idea that individuals can actively manage attention in a self-serving way, to increase or decrease anticipation. Intuitively, utility from anticipating future outcomes requires high levels

\(^9\)Ganguly and Tasoff (2017) and Meissner and Pfeiffer (2022) are notable exceptions.
\(^10\)Miller (1987) shows that some people have a desire to distract themselves from an aversive event. Golman et al. (2021) study the role of salience, manipulated via time lag, for information demand. Apart from the very different experimental paradigm, their work differs from ours in that they focus on ego utility, not anticipatory utility.
\(^11\)See Golman et al. (2017) for a comprehensive review on information avoidance.
of attention on these future outcomes. This makes attention a central determinant of anticipatory utility and opens a channel through which individuals can influence and manipulate their anticipation.

The next section introduces our experimental design. Section 3 presents our results, and section 4 concludes.

2 Design and Predictions

An environment allowing for the proper study of information preferences in a clean and unambiguous way ideally requires the following features: (i) Non-instrumentality of information: information preferably is on a predetermined event that can not be affected by subjects, to shut down instrumental motives for information demand. (ii) Full control over the timing of information: In particular, one needs to make sure that subjects realize the information at the moment they receive it. (iii) A consumption event where the act and timing of consumption can be controlled and that plausibly triggers anticipatory utility.

2.1 Experimental Design

Basic Design and Treatment Conditions

Our design accommodates these features. In the experiment subjects obtained information about whether or not they would receive an aversive stimulus. This stimulus consisted of a series of 30 electric shocks, which were administered using a standard electronic device frequently applied in pain stimulation studies in medicine. In case a subject received the stimulus, two electrodes were attached to the subject’s wrist and the series of 30 shocks was delivered in random time intervals within a time span of four minutes (see section 2.2 and Appendix A for details). These shocks are medically harmless, but painful. The electric shocks are ideal for our purposes: Much of the literature on anticipatory utility has focused on aversive events. Furthermore, electric stimuli have been shown to trigger negative anticipatory feelings and permit the implementation of real consumption in a tightly controlled way.\(^\text{12}\)

Table 1 summarizes the five main treatments and five additional control treatments we conducted. In the five main treatments, a lottery determined whether subjects received the aversive stimulus or not. Lotteries were implemented as follows: at the

\(^\text{12}\)Evidence on both neural and physiological responses to the prospect of receiving an electric stimulus suggests that electric shocks indeed trigger negative anticipatory feelings (see, e.g., Berns et al. (2006) and Schmitz and Grillon (2012)).
beginning of the experiment, the experimenter placed ten sealed envelopes in front of the subject. In all conditions, five envelopes contained a red card and five envelopes contained a blue card. Subjects were asked to pick five of the ten envelopes and hand them over to the experimenter. The outcome of the lottery was determined by the number of red cards contained in the five envelopes the subject selected. In three conditions (SLmedium, AttMain and AttControl), subjects received the shocks if at least three of the five selected envelopes contained a red card. The likelihood for this event is exactly 50%. In condition SLhigh, subjects received the stimulus if at least one envelope contained a red card, implying an ex-ante probability of getting shocked of more than 99%. In condition SLlow, subjects received the series of shocks if all five envelopes contained red cards, leading to a likelihood of getting shocked below 1%.

Subjects could choose how they wanted to be informed about the lottery outcome. The timing of information and subsequent (potential) consumption followed a fixed and precise protocol. The timeline in minutes was as follows: in t=0 subjects decided how to be informed about whether they would receive a series of shocks that would start at t=15. In the five main treatments, subjects could always select between receiving information sooner or later. Figure 1 provides a graphical illustration. If a subject opted for sooner information (upper panel of Figure 1), at t=0 the experimenter would directly open the five selected envelopes, and reveal the five contained cards to the subject. In case of later information (lower panel of Figure 1), the experimenter would open the five selected envelopes at t=12, and show the cards to the subject.

To investigate the intuition that the level of attention on the aversive stimulus affects information demand, we conducted treatments AttMain and AttControl. Figure 2 illustrates the two treatments. Our goal was to manipulate the level of attention in the time period after the choice between sooner and later information (i.e., between t=0 and t=12) and ensure that subjects are aware of the exogenously manipulated attention level when making their choice. In the SL-treatments (SLmedium, SLhigh, SLlow), by design attention was likely to be focused on the consumption event (regardless of the timing of information) since subjects were not provided any means to distract attention from the electric stimulus. In AttMain (upper panel of Figure 2) we changed this feature of the experimental environment by offering subjects a distracting activity. In other words, we created an environment where attention was not always focused on the

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13 By letting the experimenter directly transmit information to subjects face-to-face, we ensured that subjects would realize the information by the time it was revealed.
14 We opted for a direct binary choice between sooner or later information because we wanted decisions to be simple and easy to understand for subjects. A downside of his approach is that it does not yield quantitative individual-level information on the strength of information preferences.
Table 1: Experimental Treatments

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Decision</th>
<th>Prior Probability of Event</th>
<th># Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLmedium</td>
<td>Sooner or Later</td>
<td>50%</td>
<td>30</td>
</tr>
<tr>
<td>SLhigh</td>
<td>Sooner or Later</td>
<td>&gt;99%</td>
<td>30</td>
</tr>
<tr>
<td>SLlow</td>
<td>Sooner or Later</td>
<td>&lt;1%</td>
<td>32</td>
</tr>
<tr>
<td>AttMain</td>
<td>Sooner or Later</td>
<td>50%</td>
<td>30</td>
</tr>
<tr>
<td>AttControl</td>
<td>Sooner or Later</td>
<td>50%</td>
<td>30</td>
</tr>
<tr>
<td>AttMainMoney</td>
<td>Sooner or Later</td>
<td>50%</td>
<td>29</td>
</tr>
<tr>
<td>AttControlMoney</td>
<td>Sooner or Later</td>
<td>50%</td>
<td>29</td>
</tr>
<tr>
<td>ControlWTA</td>
<td>Willingness to Accept Stimulus</td>
<td>NA</td>
<td>25</td>
</tr>
<tr>
<td>ControlPerception</td>
<td>Perception of Stimulus</td>
<td>NA</td>
<td>24</td>
</tr>
<tr>
<td>ControlCalibration</td>
<td>Highest Tolerable Shock Level</td>
<td>NA</td>
<td>24</td>
</tr>
</tbody>
</table>

