The Effects of Duration Knowledge on Forecasted versus Actual Affective Experiences

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Contrary to the lay theory that predicts duration knowledge of affective episodes to ameliorate negative experiences and weaken positive ones, we demonstrate that duration knowledge increases the extremity of affective experience. In experiments 1 and 2, participants either know the exact duration of the episodes or not and then experience either negative or positive episodes. The results show that, contrary to general intuition, duration knowledge worsens negative experiences and enhances positive experiences. In experiments 3a and 3b, we identify a boundary condition wherein the effect of duration knowledge is attenuated when participants focus primarily on the end of the experience (as opposed to the ongoing experience). In closing, we highlight the theoretical implications for studies on hedonic adaptation in general and the uncertainty effect in particular. Possible mechanisms for the effect of duration knowledge are discussed.

Will a person enjoy dinner with detested in-laws more if he knows the in-laws have to go somewhere in 2 hours? Alternatively, will a person enjoy dinner with a charming friend more if he knows she will leave in 2 hours? More important, how well can people predict the effect of having the duration knowledge? That is, how well do people's intuitive responses to these questions reflect the actual changes in the dining experiences that result from knowing exactly how long the event will be? Quite a few researchers have investigated the effects of changes in duration on predicted and actual affective experiences (Coombs and Avrunin 1977; Fredrickson and Kahneman 1993; Sackett et al. 2010). However, the effect of mere duration knowledge

on affective experiences has been neglected. Given that consumers are often poor predictors of how their affective experiences evolve over time (Wilson and Gilbert 2003), it is possible that consumers are also poor judges of the effect of duration knowledge. In this article, we document how duration knowledge influences affective experiences over time and how well people can predict the effect of duration knowledge.

Intuitively, it seems likely that duration knowledge would weaken affective experiences because during a pleasurable experience, anticipating its end is generally unpleasant and should reduce the fun of the ongoing experience. Conversely, one might expect that anticipating the relief at the end of a bad experience would render it less negative. Intuition tells us that by revealing exactly when an affective episode is going to end, duration knowledge highlights the end of the episode (a better or worse future state depending on its valence). Anticipating the end contaminates the ongoing experience, thereby reducing the intensity of the experience. However, we believe that the links between duration knowledge and affective experiences are not so straightforward. For example, it has been shown that anticipating a negative (positive) future affective episode can intensify, rather than weaken, a positive (negative) ongoing experience (Meyvis and Nelson 2010). We therefore document the discrepancy between the actual effect and predicted effect of duration knowledge on affective experiences over time. Specifically, we show that contrary to lay belief,

duration knowledge actually enhances positive experiences and worsens negative experiences.

We also identify a boundary condition in which the duration effect is attenuated and discuss the connection between our findings and the extant literature on hedonic adaptation in general and the uncertainty effect in particular (Bar-Anan, Wilson, and Gilbert 2009; Wilson et al. 2005). Because our main goal is to document the actual effect of duration knowledge in opposition to people's lay intuition, we focus on demonstrating the misprediction using a variety of stimuli that vary in nature, length, and expected duration (shorter or longer than participants expect). We believe this approach attests to the robustness of the effect. Although our studies do not permit the delineation of the underlying process, we suspect that the duration knowledge effect is multiply determined, and we discuss possible underlying mechanisms, including hedonic contrast, attention, and the scarcity principle, in the general discussion.

AFFECTIVE MISFORECASTING

To understand how duration knowledge influences people's affective experiences and whether the effect deviates from people's lay belief, we first need to consider how affective experiences change over time and what people intuit about those changes. People are notoriously poor judges of future affective experiences, and they often underestimate the speed of adaptation (for a review, see Frederick and Loewenstein 1999; Hsee and Tsai 2008). That is, people do not recognize that when an external situation changes, they may feel strongly about the change initially, but their happiness (or unhappiness) tapers off over time. For example, counter to their intuition about sensitization, people quickly adapt to repeated consumption of food items (Nelson, Meyvis, and Galak 2009), increases in income (Easterlin 1995), or failure to achieve tenure (Gilbert et al. 1998). In each of those situations, the affective responses generated by those episodes weaken over time, yet people underpredict their speed of adaptation. By contrast, people can also overestimate the speed of adaptation. For example, countering lay predictions, inserting a break during repeated consumption of ice cream or music intensifies, rather than weakens, the enjoyment derived from consuming those stimuli (Kahneman and Snell 1990; Nelson and Meyvis 2008).

Knowing that people tend to misforecast their reactions to affective experiences, we believe that they might also be poor judges of the relationship between duration knowledge and their affective experiences over time. Specifically, because duration knowledge reveals when an affective episode will end, people may predict that anticipating the relief at the end of a negative experience will reduce current misery and that anticipating the disappointment at the end of a pleasurable experience will reduce current enjoyment. To verify the lay intuition, we conducted a pilot test ($n = 147$) in which we asked undergraduate students to imagine watching a movie and predict how duration knowledge would affect their enjoyment of the movie. Participants were told that the movie was either fun or boring. They were then asked to indicate, on as scale from 1 ("much worse") to 7 ("much better"), how knowing the exact duration of the movie would change their viewing experience. The results showed that participants believed that duration knowledge would weaken their experience: the fun movie would become less enjoyable and the boring movie less boring ($M_{fun} = 2.53$ vs. $M_{boring} = 6.08$; $F(1, 145) = 622.53$, $p < .01$). In each condition, the ratings were significantly different from 4, the midpoint of the scale ("no change"; p's $< .05$).

