It is well known that when people are engaged in an enjoyable task, time seems to pass quickly. This study explored the converse of this phenomenon by examining the effect of an accelerated sense of time, created using an altered clock, on the enjoyment of a word game. Sixty-two undergraduate male and female participants were divided into two groups, an accelerated time condition and a veridical time condition. In the accelerated condition participants played a modified solitaire version of the game Bananagrams® in the presence of a clock that had been modified to run at 142% normal clock speed. In the veridical condition participants played the game with an externally identical normal speed clock. Although participants in the accelerated clock condition reported enjoying the task more than those in the veridical clock condition, the results failed to reach significance: \( t (54) = .160, p = .116 \). The results suggest that people may make attributions of emotional states based on temporal experience.
TIME FLEW — I MUST BE HAVING FUN: 
THE EFFECT OF TIME PERCEPTION ON TASK ENJOYMENT 
by Travis R. Maciejewski

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COMMITTEE APPROVAL

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INTRODUCTION

Time Perception Research

Time perception has been studied by psychologists and neuroscientists for over a hundred years. Some studies focus on determining how people judge the duration of time and other studies focus on the behavioral impacts of the perceived passage of time. Research that attempts to understand the “timing mechanism” of the brain (Gibbon, 1977) aim to determine what makes the inner clock tick. More relevant to this study is research on the behavioral impacts of time. These types of studies usually systematically manipulate different variables, and compare their effects on a participant’s sense of time.

A review of the literature on time perception will show that time estimates are affected by several factors, including attention, familiarity, arousal, task enjoyment, and motivation. In particular, because highly enjoyable activities engage attentional resources (Csikszentmihalyi, 1975), people often perceive that time passes at a faster pace when they are enjoying themselves (hence the adage “time passes when you’re having fun”). This link between time perception and hedonic experience, coupled with people’s need to make causal inferences (Heider, 1944), suggests that the converse may be true as well (e.g., time flew, I must be having fun). The purpose of this study is to test the hypothesis that task enjoyment increases as a function of the perception that time has passed quickly.
Early Research on Time Perception

Philosophers have been interested in the mysteries of how humans experience time for centuries. One of the earliest, and most famous, discussions of the nature and experience of time occurs in the autobiographical *Confessions of St Augustine* (Augustine, AD 397). Book XI of the *Confessions* contains a long and fascinating exploration of time, and its relation to God. During the course of it Augustine raises the following conundrum: when we say that an event or interval of time is short or long, what is it that is described as being of short or long duration? It cannot be what is past, since that has ceased to be, and what is non-existent cannot presently have any properties, such as being long. But neither can it be what is present, for the present has no duration. In any case, while an event is still going on, its duration cannot be assessed. Augustine's answer to this riddle is that what we are measuring, when we measure the duration of an event or interval of time, is our memory of the event. From this he derives the radical conclusion that past and future exist only in the mind. The perception of temporal duration is crucially bound up with memory. It is some feature of our memory of the event (and perhaps specifically our memory of the beginning and end of the event) that allows us to form a belief about its duration.

The first modern review of time perception could be attributed to William James (1890). James refers to the term “specious present,” first introduced by E.R. Clay and quoted in James’ *Principles of Psychology* (1890). His definition of the specious present is “the short duration of which we are immediately and incessantly sensible” (p. 631).
This specious present is made up of two judgments where one precedes the other. For longer durations multiple small durations are cognitively grouped. Importantly, James identifies some key elements of contemporary time perception research. He notes that differences exist between judgments of filled durations (where a task is present) and empty durations (where there is no apparent presented stimuli or task for the participant). James states that filled duration tasks are experienced as being shorter, yet remembered as being longer. Empty durations are exactly the opposite; they are experienced as taking longer in passing, but are recalled as being shorter. James (1890) describes how the experience of time varies according to whether it is being studied as it happens or in retrospect. This difference between time being studied in passing or in retrospect would later become known as the prospective and retrospective paradigms. In prospective time perception studies, the individual is told prior to an event that he/she will need to report how long the event lasted. In retrospective time perception studies, the individual is told after an event that he/she needs to report its duration. The data from research using these two paradigms were not compared until approximately the 1970s.