Consumption event. Specifically, the treatment was building on treatment SLmedium except for one key difference. In AttMain subjects had to perform a multiple choice quiz task. Subjects were asked general knowledge questions from various fields such as sports, geography, history, arts, music etc. To further strengthen the distracting effect of the quiz, it was administered at a different computer next to the main computer device, such that subjects could not see the shocking device or the electrodes while answering the quiz questions (see Appendix A for a picture). In addition we paid subjects for quiz performance such that subjects had incentives to focus on the quiz.\(^{15}\) The timeline in AttMain was as follows. Before choosing how to be informed about the outcome of the lottery, the quiz was running for four minutes. This was done to familiarize subjects with the quiz and to make them realize that the quiz could potentially distract them from the consumption event. Then the quiz was interrupted (t=0) and subjects could choose if they wanted to be informed now or at t=12. After the interruption the quiz continued for 12 minutes. In other words, subjects could choose if they wanted to be informed at t=0 (during the interruption of the quiz) or at t=12 (after the quiz was finished).\(^{16}\) The entire timeline was known to subjects ex-ante.

In order to be able to cleanly identify potential effects of the level of attention on

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\(^{15}\)The quiz had a total of six levels and earnings increased convex in level. Level 1 = 0 euros, level 2 = 1 euro, level 3 = 2 euros, level 4 = 4 euros, level 5 = 8 euros, level 6 = 16 euros.

\(^{16}\)Note that the length of the interruption was fixed and calibrated such that there was sufficient time for subjects to make their choice and to potentially receive the information. Thus, subjects could not affect the length of the interruption with their information choice.
Figure 1: Timeline in the SL-treatments (in minutes). Subjects decide at $t = 0$. The upper panel shows the timeline if the option “Sooner” is chosen. The lower panel displays the timeline if “Later” is chosen.

Figure 2: Timeline Attention treatments (in minutes). The Figure depicts both attention treatments. Subjects decided in $t = 0$ if they want to be informed sooner or later. The consequences of the information choice are shown in Figure 1. The upper panel shows treatment Attention Main. The lower panel depicts treatment Attention Control.

information choice, we implemented a control condition that was as similar as possible to AttMain, with the exception that between the information choice ($t = 0$) and $t = 12$ there would be no scope for distraction from the electric stimulus. Accordingly, in AttControl (lower panel of Figure 2) subjects went through four minutes of the same quiz as in AttMain. Then the quiz was interrupted ($t = 0$) and subjects could decide whether they wanted information now or in 12 minutes. The length of the interruption was the same as in AttMain. However, in contrast to AttMain, in treatment AttControl the quiz did not continue after the interruption. Between $t = 0$ and $t = 12$, subjects (like in the baseline SL-treatments) had to sit in front of the main computer with the shocking device, electrodes etc., with no means to distract attention from the electric stimulus.
Subjects knew that the quiz was only resumed at the very end of the experiment, after subjects (potentially) had received the electric stimulus. Comparison of choices between AttMain and AttControl allows for a clean identification of the effect of attention on information choices.

A potential concern might be that treatment differences between AttMain and AttControl could merely reflect a motive to stay focused on the quiz. People might not want to obtain any information in the interruption of the quiz in AttMain, because they want to concentrate on the quiz. To address this, we conducted treatments AttMainMoney and AttControlMoney. The two treatments were identical to AttMain and AttControl, except that we removed the electric shock component. Instead, information was on whether subjects won or lost in a monetary lottery. If the quiz generates a general motive to avoid information because information distracts from the quiz, such a motive should also be present when information is about winning or losing in a monetary lottery.\footnote{17}

In order to study the role of beliefs for preferences over information, treatments SLhigh, SLmedium and SLlow systematically varied the ex-ante likelihood of getting shocked. Priors ranged from low (implying a less than 1% likelihood of getting shocked) to medium (50% likelihood of getting shocked) and high (more than 99% likelihood of getting shocked). Comparison of information choices for different priors allows to identify potential effects of beliefs on information preferences.

**Procedures**

The experiment was administered in two separate office rooms of the BonnEconLab. In each room there were two desks with a computer, a set of instructions and the electronic pain stimulation device (see Appendix A for pictures).\footnote{18} Subjects were invited to the lab such that only two subjects would participate at the same time (one per room). In some cases, it happened that consecutive experimental sessions overlapped, due to subjects arriving too early or too late. In case this happened, there were two subjects present in one room for some time. To avoid potential spillover effects should this occur, the two desks in each room were separated with partition walls. Moreover, in all treatments subjects were asked to wear noise-canceling headphones while reading instructions and taking their decisions.

\footnote{17}{See section 3.1 for further details.}
\footnote{18}{In treatments AttMain and AttControl there were two computers per desk. The additional computer was used to administer the quiz, and was placed sufficiently distant from the other computer, such that while doing the quiz, subjects could not see the other computer and the shocking device.}
There was always one experimenter assigned to one subject. The experimenter welcomed the subject and asked him or her to read and sign a consent form. Afterwards, subjects were randomly assigned to treatments. Experimental instructions were provided to subjects on computer screens. Subjects were instructed in detail about the structure and timing of the respective information conditions they could select from and were given the opportunity to ask questions. Then subjects made their choice on the computer screen. The order in which the two choice alternatives were presented to subjects on the computer screen (left or right) was randomized between sessions. After subjects had made their choice, the experimenter started an electronic time clock that counted down 15 minutes (the time after which subjects potentially would receive the shock series).

At $t = 15$, in case the lottery determined that a subject received the series of electric shocks, the experimenter attached the two electrodes and a calibration phase began. Calibrating the shock intensity was required by the ethics committee and is standard and necessary for using electric pain stimulation, because individual pain perception and tolerance is very heterogeneous and depends on various factors such as body weight or the exact position of the electrodes. During the calibration phase, the shock level was increased in consecutive steps (starting from a very low level), and subjects could indicate the shock level that was just tolerable for them. This level then determined the intensity of the series of shocks.