In a follow-up study, we asked another group of participants ($n = 60$) to describe how duration knowledge would change their experience in watching a boring or a fun movie. Participants indicated that duration knowledge would help them cope with having to watch a boring movie (e.g., "[duration information] helps me prepare for the suffering") and that duration knowledge would reduce the enjoyment of a fun movie (e.g., "It would be less interesting and exciting if I know [the duration] in advance"; "I would not want to know the duration, so that I would enjoy the movie more without thinking about how much time is left").

To test how accurately people predict the effect of duration knowledge on affective experiences, we conducted one field study and three lab experiments. Experiment 1, conducted in a field setting, provides initial empirical evidence for the discrepancy between the actual effect and predicted effect of duration knowledge using a negative experience. Specifically, although participants predict that duration knowledge will improve their negative experience, duration knowledge actually worsens their experience. Experiment 2 expands the finding and replicates the misprediction in both positive and negative domains: rather than weakening the experience, duration knowledge intensifies it. Experiments 3a and 3b identify a boundary condition in which the effect of duration knowledge weakens.

A potential explanation for the intensifying effect of duration knowledge is that when the duration information is not available, people expect longer duration due to wishful thinking for pleasurable events and dread of unpleasant ones. When the pleasurable event turns out to be shorter than expected, people are disappointed and therefore evaluate the experience less positively than when they know the duration in advance. In the negative domain, people may be elated when an aversive experience ends earlier than expected, and so their overall evaluation is less negative. We address this concern in all the experiments and show that the effect of duration knowledge operates independent of expected duration, thus disproving this explanation.

To avoid potential confounders such as a feeling of uncertainty arising from lacking the exact duration knowledge, we took great care to ensure that control participants knew the approximate duration of the stimuli; we used familiar affective episodes (all participants had similar past experiences) or warm-up trials before the main test. Thus, lacking the exact duration knowledge should not increase feelings of uncertainty in our scenarios. Further, we connect our studies with the literature on hedonic adaptation and explore the interplay between duration knowledge and uncertainty

(Bar-Anan et al. 2009; Wilson et al. 2005) in an additional study. In closing, we discuss possible underlying mechanisms for the intensifying effect of duration knowledge.

EXPERIMENT 1

This field study documents the actual effect and predicted effect of duration knowledge in a negative domain.

Method

Participants and Design. Eighty-three middle school students (46% females, 54% males; age: 10–12 years) at a cram school in Taiwan participated in this study. The study used a 2 (task: experience vs. prediction) × 2 (duration information: unknown vs. known) between-subjects design. Participants were randomly assigned to one of the four experimental conditions.

Cram schools are specialized schools that train their students to meet academic goals. Students usually attend the cram school after their regular school has ended, from 6:00 to 9:00 p.m. Instructors of the cram school at which we conducted the study occasionally ask students to stay extra hours in the classroom to do their homework or study for exams after the 3-hour normal session. We call this an after-hours session. On average, these extra sessions last from 30 to 90 minutes. Because students are usually tired after their 3-hour normal session, staying for an extra session is generally considered unpleasant.

Procedure and Dependent Measures. The after-hours session in our study lasted for 60 minutes, and all the participants stayed for the entire session. Before the after-hours session, all the participants received a booklet that contained the instructions for the study. Half of them were asked to predict their experience during the extra study session, and the remaining half were told that they would evaluate their experience at the end of the study session. Toward the end of the booklet, they encountered the duration knowledge manipulation. Half of the participants learned that they would stay for 60 minutes (duration-known condition), and the remaining half learned that the after-hours session would be similar in length to other after-hours sessions they had attended (duration-unknown condition). Although students in the duration-unknown condition did not have the exact duration information, they knew the range (30–90 minutes) from prior experience, and staying for 60 minutes would seem normal to them. There was a clock in the classroom, so all the participants were able to check the time during the session. Students were asked to either predict or rate their experience during the after-hours session, using 10-point scales (two pairs of scale anchors: 1 = very unpleasant, 10 = very pleasant; 1 = very unhappy, 10 = very happy). We also measured participants' expected duration. Students in the prediction condition were asked to indicate whether they anticipated the session to be shorter or longer than expected (1 = much shorter; 10 = much longer) after the session was over. Students in the experience condition

reported whether the session was shorter or longer than expected after they rated the experience (1 = much shorter; 10 = much longer) at the end of the session.

Results and Discussion

A 2 × 2 ANOVA showed a significant interaction only between duration information and task for the pleasantness rating ($F(1, 79) = 18.74$, $p < .001$) and the happiness rating ($F(1, 79) = 17.40$, $p < .001$). Below, we report the planned contrast for actual and predicted experience, respectively.