This entire calibration procedure was known to subjects ex-ante. Therefore one might worry that subjects might misreport their own tolerance level in order to receive very low, i.e., less painful shocks. Notice that, if this were true, it would be orthogonal to all our treatment comparisons and would merely reduce the intensity and therefore the anticipatory (dis-)utility arising from the consumption event, making it less likely for information preferences to manifest themselves. Nonetheless, to further investigate the issue of a potential downward bias in reported tolerance levels, we conducted treatment ControlCalibration. In this treatment, subjects only went through the calibration phase, but without receiving any further shocks. Therefore, there were no strategic incentives to misreport tolerance levels. Reported tolerance levels did not differ significantly between that treatment and calibrations in the main treatments. More specifically, the average tolerance level elicited in ControlCalibration was 10.46 compared to 9.91 in the main treatments.\textsuperscript{19} Testing for differences between elicited tolerance levels from the main treatments and tolerance levels from ControlCalibration yields no significant effects (t-

\textsuperscript{19}A total of 70 subjects from the five main treatments received the aversive stimulus and thus went through the calibration phase.
test, $t = -0.54, p = 0.59$; Ranksum-test, $z = -0.38, p = 0.70$).

In addition to Control Calibration, we conducted two further control treatments, ControlWTA and ControlPerception. In these experiments we were interested in how subjects experience and evaluate the consumption event we implemented. In ControlWTA, we used a price list format to elicit the amount of money we would have to pay subjects to be willing to experience the series of 30 shocks. Subjects faced 20 decisions, where they could choose between receiving the series of 30 shocks plus a fixed amount of money (that was increased in 1 euro increments from 1 euro to 20 euros) and receiving no stimulus but also no additional money. In ControlPerception, subjects experienced the series of shocks and were subsequently asked to rate how unpleasant they perceived the stimulus on a scale from 1 (not at all unpleasant) to 7 (very unpleasant). In ControlWTA, we find that the average amount subjects requested in order to experience the shock series was 8.3 euros (median = 8, std. dev. = 5.4). In ControlPerception the average rating was 5.6 (median = 5, std. dev. = 1.2). Thus, taken together, the perception of the consumption event was (as expected) quite negative and the amount of money subjects demanded to experience the event was substantial.

A total of 283 subjects participated in our study. One invited subject showed-up to the study but decided not to participate once they were informed that in the course of the study they might receive a series of electric shocks. Participants were recruited from the regular subject pool of the BonnEconLab (University of Bonn) using the online recruitment system by Greiner (2003) and received a show-up fee of 20 euros. The experiment was computerized using the software Presentation. The electric shocks were administered using “Pain Stimulation Shockers” (SHK1), developed and produced by the company Psychlab. These devices are specialized for scientific use in laboratory environments. Appendix A provides further details and pictures of these devices. Instructions subjects received, including the consent form and instructions for the calibration phase are provided in Appendix C.

This result is consistent with recent evidence for lying aversion. There exist, by now, a number of studies in different contexts that reveal a pronounced preference for truth-telling (see, e.g., Gneezy (2005), Fischbacher and Heusi (2013), Abeler et al. (2014)). Such preferences are likely to be particularly strong in the face-to-face interaction we are implementing and might create incentives to report pain perception truthfully.

In treatments AttMain and AttControl subjects could earn additional money during the quiz, which is why we reduced the show-up fee to 15 euros.
2.2 Predictions

We informally discuss two theories that make specific predictions for the role of attention and beliefs, respectively.

2.2.1 Attention

Golman and Loewenstein (2018) formalize the connection between attention and information demand. Specifically, they model the intuition that incoming information can influence (increase) attention on future consumption outcomes. Given anticipatory (dis)utility, individuals do not want to focus attention on bad outcomes and they can use the choice of later information to reduce the level of attention on the bad outcome. In addition, however, individuals are assumed to be curious. Thus, in treatment AttMain, Golman and Loewenstein (2018) predict that both curiosity and managing attention on future outcomes impact information choices, with the two motives operating in different directions. While curiosity implies demanding sooner information, later information helps reduce attention on the bad consumption outcome. In contrast, in treatment AttControl, we took away the distracting activity. As a consequence, attention is by design focused on the consumption event, with little scope for managing attention. Therefore, in AttControl (similar to the SL-treatments) the curiosity motive should dominate. Accordingly, Golman and Loewenstein (2018) predict that more subjects choose sooner information in treatment AttControl, compared to AttMain.

Notice that the curiosity motive could be replaced by other types of preferences for early resolution of uncertainty. For instance, if attention is high, subjects dread the uncertainty of not knowing whether the negative outcome will materialize, and hence have a need to overcome this uncertainty by choosing early information revelation.

An additional motive that is closely related to the one above and consistent with Golman and Loewenstein (2018) is that the distracting activity increases subjects’ desire to not focus on the aversive stimulus. Intuitively, some portion of anticipatory disutility in general is likely to arise from negative anticipation ruining the utility of other activities. For instance, constantly thinking about an imminent surgery is likely to decrease the pleasure of meeting friends or of spending time with the family. In AttMain, subjects might anticipate that worrying about the shocks might reduce the potential utility of enjoying the quiz or might reduce their performance in the quiz. This goes beyond a possible effect of simply not wanting any information that is being addressed with treatments AttMainMoney and AttControlMoney. To put it differently, introducing the quiz might not only allow subjects to manage their attention, it might also increase their
motivation to do so. Following Golman and Loewenstein (2018), the means to reduce attention on the aversive stimulus is later information, implying that later information becomes more attractive.

\textit{Golman and Loewenstein (2018) predict that the fraction of subjects preferring later over sooner information is higher in AttMain compared to AttControl.}

2.2.2 Variation in Beliefs

Epstein (2008) models anticipatory feelings such as anxiety or hope in an axiomatic preference framework. He demonstrates that such a preference model can generate intuitive patterns of information demand. We make use of one of his examples where he combines his general framework with rank-dependent utility (RDEU) to show that individuals might prefer early information if the good outcome is very likely ex-ante and prefer delayed information if the bad outcome is very likely ex-ante.

\textit{Epstein RDEU\textsuperscript{22} predicts that the fraction of subjects preferring sooner information should be higher in treatment SLlow compared to treatment SLhigh.}

3 Results

Figure 3 summarizes results from the five main treatments. We first note that, looking at the SL-treatments (left panel) as well as AttControl (right panel), subjects seem to prefer early information revelation. Pooling observations from these conditions, we find that 77\% of subjects prefer to receive information early. Using a binomial test we reject the null hypothesis that choices of sooner and later information are equally likely, pointing towards a distinct preference for early information in these conditions (\(p < 0.01\)).

3.1 Attention

RESULT 1: \textit{A manipulation of the level of attention on the aversive stimulus affects information choices. When attention is reduced (treatment AttMain), significantly more subjects prefer later information (compared to treatment AttControl).}

\textsuperscript{22}We call this the “Epstein RDEU” prediction, since it is not a general prediction of his model, but is generated from combining his general model framework with RDEU. Also notice that the key contribution of Epstein (2008) is to show that certain patterns of information demand can be generated in an axiomatic framework, rather than to offer clear-cut behavioral predictions.
Figure 3 reveals that 80\% of subjects prefer sooner information in treatment AttControl, similar to the respective fractions of subjects in the SL-treatments. In treatment AttMain, however, only about 48\% of subjects prefer sooner information. Regression analysis in Table 3 (column (1)) confirms that this drop in choices of sooner information is statistically significant.\textsuperscript{23}

Notice that the choice fractions in AttMain are very close to 50-50. This can be interpreted in two ways. In the first interpretation, preference heterogeneity among subjects led to a situation where for some subjects in AttMain, sooner information remains preferred over later information, while other subjects now prefer later information. In the second interpretation, the increased attractiveness of later information (by chance) led to indifference between sooner and later information for all subjects in AttMain. The following piece of evidence suggests that the latter interpretation is unlikely. Recall that in all our treatments we randomized which choice alternative appeared on which side of the decision screen. In addition, always the left option on the screen was “preselected”. In other words, if subjects wanted to implement the left option, they could simply stick to the preselected option and press Enter. If they wanted to implement the right option, they first had to select the right option using the cursor and then confirm by pressing Enter. Thus, in case of indifference between the two options, one would expect that

\textsuperscript{23}Very similar results are obtained using linear regressions ($t = -2.81$, $p < 0.01$) or non-parametric tests (Wilcoxon ranksum test, $z = 2.66$, $p < 0.01$).
the presentation of the choice alternatives would matter for actual choices. When we introduce the order of the choice alternatives on the screen as an explanatory variable for information choices in the AttMain treatment, we find no evidence that this ordering mattered for subjects’ choices ($z = 0.73$, $p = 0.46$, Probit regression).

Table 2: Probit Estimates of Information Choices

<table>
<thead>
<tr>
<th>Dependent variable: choice of sooner information</th>
<th>Attention treatments</th>
<th>SL-treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>AttMain</td>
<td>-0.925***</td>
<td>-0.219</td>
</tr>
<tr>
<td></td>
<td>(.350)</td>
<td>(.360)</td>
</tr>
<tr>
<td>SLmed</td>
<td>-0.167</td>
<td>-0.167</td>
</tr>
<tr>
<td></td>
<td>(.357)</td>
<td>(.357)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.842***</td>
<td>0.842***</td>
</tr>
<tr>
<td></td>
<td>(.263)</td>
<td>(.262)</td>
</tr>
</tbody>
</table>

Observations 60 92
(Pseudo $R^2$) 0.094 0.004

Probit estimates, robust standard errors in parentheses. In column (1) we regress information choice from AttMain and AttControl on a treatment dummy. In column (2), choice between sooner or later information is regressed on a set of dummy variables capturing variations in priors. SLhigh is the omitted category.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

A potential concern might be that the treatment difference we have identified between AttMain and AttControl could merely reflect a desire to remain focused on the quiz. Subjects might not want to obtain any information during the interruption of the quiz in AttMain, because they want to remain concentrated on the quiz. Recall that, to address this potential concern, we conducted treatments AttMainMoney and AttControlMoney. The two treatments were identical to AttMain and AttControl, except that we removed the electric shock component. Instead, information was on whether subjects won or lost in a monetary lottery. Winning the lottery implied an additional payment of 2 euros. The prior likelihood was 50-50 and the lottery was implemented using envelopes, exactly as in the other treatments. The key idea behind these additional treatment conditions was that, if the quiz generates a general motive to avoid information in AttMain because information distracts from the quiz, this motive should also be present when information is about winning or losing in a monetary lottery. If, instead, the treatment difference between AttMain and AttControl is tied to the anticipatory disutility that stems from the electric shocks, then this effect should not be present between AttMainMoney and AttControlMoney. Table 5 in Appendix B summarizes corresponding regression results. We find no significant differences between information
choices in AttMainMoney and AttControlMoney. While in AttControlMoney, 62% of subjects preferred sooner information, 69% preferred sooner information in AttMainMoney. Thus, in contrast to treatments AttMain and AttControl, sooner information is even chosen slightly more frequently in the main condition (see Table 5 column (1)). Column (2) of Table 5 presents results from a difference-in-difference specification using all attention treatments, regressing information choice on a treatment dummy (main versus control), a monetary lottery dummy (money versus electric shock) and an interaction term. The point estimate of the interaction term is significantly different from zero, indicating that the treatment effect we identified between conditions AttMain and AttControl significantly differs from that in AttMainMoney and AttControlMoney.

Taking findings from the SL-treatments and treatments AttMain and AttControl together, subjects seem to prefer sooner information. However, this preference is not uniform, but rather depends on specific contextual features. In contexts where the nature of the environment does not induce constant focus on the (negative) consumption event, later information becomes relatively more attractive.

### 3.2 Variation in Beliefs

RESULT 2: *Choices between sooner and later information are not significantly affected by variations in prior likelihoods of the negative event.*

In column 2 of Table 2 we analyze if choices in the SL-treatments are affected by changes in prior beliefs about the consumption event. Information choices in the SL-treatments are regressed on a set of dummy variables capturing variations in the prior. We find that information choices when choosing between sooner or later information are not significantly affected by differences in the prior (none of the treatment coefficients is significantly different from zero). Joint Wald-tests do not reject the null hypothesis of zero treatment differences ($\chi^2(2) = 0.40, p = 0.820$). While we are not sufficiently powered to identify a precise null, we can rule out very large effects of prior beliefs. Figure 3 reveals that the largest possible effect is for treatment SLmed compared to SLhigh. The 95% confidence interval for the treatment coefficient on SLmed relative to baseline SLhigh is (-0.289, 0.155), meaning that we can say with 95% confidence that this treatment decreases the relative frequency for sooner choices by less than 28.9 percentage points.