Experience. For students who rated their experience after the session was over, a one-way ANOVA showed that duration knowledge worsened the experience. Specifically, students who knew the duration of the after-hours session rated the experience more negatively than students who did not have that information (pleasantness: $M_{known} = 2.96$ vs. $M_{unknown} = 3.79$; $F(1, 51) = 7.21$, $p = .01$; happiness: $M_{known} = 2.96$ vs. $M_{unknown} = 3.68$; $F(1, 51) = 3.82$, $p = .05$).

Prediction. For predictors (students who made predictions before the after-hours session), a one-way ANOVA also showed a significant effect of duration information on the pleasantness rating ($F(1, 28) = 15.86$, $p < .001$) and the happiness rating ($F(1, 28) = 35.66$, $p < .001$) but with a reversed pattern: students who knew the duration of the after-hours session predicted their experience would be less negative than did students who did not have the precise duration information (pleasantness: $M_{known} = 3.53$ vs. $M_{unknown} = 2.33$; happiness: $M_{known} = 3.53$ vs. $M_{unknown} = 2.07$).

Expected Duration. Although a two-way ANOVA revealed a significant effect of duration knowledge on expected duration ($F(1, 79) = 15.80$, $p < .01$), the effect of duration information was not due to differences in expectation. In fact, students from the duration-known condition actually felt the session to be even shorter than they had expected, compared with students from the duration-unknown condition ($M_{known} = 4.50$ vs. $M_{unknown} = 5.86$). Specifically, participants in the duration-unknown condition rated the actual duration as no different from their expectation (no different from 5.5, the midpoint of the scale anchored at "same as expected duration"; $t(42) = 1.34$, $p = .19$), but participants in the duration-known condition rated the actual duration as shorter than they had expected (lower than the midpoint of the scale; $t(39) = -5.28$, $p < .01$). However, those in the duration-known condition still rated the experience more negatively than did those in the duration-unknown condition, suggesting that the duration knowledge effect operates on top of, or even in spite of, the effect of expectation. Further, we controlled for expectation by including the differences in expected duration as a covariate in the two-way ANOVAs and still observed a significant interaction of task and duration knowledge on pleasantness and happiness ratings, respectively (both $p < .001$). In sum, experiment 1 shows that while people believe that duration knowledge improves a negative experience, dura-

tion knowledge actually renders the experience even more unpleasant.

EXPERIMENT 2

Experiment 2 expands our findings by demonstrating the misprediction of the effect of duration knowledge in both the positive and the negative domains in a well-controlled laboratory setting using a short experience. We also measured real-time enjoyment to show how duration knowledge affects experiences over time and to rule out the expectation account. If the duration knowledge effect was due to different expectations of duration (as a result of our manipulation of duration knowledge), the effect should only manifest in the retrospective evaluation (due to disappointment or elation after the shorter-than-expected experience is over) but not in the real-time responses.

Method

Participants and Design. Students at the University of Toronto ($n = 139$) completed this computer-based study and received $5.00. The study used a 2 (valence: positive vs. negative) × 2 (duration information: unknown vs. known) between-subjects design in which participants evaluated their affective experience of listening to a piece of music (experiencers). In addition, we recruited another group of 119 participants to predict the experience using the same 2 × 2 factorial design (predictors). These predictors previewed the music for 5 seconds before making predictions.

Procedure. Participants who were experiencers were randomly assigned to one of the four conditions. To help participants become familiarized with the task and control for their expectation, we first asked them to listen to and rate a sample sound (forest sounds, with birds chirping) that was rated as neutral in a pretest. With this sample sound as the anchoring point across conditions, we predicted (and confirmed in manipulation checks) that participants would not have different expectations about the duration of the song in the main test, regardless of their duration knowledge. In the main test, participants listened to either a pleasant song clip (positive condition) or an unpleasant song clip (negative condition). Specifically, in the positive condition, the song clip was a 30-second excerpt from "Bigger than My Body" (a 2003 Top 40 hit) performed by the original singer, John Mayer. (This clip is available for free at most major online music stores.) In the negative condition, the same segment of the music was performed by one of the authors, who sings abominably. A pretest showed that the 30-second excerpt by the original vocalist was rated as very pleasant, and the version sung by the researcher was rated as very unpleasant ($M_{pos} = 6.97$ vs. $M_{neg} = 2.07$ based on a 0–10 point scale; $F(1, 70) = 89.44$, $p < .001$).

Before listening to the main song clip, participants first encountered the duration manipulation; they either were told the song clip would last for 30 seconds (duration-known condition) or skipped this information (duration-unknown condition). Next, participants began listening to the music. As in experiment 1, participants in this study had access to a clock when the music played (i.e., a digital clock at the bottom of the computer screen.)

Dependent Measures. While participants were listening to the music, they were asked to report their real-time experience. We used a computerized scale that was adapted from the positive-negative affect meter (Fredrickson and Kahneman 1993; Levenson and Gottman 1983) to obtain moment-by-moment reports of affective experience using an unmarked 15-point scale (with "very unpleasant" and "very pleasant" as anchors on the far left and far right, respectively; data were recorded as −7 for " very unpleasant" and 7 for "very pleasant"). The ratings were captured every 3 seconds, yielding 10 real-time evaluations (E_{t3}, E_{t6}, . . . E_{t30}).