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24 Similar results are obtained using linear regressions or pairwise non-parametric tests.
We implemented the lotteries using envelopes, in order to make the ex-ante probabilities salient and easy to comprehend for subjects. For the treatments where the ex-ante likelihood was high (low) we also directly told subjects in the instructions that receiving the shocks was rather (un)likely. Still, a possible concern might be that our finding that information choices are not significantly affected by variations in prior beliefs is due to possible misperceptions of the true probabilities. In other words, it could be that information demand is not influenced by differences between priors in our experiment, because subjects’ actual beliefs did not reflect these differences. To address this concern, we elicited subjective beliefs for a subset of subjects.²⁵ In Appendix B we analyze corresponding results. Two findings suggest that the empirical validity of the concern is low. First, we show that our variations in priors were effective in the sense that they strongly influence subjects’ stated beliefs.²⁶ Second, we show that information choices are not significantly affected by these stated beliefs (confirming our finding that choices are not affected by objective probabilities).

4 Discussion and Concluding Remarks

Virtually all economic activities have consequences for the structure and timing of information decision-makers receive. Sending out an application for a new position at a company eventually triggers information about how the company evaluates the applicant. Likewise, a managerial decision to engage in a risky endeavor implies, that the manager will eventually receive news about the success or failure of that endeavor. While the standard economic approach to information reduces the utility consequences of information to instrumental motives, the literature on anticipatory utility formalizes direct utility consequences of how and when we obtain information. Taking these utility consequences into account will improve our understanding of economic decision-making. Information provision is also a fundamental element of policy-making. When providing information to the public on, say, the state of the economy or dangers arising from environmental damage, policy-makers need to take the utility-consequences of the timing of information provision into account.

In this paper, we experimentally investigate preferences for non-instrumental information. We implement a real (negative) consumption event in a controlled lab environ-

²⁵At the end of the experiment, we asked the following question: “In this experiment, a lottery determined whether you would receive a series of electric shocks, or not. What do you think, what was the exact probability to receive the electric shocks? Please provide your answer in percent.”

²⁶Interestingly, we see a slight asymmetry in the response to objective probabilities, where downward adjustments are more pronounced than upward adjustments, consistent with wishful thinking (Engelmann et al. (2019)).
ment and vary information structures along two dimensions, attention and prior beliefs. Our experimental design allows precise control over the timing of information and the consumption event and ensures non-instrumentality of information. Our findings highlight that attention plays a crucial role for information demand. Variations in prior beliefs of the consumption event, however, do not affect choices. An interesting avenue for future research might be to study the interaction between attention and the role of priors. While our findings suggest that prior variation does not play a huge role for information preferences when attention is focused on the aversive stimuli, this could differ in contexts where attention is exogenously reduced.
References


Engelmann, Jan, Mael Lebreton, Peter Schwardmann, Joel van der Weele and Li-Ang Chang 2019. “Anticipatory Anxiety and Wishful Thinking.” working paper.


Schmitz, Anja and Christian Grillon. 2012. “Assessing fear and anxiety in humans using the threat of predictable and unpredictable aversive events (the NPU-


Appendix A

Pictures of Lab Environment

Picture of desk for the SL treatments.

Picture of desk for treatments AttMain and AttControl, including the two computers. The right computer administered the quiz. Note that the two computers in AttMain and AttControl were placed such that, while performing the quiz, subjects could not see the other computer.
The Electric Stimulus

The electric stimulus was administered with devices (SHK 1) manufactured by the company Psychlab. These devices are specifically tailored for scientific purposes. Electric stimulation is frequently used to induce pain or fear (see, e.g., Brooks et al. 2010 and Cohn et al. 2015) and neural as well as physiological evidence suggests that the expectation of receiving an electric stimulus indeed triggers negative anticipatory feelings (see, e.g., Berns et al. (2006) and Schmitz and Grillon (2012)).

If a subject received the electric stimulus, two electrodes were attached to the subject’s wrist (see below for a picture of an electronic device including electrodes). The electrodes delivered focused and centered electric shocks. After the calibration phase, subjects received a series of 30 shocks which were delivered in random time intervals within a total time span of four minutes, and each individual stimulus had a length of 0.1 seconds.

Picture of electronic device, electrodes, noise-cancelling headphones.
Appendix B

Perceived Priors

Here we analyze findings from the measure of perceived ex-ante likelihood of getting shocked we elicited for a subset of subjects for the SL treatments. We first demonstrate that our manipulation of prior probabilities was effective in the sense that it had a strong impact on perceived priors. Then we show that (similar to objective priors) subjective priors did not affect information choices.

Table 3: Linear Regression of Perceived Priors

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived ex-ante likelihood</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior high</td>
<td>32.96***</td>
<td>(2.82)</td>
<td></td>
</tr>
<tr>
<td>Prior low</td>
<td>-39.42***</td>
<td>(2.13)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>49.375***</td>
<td>(.62)</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( R^2 )</td>
<td>.8954</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OLS estimates, robust standard errors in parentheses. Perceived likelihood for receiving a shock is regressed on set of dummy variables capturing variations in objective priors.

\* p < 0.10, \** p < 0.05, \*** p < 0.01

The table reveals that beliefs about the likelihood of getting shocked strongly respond to changes in the objective probability. Almost all subjects in SLmedium stated priors of exactly 50% (note that in these treatments we also directly told subjects in the instructions that getting shocked and not getting shocked was equally likely). Beliefs are substantially higher in SLhigh, and substantially lower in SLlow. There appears to be a slight asymmetry in the response to objective probabilities. Downward adjustments are more pronounced than upward adjustments, which might reflect wishful thinking.

Next we analyze if subjects’ perceived priors affected choices of information conditions. In Table 4 we regress information choices on perceived priors and additional controls. Similar to results from Table 2 where objective probabilities are used, we find no effect of perceived priors on information choices.
Table 4: Probit Estimates of Information Choices

<table>
<thead>
<tr>
<th>Dependent variable: choice of sooner information</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
</tr>
<tr>
<td>Perceived Prior</td>
</tr>
<tr>
<td>-.001</td>
</tr>
<tr>
<td>(.005)</td>
</tr>
<tr>
<td>Constant</td>
</tr>
<tr>
<td>.676**</td>
</tr>
<tr>
<td>(.273)</td>
</tr>
</tbody>
</table>

Observations 70  
(Pseudo \( R^2 \)) .058

Probit estimates, robust standard errors in parentheses. Choice between sooner or later information is regressed on perceived likelihood of getting shocked.

\* \( p < 0.10 \), \** \( p < 0.05 \), \*** \( p < 0.01 \)

**AttMainMoney and AttControlMoney**

Table 5: Probit Estimates of Information Choices

<table>
<thead>
<tr>
<th>Dependent variable: choice of sooner information</th>
</tr>
</thead>
<tbody>
<tr>
<td>All attention treatments</td>
</tr>
<tr>
<td>(1)</td>
</tr>
<tr>
<td>(2)</td>
</tr>
<tr>
<td>AttMain</td>
</tr>
<tr>
<td>.188</td>
</tr>
<tr>
<td>(.343)</td>
</tr>
<tr>
<td>Money</td>
</tr>
<tr>
<td>-.534</td>
</tr>
<tr>
<td>(.354)</td>
</tr>
<tr>
<td>AttMain*Money</td>
</tr>
<tr>
<td>1.113**</td>
</tr>
<tr>
<td>(.488)</td>
</tr>
<tr>
<td>Constant</td>
</tr>
<tr>
<td>.307</td>
</tr>
<tr>
<td>(.239)</td>
</tr>
<tr>
<td>Observations</td>
</tr>
<tr>
<td>58</td>
</tr>
<tr>
<td>118</td>
</tr>
</tbody>
</table>

Probit estimates, robust standard errors in parentheses.

\* \( p < 0.10 \), \** \( p < 0.05 \), \*** \( p < 0.01 \)

**Clumped versus Piecewise Information**

We also tested whether subjects prefer clumped over piecewise information. Interestingly, in Kőszegi and Rabin (2009), subjects are averse to belief fluctuations and hence dislike receiving information piece by piece. Ely et al. (2015) instead model surprise and suspense which can make people appreciate belief fluctuations. While our main results support the prediction by Kőszegi and Rabin (2009), a follow-up experiment was somewhat inconclusive. We hence decided to not make this the focus of the paper but
nonetheless report corresponding results in this Appendix.

We conducted separate treatment conditions that allow us to study preferences over clumped versus piecewise information (CP-treatments). In the CP-treatments, the two alternatives were information in one piece or piecemeal information. A subject deciding for clumped information would obtain information exactly as in the sooner information condition, see timeline below. At $t=0$ the experimenter would directly open the five selected envelopes, and then reveal the five cards in one piece to the subject. If information was transmitted piece by piece, every three minutes the content of one envelope was revealed to subjects. More specifically, at $t=0$, the experimenter would open the first envelope and show the respective card to the subject. At $t=3$, the second card would be revealed, and so on, until at $t=12$ the fifth and last card would be shown. Notice that piecewise information in our set-up also implies a delay of information. We chose this implementation because theories predicting an aversion towards piecewise information require that no information is delayed through clumping (see Kőszegi and Rabin (2009)). Therefore, to identify specific attitudes towards piecemeal information, we need to take potential preferences for sooner or later information into account. For that purpose, we will use choices from the SL-conditions as a benchmark. In other words, we will compare choices between clumped and piecemeal information to choices between sooner and later information. This comparison allows us to “fix” preferences for early (or late) resolution of uncertainty and thus to identify if piecemeal information has a distinct effect on information demand.

Looking at choices between clumped and piecemeal information, we find that about

![Timeline in the CP-treatments](image-url)
90% of subjects prefer clumped information. A binomial tests rejects the null hypothesis that subjects randomized with equal probability between clumped and piecemeal information \((p < 0.01)\). More importantly, the fraction of subjects preferring clumped information is significantly higher than the fraction of subjects choosing sooner information \((p < 0.01)\), pointing to a distinct aversion towards piecemeal information.

In a follow-up study, we tried to delve deeper into the underlying mechanisms by studying key assumptions in Kőszegi and Rabin (2009). Specifically, we test whether subjects indeed are loss averse w.r.t. changes in their beliefs as is assumed Kőszegi and Rabin (2009). This loss aversion is what creates a demand for clumped information in their model. We conducted a treatment similar to the CP treatment, except that we exogenously assigned subjects to piecewise information and measure how their mood changes with the first piece of information. Subjects could indicate on a slider from -100 to +100 how their mood changed, where -100 would mean that their mood worsened substantially, and +100 would mean that their mood has increased substantially. A value of 0 would indicate unchanged mood.

A total of 80 subjects participated in this experiment. We do not find any indication that negative news affect mood more strongly compared to positive news. On average, participants adjusted their mood downwards by 14 points after negative information, and upwards by 21 points after positive information. We can reject the null hypothesis that negative news affect mood more strongly at any conventional level.

Appendix C

We provide instructions for treatments SLhigh and AttMain, translated into English. We also provide the consent form subjects had to sign at the beginning of the experiment if they wanted to participate, as well the instructions for the calibration phase.

Instructions - SLhigh

Instructions were provided on the computer screen.

Screen 1

Before the experiment begins, in the following you will receive instructions about the experiment. All instructions will be provided on your computer screen. Once you have read and understood all the explanations and information provided on a screen,
please press the red button on your keyboard to get to the next screen.

At the very end of the experiment we will distribute a short questionnaire. Afterwards, the experiment ends.

Please note: in this experiment, there are no correct or incorrect answers. You should simply decide based on your own preferences.

For your participation in this study you will receive 20 euros, which will be paid to you at the end of the experiment.

Please put on your headphones now to avoid distractions from other participants. In case you have any questions, feel free to ask the experimenter at any time.

Screen 2

In this experiment, a lottery will determine,

• whether about 15 minutes after the beginning of the experiment you will receive a series of 30 painful electric shocks,

• or whether you will not receive any electric shocks.

In the lottery, receiving the electric shocks is very likely.

If the outcome of the lottery is such that you do not receive the electric shocks, you will definitely not receive any electric shocks throughout the experiment.

If the outcome of the lottery is such that you will receive the electric shocks, a series of 30 shocks will be delivered in random time intervals within a time span of a couple of minutes.

During the 15 minutes, the experimenter will inform you in 3 minute intervals about the time elapsed so far.
In front of you you see 10 sealed envelopes. Each envelope contains a card. This card is either red or blue. In total there is an equal number of red and blue cards. In other words, 5 envelopes contain a red card and five envelopes contain a blue card.

You will soon be asked to select 5 of the 10 envelopes and hand these 5 envelopes over to the experimenter.