After the music finished playing, participants were asked to rate their overall experience by moving an unmarked slider on an evaluation scale anchored by "very unpleasant" on the far left and "very pleasant" on the far right. Data were recorded by the computer using a 0–10 continuous scale (0.0 = very unpleasant; 10.0 = very pleasant). Subsequently, participants were asked to indicate how long this song clip seemed to them, by moving the slider on the scale anchored by "very short" on the far left and "very long" on the far right, recorded again by the computer using a 0.0–10.0 continuous scale. Predictors listened to a 5-second sample of the target song, sung either by John Mayer or by the tone-deaf researcher, and predicted their enjoyment using the same 0.0–10.0 scale, after either being informed of the song's duration or not.

Results

Perceived Duration. First, consistent with previous findings that positive experiences feel shorter than negative experiences (McGrath and Tschan 2003), participants perceived the negative song to be longer than the positive song ($M_{neg} = 6.22$ vs. $M_{pos} = 4.67$; $F(1, 134) = 19.58$, $p < .001$). As predicted, the main effect of duration knowledge was not significant ($M_{known} = 5.52$ vs. $M_{unknown} = 5.35$; $F(1, 134) = .20$, $p = .66$), and neither was the interaction between valence and duration information ($F(1, 134) = 1.87$, $p = .17$).

Experience. Participants' overall evaluation of the music was submitted to a two-way ANOVA. The results showed a significant main effect of valence ($F(1, 135) = 115.38$, $p < .001$), no main effect of duration information ($F(1, 135) = .039$, $p = .84$), and a significant interaction between valence and duration information ($F(1, 135) = 8.06$, $p = .005$). Duration knowledge increased the enjoyment derived from the pleasant version of the song ($M_{known} = 7.13$ vs. $M_{unknown} = 6.20$; $F(1, 69) = 3.24$, $p = .07$), and the effect was reversed for the unpleasant version of the song ($M_{known} = 2.33$ vs. $M_{unknown} = 3.41$; $F(1, 66) = 5.06$, $p < .05$). Further, we submitted the real-time responses to a 10

(online evaluation) × 2 (valence) × 2 (duration information) repeated-measures ANOVA, which yielded a significant three-way interaction ($F(9, 1,215) = 2.32$, $p < .05$). As depicted in figure 1, duration knowledge enhanced the experience of listening to the pleasant music but worsened the experience of the unpleasant music. This effect became more pronounced as the music played, suggesting that duration knowledge increased the intensity of the enjoyment or displeasure over time, thereby decelerating adaptation. The fact that the ongoing experience mirrored the evaluation of overall experience confirmed that the effect of duration knowledge on overall experience was not due to differences in expectation but to changes in experiences over time.

Prediction. A two-way ANOVA showed a significant main effect of valence on predicted enjoyment of the song ($M_{neg} = 3.31$ vs. $M_{pos} = 7.32$; $F(1, 117) = 142.73$, $p < .001$) and a significant interaction between valence and duration information ($F(1, 117) = 8.52$, $p < .01$). In contrast with the actual effect of duration knowledge, predictors indicated that knowing the exact duration would reduce their enjoyment of the good version of the song ($M_{known} = 6.97$ vs. $M_{unknown} = 7.88$; $F(55) = 4.02$, $p = .05$) and the unpleasantness of the bad version ($M_{known} = 3.85$ vs. $M_{unknown} = 2.74$; $F(62) = 4.70$, $p = .03$).

Discussion

Experiment 2 replicated the misprediction of the effect of duration knowledge using a short event in both positive and negative domains in a well-controlled laboratory setting. Consistent with our pilot test and experiment 1, people predicted that knowing the duration would weaken their experience: they predicted that the pleasant version of the music would be less enjoyable and the unpleasant version less negative. However, in reality, duration knowledge intensified the experience. Further, we ruled out expectation as an alternative explanation for the observed effect using expectation measure and real-time responses.

Thus far, we have used stimuli whose duration is similar to participants' expectation, even though not all of them had access to the exact duration. To further generalize our findings, in the next study we used an affective episode that lasted longer than participants had expected. Specifically, we played the warm-up clip from experiment 2, which is significantly shorter than the sound clip used for the main task of experiment 3.

Results of experiments 1 and 2 establish that countering lay belief, duration knowledge intensifies, rather than weakens, affective experiences over time. Is there an exception? We explore this possibility in the next study. Our conjecture, based on the results of experiments 1 and 2, is that knowing when an affective episode is going to end (revealed by duration knowledge) may highlight the state wherein the ongoing experience is terminated, a negative state for pleasurable experiences and a positive state for unpleasant experiences. The worse or better future may serve as a point of comparison that increases attention to the ongoing experience and, consequently, intensifies the ongoing experience (Loewenstein 1987; Wilson and Gilbert 2008). If this is the case, then maintaining attention to the ongoing experience of an affective episode should replicate our previous findings, but directing attention away from the on-

FIGURE 1

ONLINE ENJOYMENT OF LISTENING TO MUSIC FOR EXPERIMENT 2
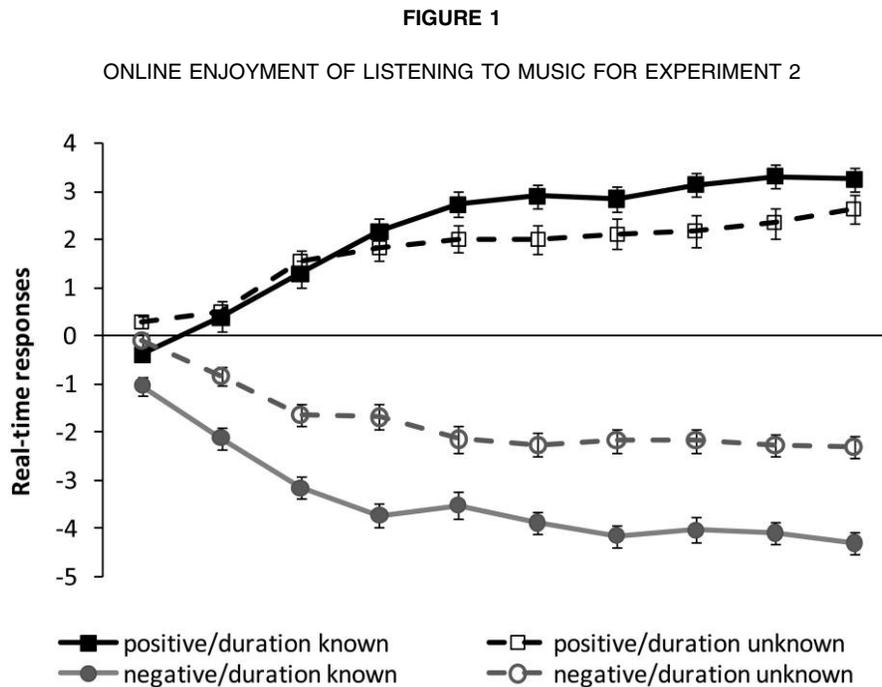
going experience toward the end of the episode (a worse or better future) should contaminate the experience and attenuate the effect of duration knowledge. We test this potential boundary condition using a positive experience in experiment 3a and a negative one in experiment 3b.

EXPERIMENT 3A

Previous research has shown that counting down an activity (e.g., doing sit-ups) directs attention away from the activity to its end (Shalev and Morwitz 2009). Drawing on this research, we increase attention to the end of an affective episode by counting down the time during the episode. We expect duration knowledge accompanied by the countdown to weaken the affective experience.

Method

Participants and Design. Students from the University of Toronto ($n = 136$) completed this computer-based study in exchange for course credit. The study used a four-level, single-factor between-subjects design (duration unknown, duration known/no timer, duration known/countdown, and duration known/count up). While the first three conditions were the most critical, to ensure that any condition effect cannot be attributed to unintended nuances created by displaying the countdown message, we added a condition in which we displayed a count-up message during the episode (duration-known/count-up condition). Given that the timer message in the count-up condition resembled the time display in our previous studies, we expected to replicate the duration knowledge effect in the count-up condition such that the count-up timer would also increase enjoyment and slow down adaptation.

Procedure. Participants were randomly assigned to one of the four conditions. All participants first completed a warm-up trial and listened to the neutral sound from experiment 2. Next, they listened to a music clip (an excerpt of Mozart's piano sonata), which was rated as positive in pretesting. The basic procedure was similar to that of experiment 2, except for two modifications: (1) the duration of the music in the main test was extended to 75 seconds, and (2) we manipulated the extent to which participants paid attention to the end of the experience. The duration-unknown and duration-known/no-timer conditions were similar to previous studies. As in experiment 2, the clock on the computer screen was available while the music played, so participants were able to see the passage of the time in those two conditions. In the countdown condition, time-elapse information appeared on the computer screen during the music, saying, "This sound will end in X seconds." In the count-up condition, the message says, "This sound has lasted for Y seconds" ($Y = 75 - X$). The countdown and count-up messages were updated every second. Consistent with prior research (Shalev and Morwitz 2009), we expected the countdown message to increase attention to the end of the song and the count-up message to maintain attention to the song itself.

To ensure that the song in the main test was longer than participants had expected, we played the 20-second neutral clip from experiment 2 in the warm-up trial for all participants and told them that the purpose of the warm-up trial was to help them familiarize with the study procedure. We reasoned that participants would therefore expect the main clip to last about as long as the sample clip. Because the main clip was actually much longer (75 seconds), it should be perceived to be longer than expected, and manipulations checks confirmed that it was.

When the music stopped playing, participants reported their overall evaluation using the measure from experiment 2. Subsequently, we measured participants' expectations by first asking them how long, in seconds, they had expected the sound clip in the main test would be. We then asked them to estimate, in seconds, how long it had actually lasted. We subtracted the perceived duration from the expected duration as a measure of expectation differential.