The lottery then works as follows: The experimenter will open the 5 envelopes you handed over to him. If at least 1 out of the 5 selected envelopes contains a red card, you will receive the series of 30 electric shocks. Otherwise (i.e., if none of the 5 envelopes contains a red card), you will receive no electric shocks. Since the total number of red cards is 5, it is very likely that you will receive the electric shocks.

Please select 5 out of the 10 envelopes and hand them over to the experimenter.

If you want to, you will be given the opportunity to open the remaining 5 envelopes at the end of the experiment to verify that in total there were indeed 5 red and 5 blue cards in the 10 envelopes.

There are two options how you can be informed about whether 15 minutes after the beginning of the experiment you will receive the series of electric shocks or not. You can decide which of the two options you prefer (in terms of timing, the experiment begins with your choice).

- “Now”: the experimenter, right at the beginning of the experiment (i.e. right after you made your decision), will open all 5 envelopes, such that you will learn immediately whether you will receive the series of 30 electric shocks or not.
- “Later”: the experimenter will open all 5 envelopes later, 12 minutes after the
beginning of the experiment (i.e. 12 minutes after you made your decision), such that you will learn after 12 minutes whether you will receive the series of 30 electric shocks or not.

Screen 6

This graph illustrates both options. You can also see from the graph that neither the total duration of the experiment, nor the time when you potentially receive the electric shocks depends on your decision.

Screen 7

Example 1

Imagine that 2 of the 5 cards you selected contain a red card.

“Now”: if you decided for the option “now”, directly at the beginning of the experiment all envelopes would be opened and you would learn in this example that 2 of the 5 cards are red and that therefore you will receive the series of electric shocks.

“Later”: if you decided for the option “later”, 12 minutes after the beginning of the experiment all envelopes would be opened and you would learn in this example that 2
of the 5 cards are red and that therefore you will receive the series of electric shocks.

*Screen 8*

Example 2

Imagine that 4 of the 5 cards you selected contain a red card.

“Now”: if you decided for the option “now”, directly at the beginning of the experiment all envelopes would be opened and you would learn in this example that 4 of the 5 cards are red and that therefore you will receive the series of electric shocks.

“Later”: if you decided for the option “later”, 12 minutes after the beginning of the experiment all envelopes would be opened and you would learn in this example that 4 of the 5 cards are red and that therefore you will receive the series of electric shocks.

*Screen 9*

As already mentioned, your choice in this experiment is whether you want to be informed “now” or “later” about whether you will receive the electric shocks or not.

You can make your choice by simply selecting your preferred option on the decision screen.

*The next screen was a waiting screen which was displayed for 10 seconds. Afterwards the next screen appeared.*

*Screen 11*

Remember: Depending on the content of the 5 envelopes you selected, 15 minutes after the beginning of the experiment, you will receive a series of 30 painful electric shocks.
If at least 1 of the 5 envelopes contain a red card, you will receive the series of electric shocks.

After this, subjects could make their choice, i.e., the experiment began.
Instructions - AttMain

Instructions were provided on the computer screen.

Screen 1

Before the experiment begins, in the following you will receive instructions about the experiment. All instructions will be provided on your computer screen. Once you have read and understood all the explanations and information provided on a screen, please press the red button on your keyboard to get to the next screen.

At the very end of the experiment we will distribute a short questionnaire. Afterwards, the experiment ends.

Please note: in this experiment, there are no correct or incorrect answers. You should simply decide based on your own preferences.

For your participation in this study you will receive 15 euros, which will be paid to you at the end of the experiment.

Please put on your headphones now to avoid distractions from other participants. In case you have any questions, feel free to ask the experimenter at any time.

Screen 2

In this experiment you will be participating in a quiz. The quiz will take place at the computer on the desk next to you. The quiz questions cover different topics (for instance sports, geography, history, arts, music etc.). For each question you will be provided with 4 possible answers, of which exactly one will be correct.

You earnings from this experiment increase, the more quiz questions you answer correctly. More specifically, your earnings increase in the level that you are reaching. Once you have answered 10 questions correctly (you do not need to answer 10 questions in a row correctly, what counts is the total number of correctly answered questions) you reach level 2. Afterwards, you always need to answer 20 questions correctly to reach the next level. Your earnings from the quiz are determined as follows:

- Level 1 = 0 euros
• Level 2 = 1 euros
• Level 3 = 2 euros
• Level 4 = 4 euros
• Level 5 = 8 euros
• Level 6 = 16 euros

You can see that your earnings increase substantially, the higher the level that you reach. Notice that the total number of quiz questions is limited. Therefore, you should try to answer each question as best as you can.

**Screen 3**

The quiz will shortly be interrupted after 4 minutes.

During this interruption you will be asked to make a decision, which we will in the following explain in more detail.

After the interruption, the quiz continues.

**Screen 4**

In this experiment, a lottery will determine,

• whether about 20 minutes after the beginning of the experiment you will receive a series of 30 painful electric shocks,

• or whether you will not receive any electric shocks.

In the lottery, receiving the electric shocks and not receiving the electric shocks is equally likely.

If the outcome of the lottery is such that you do not receive the electric shocks, you will definitely not receive any electric shocks throughout the experiment.
If the outcome of the lottery is such that you will receive the electric shocks, a series of 30 shocks will be delivered in random time intervals within a time span of a couple of minutes.

**Screen 5**

In front of you you see 10 sealed envelopes. Each envelope contains a card. This card is either red or blue. In total there is an equal number of red and blue cards. In other words, 5 envelopes contain a red card and five envelopes contain a blue card.

You will soon be asked to select 5 of the 10 envelopes and hand these 5 envelopes over to the experimenter.

The lottery then works as follows: The experimenter will open the 5 envelopes you handed over to him. If at least 3 out of the 5 selected envelopes contain a red card, you will receive the series of 30 electric shocks. Otherwise (i.e., if less than 3 out of the 5 envelopes contain a red card), you will receive no electric shocks. Since the total number of red and blue cards is exactly the same, both events are equally likely.

**Screen 6**

Please select 5 out of the 10 envelopes and hand them over to the experimenter.

If you want to, you will be given the opportunity to open the remaining 5 envelopes at the end of the experiment to verify that in total there were indeed 5 red and 5 blue cards in the 10 envelopes.

**Screen 7**

There are two options how you can be informed about whether 20 minutes after the beginning of the experiment you will receive the series of electric shocks or not. During the interruption of the quiz you can decide which of the two options you prefer.

- “Now”: the experimenter will open all 5 envelopes right away (i.e. during the
interruption of the quiz), such that you will learn immediately whether you will receive the series of 30 electric shocks or not.

• “Later”: the experimenter will open all 5 envelopes later, after the end of the quiz (i.e. about 12 minutes after you decision), such that you will learn after 12 minutes whether you will receive the series of 30 electric shocks or not.

The following two screens illustrate the two options in more detail.

**Screen 8**

![Graph illustrating both options](image)

This graph illustrates both options. You can also see from the graph that neither the total duration of the experiment, the sequence of the quiz, the amount of time you can spend on the quiz, or the time when you potentially receive the electric shocks depends on your decision.

**Screen 9**

Thus, the timing of the experiment is as follows:

- Right after the instructions, the quiz begins.
- The quiz will be interrupted after 4 minutes.
• During this interruption you can decide when you want to be informed about whether you will receive the electric shocks or not.

• If you choose “now”, you will be informed immediately, during the interruption of the quiz.

• If you choose “later”, you will be informed later, after the quiz ended (i.e. after 12 minutes).

• After the interruption, the quiz will presume. Note again that the length of the interruption is fixed and does not depend on your choice.

• After the quiz, depending on the outcome of the lottery, you will either receive the series of electric shocks, or not.

Screen 10

Example 1

Imagine that 4 of the 5 cards you selected contain a red card.

“Now”: if you decided for the option “now”, directly after your decision, during the interruption of the quiz, all envelopes would be opened and you would learn in this example that 4 of the 5 cards are red and that therefore you will receive the series of electric shocks. After that the quiz would presume.

“Later”: if you decided for the option “later”, 12 minutes after your decision, after the quiz ended, all envelopes would be opened and you would learn in this example that 4 of the 5 cards are red and that therefore you will receive the series of electric shocks.

Screen 11

Example 2

Imagine that 2 of the 5 cards you selected contain a red card.
“Now”: if you decided for the option “now”, directly after your decision, during the interruption of the quiz, all envelopes would be opened and you would learn in this example that 2 of the 5 cards are red and that therefore you will not receive the series of electric shocks. After that the quiz would presume.

“Later”: if you decided for the option “later”, 12 minutes after your decision, after the quiz ended, all envelopes would be opened and you would learn in this example that 2 of the 5 cards are red and that therefore you will not receive the series of electric shocks.

*Screen 12*

As already mentioned, your choice in this experiment is whether you want to be informed “now” or “later” about whether you will receive the electric shocks or not.

You can make your choice during the interruption of the quiz by simply selecting your preferred option on the decision screen.

*The next screen was a waiting screen which was displayed for 10 seconds. Afterwards the next screen appeared.*

*Screen 14*

Remember: Depending on the content of the 5 envelopes you selected, about 20 minutes after the beginning of the experiment, you will receive a series of 30 painful electric shocks.

If at least 1 of the 5 envelopes contain a red card, you will receive the series of electric shocks.

*Screen 15*

On the computer on the desk next to you you can now start the quiz.
Consent Form

Upon arrival in the lab, subjects were welcomed and asked to carefully read all the information provided on the consent form. In case a subject was willing to participate, the subject was asked to sign the consent form.

Information for participating in this experiment of the BonnEconLab

Dear participant,

welcome to this study. For participating in this study, you will receive 20 euros.

As part of this study, it can happen that you will receive a somewhat painful electric stimulus via two electrodes attached to your wrist. In the following we will provide you with more information about the electric shocks. Should you decide to participate in this study, we will ask you to sign a consent form. After this, you will receive detailed information and instructions about your tasks and all the details of the experiment. Please read the following information carefully and feel free to ask questions at any time.

Information

As part of this study, you might receive a somewhat painful electric stimulus via two electrodes, that will be attached to your wrist. The electric stimulus will be administered with devices that are specifically tailored for scientific purposes. This method has been used in many studies without any complications.

The level of electric shocks will be adapted to your individual pain perception. For this, your individual pain perception will be calibrated on a simple scale.

The scale goes from 1 to 10 and looks as follows:
On the scale, a “2” should reflect a shock intensity that you were just able to detect. A “8” should reflect an intensity that you are maximally able to tolerate.

Example: the first time you are able to perceive the stimulus, you rate it with a “2”. The subsequent stimuli will have a higher intensity, so, depending on how you perceived them, you maybe rate them with a “3” or a “4”. Once you have reached “8”, the calibration phase is over.

You cannot participate in this study if one of the following applies to you:

- Pregnancy
- Programmable devices in your body (e.g., insulin pump, heart pacemaker)
- Currently under pain medication
- Chronic pain syndrom
- Heart diseases
- Age below 18

The electric shocks are medically harmless. However, we would like to mention the following: The shocks can lead to a small increase in body temperature. Also stimulation of nerves can occur. Finally, we need to inform you that for this study there exists no special insurance for participants. Insurance coverage therefore only exists via the liability insurance of the University of Bonn.
Consent form

Name of participant:

I have read the information provided above and the experimenter name of experimenter answered the questions I had.

Please check all that apply:

- I have read and understood the consent form as well as the information for participants. Questions have been discussed and answered. I had a sufficient amount of time to decide whether I want to participate in this study or not.

- I was informed my participation in this study is entirely voluntary. I can withdraw my consent to participate in this study any time. Also the experimenter can stop the study any time he wants based on his experiences.

- I agree to participate in this study.

Finally, participants were asked to state if any of the above mentioned exclusion criteria applied to them.
Instructions - Calibration

We will now measure your individual pain perception using a simple scale. This is done to ensure that the intensity of the electric stimulus you will receive is still tolerable for you.

The scale goes from 1 to 10 and looks as follows:

![Scale Image]

We will begin with a very low shock intensity. The intensity is then gradually increased. After every shock, you can rate how you perceived this shock using this scale.

On the scale, a “2” should reflect a shock intensity that you were just able to detect. A “8” should reflect an intensity that you are maximally able to tolerate.

Example: the first time you are able to perceive the stimulus, you rate it with a “2”. The subsequent stimuli will have a higher intensity, so, depending on how you perceived them, you maybe rate them with a “3” or a “4”. Once you have reached “8”, the calibration phase is over.