Results

Expected Duration. As expected, the sound clip was rated as significantly longer than expected in the tests of expectation differential: on average, the music clip was perceived as 20.88 seconds longer than participants' expectation ($t(135) = 5.78$, $p < .001$), and this perception did not differ across conditions ($F(3, 132) = 1.89$, $p = .14$).

Overall Evaluation. A one-way ANOVA showed a significant difference across conditions for participants' overall enjoyment of the music ($F(3, 132) = 8.22$, $p < .001$). Planned contrasts showed that consistent with previous studies, participants rated their enjoyment to be higher in the duration-known (no-timer) condition than in the duration-unknown condition ($M_{known/no} = 7.76$ vs. $M_{unknown} = 7.09$; $F(1, 65) = 3.79$, $p = .05$). However, duration knowledge accompanied by a countdown message significantly reduced the enjoyment ($M_{known/down} = 6.12$ vs. $M_{unknown} = 7.09$; $F(1, 65) = 3.94$, $p = .05$), suggesting that focusing on the termination of the music (a worse future) weakened, rather than intensified, the enjoyment, a reversal of the duration knowledge effect. The count-up condition resembled the duration-known/no-timer condition ($M_{known/no} = 7.76$ vs. $M_{known/up} = 7.86$; $F(1, 67) = .14$, $p = .71$). Just as in the duration-known/no-timer condition, participants in the count-up condition enjoyed the music more than did participants in the duration-unknown condition ($M_{known/up} = 7.86$ vs. $M_{unknown} = 7.09$; $F(1, 68) = 4.52$, $p < .05$). These results ruled out additional information in the counting message as an alternative explanation for the effect observed in the countdown condition.

EXPERIMENT 3B

This experiment replicates the effect of duration knowledge on a longer-than-expected episode and examines the boundary condition in a negative domain.

Method

Students at the University of Toronto ($n = 131$) completed this computer-based study in exchange for course credit. Experiment 3b is similar to experiment 3a, except that the stimulus is negative in this study. Specifically, participants listened to an aversive noise: vacuum cleaner noise. This noise sequence lasted for 45 rather than 75 seconds because a pretest showed that listening to such an aversive noise for more than 45 seconds was overly negative and might affect participants' well-being. Further, as evidenced in experiment 2 and in prior research (McGrath and Tschan 2003), negative experiences feel longer than positive ones. Thus, although the length of the aversive noise in experiment 3b is only 45 seconds, as we show later in the results section, the 45-second aversive sound was sufficiently longer than people's expectation in our study setting.

Results

Expected Duration. Consistent with experiment 3a, the sound clip was perceived as significantly longer than expected: overall, the music clip was 18.95 seconds longer than participants expected it to be ($t(127) = 14.34$, $p < .001$), and this expectation differential did not differ across conditions ($F(3, 124) = 1.92$, $p = .13$).

Overall Evaluation. A one-way ANOVA showed a significant difference across conditions for the overall evaluation of the noise ($F(3, 127) = 8.45$, $p < .001$). Consistent with previous studies, duration knowledge (without timer) worsened the experience of listening to the noise (a lower number indicates lower enjoyment; $M_{known/no} = 2.33$ vs. $M_{unknown} = 3.03$; $F(1, 66) = 4.58$, $p < .05$). However, when the duration was accompanied by a countdown message, which should focus attention on the end of the noise, duration knowledge significantly improved the negative experience ($M_{known/down} = 3.77$ vs. $M_{unknown} = 3.03$; $F(1, 60) = 4.25$, $p < .05$). Similar to experiment 3a, further analyses confirmed that the duration/count-up condition resembled the duration/no-timer condition ($M_{known/no} = 2.33$ vs. $M_{known/up} = 2.33$; $F < 1$) and that duration knowledge accompanied by a count-up message rendered the noise more aversive ($M_{known/up} = 2.33$ vs. $M_{unknown} = 3.03$; $F(1, 63) = 4.29$, $p < .05$).

Discussion

Experiments 3a and 3b show that the duration knowledge effect persists even when affective episodes are significantly longer than expected. The results replicate our earlier findings: duration knowledge intensifies both positive and negative experiences. In addition, we identify a boundary condition for the duration knowledge effect: consistent with lay beliefs, when people's attention is directed to the end of the experience, duration knowledge weakens affective experiences.

GENERAL DISCUSSION

Our central finding is that duration knowledge increases the intensity of an affective experience, a fact that runs counter to people's general intuition. In four experiments, we consistently showed that, contrary to lay predictions, duration knowledge worsened aversive experiences (experiments 1, 2, and 3b) and enhanced pleasant experiences (experiments 2 and 3a) in both field and lab settings. Duration knowledge has this effect whether the experience is long or short and whether the length is in line with participants' expectations or clearly longer than expected. Further, we identified a boundary condition: the effect of duration knowledge reverses when people focus primarily on the end of an ongoing experience (as opposed to the experience itself).

Our work contributes to several areas of research. Research on affective forecasting has shown that people are poor judges of the long-term impact of negative or positive experiences (Gilbert et al. 1998) or the effect of adaptation on ongoing experience (Kahneman and Snell 1990). Our research offers another instance of affective misprediction by showing that people do not accurately predict the effect of duration knowledge on their experiences. In the duration literature, although existing research has looked at the effect of lengths of duration and duration neglect (e.g., Fredrickson and Kahneman 1993; Kahneman et al. 1993), our work is the first to compare how duration knowledge affects the intensity with which people experience affective episodes.

Duration Effect versus Uncertainty Effect

Although duration knowledge is an important determinant of affective experiences, it is certainly not the only factor. Research has shown that people adapt more slowly to uncertain events than to certain events. For example, Wilson et al. (2005) report that a gift from a mysterious source creates longer-lasting happiness than does an identical gift from a specified source. Although they did not demonstrate the mediating role of uncertainty, the authors speculated that the uncertainty of the source of the gift focuses people's attention on the gift longer after they receive it. However, if the source is revealed when people receive the gift, they report lower happiness after a time delay, suggesting faster adaptation than in the uncertain condition. In our studies, we controlled for uncertainty by purposely using a familiar task (after-hours session in the field study) and using warm-up trials before the main test (lab experiments). Thus, we believe it was unlikely that our participants experienced great uncertainty due to lacking exact duration information. In our duration-unknown condition, which served as a control, participants had a rough idea of how long the experiences would last, even though the exact duration was not provided. These control participants' circumstances were much like circumstances that consumers often encountered in life. For example, when people go to a movie, they know it will be roughly 2–3 hours. They may lack precise duration information, but their rough knowledge of how long movies run will allay any duration uncertainty. In that regard, our

scenarios differ from the gift-giving scenario in Wilson et al. (2005): receiving a gift from an anonymous source is uncommon, but knowing the approximate but not the exact duration of an experience is quite common in daily life.

However, it is possible that if attention is drawn to the uncertainty arising from lacking the exact duration, the duration effect might be reversed, consistent with the uncertainty effect (Bar-Anan et al. 2009; Wilson et al. 2005). We therefore conducted an additional study to investigate the interplay between uncertainty and duration knowledge. We predicted that when there is little uncertainty arising from lacking exact duration knowledge (as in our experiments 1–3), we would replicate our earlier findings: duration knowledge would intensify affective experiences. In contrast, if the uncertainty of duration was high, we predicted that the effect of duration knowledge would reverse and that not knowing (rather than knowing) the exact duration would intensify affective experiences, replicating the uncertainty effect.

To test this possibility, we borrowed the paradigm of the uncertainty effect (e.g., Bar-Anan et al. 2009). In this follow-up study, the stimuli (an excerpt of the pleasant movie *The Natural*), uncertainty manipulation, and study procedure were similar to those for studies 1–3 in Bar-Anan and colleagues (2009). Our study employed a 3 (uncertainty: control, certainty vs. uncertainty) × 2 (duration information: known vs. unknown) between-subjects design ($n = 140$). As in Bar-Anan and colleagues (2009), we manipulated uncertainty by asking participants to read aloud and repeat three sentences designed to alter their perceived uncertainty while they watched a film clip. In the certainty condition, participants read, "I see," "I understand," and "I see what's happening." In the uncertainty condition, participants read, "I wonder," "I am curious," and "I am not sure what's happening." As in previous studies, participants first completed a warm-up trial by watching a short neutral clip and practiced saying aloud neutral sentences ("I am in a movie," "It's a neutral clip," "I am watching it") while watching the clip, followed by the duration knowledge manipulation. They then encountered the certainty manipulation and watched the main video clip and evaluated their overall experience using the same pleasantness measure as in experiments 2 and 3. Control participants did not read any sentences during either the trial or the main clip.

A two-way ANOVA showed only a significant interaction between uncertainty and duration information ($F(2, 134) = 5.66, p < .005$) in influencing the overall movie experience. A series of planned contrasts showed that in the control conditions, we replicated our duration knowledge effect: knowing the duration increased the enjoyment of the viewing experience ($M_{known} = 7.49$ vs. $M_{unknown} = 6.62$; $F(1, 46) = 4.32, p < .05$). A similar pattern was obtained in the certainty condition ($M_{known} = 6.82$ vs. $M_{unknown} = 5.61$; $F(1, 39) = 4.11, p < .05$); that is, those who knew the exact duration of the movie clip enjoyed the movie more, suggesting that duration knowledge intensified the affective experience. The converging results from the control and cer-

tainty conditions suggest that control participants should not have felt much uncertainty. However, in the uncertainty condition, lacking the duration knowledge increased enjoyment ($M_{known} = 5.46$ vs. $M_{unknown} = 6.54$; $F(1, 51) = 3.75, p = .05$), consistent with the uncertainty effect.

In the experimental conditions, the participants may have been distracted by the read-aloud task while watching the movie, so it was not surprising that the overall ratings in those treatment conditions were lower than those in the control condition ($F(2, 134) = 4.55, p < .05$). The main effect of duration knowledge was not significant ($F < 1$).

The results of this study support our prediction that duration knowledge intensifies an experience when people do not experience uncertainty regarding lack of exact duration information (in the certainty and control conditions). However, when a feeling of uncertainty is evoked, we replicated the uncertainty effect (Bar-Anan et al. 2009; Wilson et al. 2005) and reversed the duration effect, such that knowing the exact duration reduced enjoyment. These findings in the control and certainty conditions are entirely consistent with our findings in experiments 1–3 and confirm that uncertainty plays a minimal role in our findings. Given that it is very common for people to know the approximate duration of affective experiences but not the exact duration, and that they normally do not feel unusually uncertain about lacking the exact duration information, our findings imply that providing precise duration information can systematically intensify affective experiences over time and consequently reduce the pace at which people adapt to their affective experience.

Possible Underlying Processes

Hedonic Contrast. Our studies show that the duration effect is robust and reliable. Our interpretation of the results is that duration knowledge prompts people to consider the state in which the ongoing experience terminates: an undesirable future state for pleasurable experiences and alleviation for unpleasant experiences. Experiencing a pleasurable event while simultaneously anticipating a worse future is likely to remind people of ways in which their current circumstances are satisfying, rendering the ongoing experience more enjoyable. Similarly, experiencing an unpleasant event while anticipating a better future is likely to remind people that their current circumstances are dissatisfying, rendering the ongoing experience even more irritating.

Our interpretation is inspired by prior research showing that an anticipated future affective episode can intensify an ongoing experience due to the hedonic contrast between the present experience and the anticipated future event (Loewenstein 1987; Meyvis and Nelson 2010; Smith et al. 2009). For example, participants enjoyed listening to a song more when they expected the song to be followed by noise, and they disliked listening to noise more when they anticipated listening to pleasant music after the noise (Meyvis and Nelson 2010). The delineation of a boundary condition in experiments 3a and 3b provides support for the contrast account. In the boundary condition, counting down an af-

fective experience caused participants to focus primarily on the ending of the experience and little on their ongoing experience. This change in focus might have weakened the hedonic contrast between the ongoing experience and its end and thus eliminated the duration knowledge effect.

Attention. Related to hedonic contrast, attention is another possible explanation for our results. Past research has shown that increased attention to pain intensifies the pain, and attention to a pleasant event increases the enjoyment of the experience (for a review, see Wilson and Gilbert 2008). It is likely that in our studies, when people know exactly when an affective episode will end (identified by duration information), they pay more attention to the ongoing experience as the end draws near, thereby intensifying the overall experience.

Scarcity. One might attribute the effect of duration knowledge on positive experiences to the scarcity principle (Cialdini 1993). Previous research has shown that when a resource becomes scarce, it increases in value. Related to our work, if an affective stimulus is considered to be a limited resource when it comes to an end, the awareness of its potential unavailability can render it more enjoyable (Kurtz 2008). However, this view cannot account for the effect of duration knowledge on negative experiences. Future work is needed to systematically investigate the mechanisms underlying the effect of duration knowledge.

Other Boundary Conditions and Future Research

Two boundary conditions for the effect of duration knowledge were identified in our studies: duration knowledge weakens affective experience when people primarily focus on the termination of the experiences rather than on the current experiences (experiments 3a and 3b) and when the experiences feel uncertain (uncertainty study). There may be other ways to attenuate the duration effect. For example, the experiences in our studies are mildly pleasant or unpleasant, and people can adapt to them quickly. Duration knowledge may have a smaller effect on extreme experiences (e.g., a wedding or delivering a child) because contemplating the end of the experience and contrasting it with the ongoing experience can do little to intensify an already intense experience. Further, people's familiarity with an affective experience may also moderate the duration knowledge effect. For example, commuters are generally familiar with the duration of a traffic jam between work and home, so lacking a precise duration of the congestion evokes little uncertainty. Thus, they are more likely to exhibit the intensifying effect of duration knowledge. By contrast, lacking the duration information of an uncommon event (e.g., electricity blackout) is likely to exacerbate uncertainty, which in turn intensifies the experience. Future research is required for how event intensity, event familiarity, or potential individual differences in need for duration information moderate the effect of duration knowledge.

In addition, when an affective experience is considered a

means to an end, its duration may be perceived as the cost of obtaining the outcome ("If I have to wait for an hour to get tickets, the cost is too high, and I am not going to the show") or signal the value of the outcome ("The concert must be very good given the 1-hour wait time"; Koo and Fishbach 2010). Prior research on waiting has found that informing people of the wait time for a service can enhance people's satisfaction or service quality judgment (Hui and Zhou 1996; Kumar, Kalwani, and Dada 1997). However, it is important to note that those studies did not study the actual waiting experience, so it is an empirical question whether knowing the wait time can actually improve or worsen the waiting experience itself. Further, waiting is a special negative experience in that there are common coping strategies that can make it less unpleasant. For example, people can read a book while waiting. However, for many negative experiences, these strategies are not suitable (e.g., reading is inappropriate when one is having dinner with disliked people). Although goal pursuit and coping are beyond the scope of this research, future research might fruitfully investigate how the information value of an affective experience, or possibility of coping, can potentially interact with duration knowledge to influence hedonic adaptation and affective experiences over time.

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