Differences between the prospective and retrospective paradigms were likely noted by some earlier researchers, but not until extensive research on topics like affect and attention did major differences between the two paradigms emerge. Of main concern is that early researchers did not specifically note which paradigm they adopted, thereby making the data difficult to interpret. Specifically choosing to use one method over the other is a significant research decision, and unless that choice was reported by the researchers it is impossible to determine which paradigm was used.
During the fifty years following James (1890), multiple other researchers explored the variables that influenced time perception. Langfeld and Allport (1916) constructed a set of psychology laboratory exercises relating to time perception to be used in introductory psychology courses. These experiments involved the estimation of time intervals, two different units on the perception of filled and unfilled time, and the perception of subjective temporal rhythm.

Sturt (1923) worked on how accurately people are able to estimate duration. Harton (1938, 1939) examined the influence of task difficulty on time estimation, and the relationship between time estimation and actual time. Gilliland, Hofeld, and Eckstrand, (1946) continued in the same manner as James in attempting to draw together many of the smaller experimental works on time perception. They continued James’ work on the study of filled and unfilled time, and formulated general theories of time perception. These researchers also studied individual differences in time perception, cues for time perception, time perception in non-human animals, and learning in time perception (Gilliland et al., 1946). This research was conceptually informative, but much of the early work has been repeated using more modern methods of studying time perception.

Loehlin (1959) identified some of the problems with the early research. His research sought to eliminate extraneous variables and study only the influence of different activities on the apparent (subjective) length of time. One key error noted was that in many experiments participants are asked how long a specific duration of time was. He noted this was a problem because two judgments are possible. The first judgment
could be how long time seemed, (i.e., a subjective judgment), and the second could be how much time they actually thought had passed (i.e., an objective judgment). Some authors prior to Loehlin were already making this distinction (e.g., Brunswick, 1949), but much of the other research is vague concerning which judgment is being reported.

Loehlin (1959) tested his participants using many different time perception procedures. All participants engaged in a variety of time judgment tasks and answered 85 questionnaire items about their perception of time and attitude towards time in everyday life. Seventy percent of the participants took the Minnesota Multiphasic Personality Inventory (MMPI). Twenty-eight different measures were selected for analysis. These measures were factor-analyzed and then interpreted in light of the personality information gained from the MMPI. The questionnaire items were also included in the analysis to examine if people who had different levels of time perception/judgment accuracy experienced time differently in their everyday lives. Loehlin’s results identified four key variables that influenced the judgments of duration. These variables are interest vs. boredom, filled vs. empty intervals (which could be interpreted as an attention factor), repetition of an activity, and activity vs. passivity.

In addition to Loehlin (1959), other researchers were equally unimpressed by the work being done on time perception. Craik and Sarbin (1963) point out that three methods are typically used to study interval judgments. These methods are verbal estimation, the method of production, and the method of reproduction. These methods are still being used in contemporary research. Craik and Sarbin are actually more concerned
with how the human timing system works. They suggest that a cognitive process exists
wherein sensory input is received and transformed by an input modulator. This function
works due to repeated pairings of somewhat rhythmic events and time intervals. The
successive experience of an event can then be judged for time based on the previous
judgments made. To study how this functions, Craik and Sarbin (1963) used a new
research technique: the altered clock.

By creating an altered clock, Craik and Sarbin (1963) were able to study time
passing at half speed to above double speed. The manipulation could be controlled in
steps of 10 revolutions (30 rpm, 40rpm…, 120rpm, 130rpm.). This manipulation of the
clock hand speed was done out of the sight of the participant. The researchers had
participants work on a series of 14 tasks. The first five tasks were done with the clock
running at normal speed, the last nine were done either at double speed (Group A) or half
speed (Group B) of actual time. Participants were told that while they were working on
the tasks they would hear a buzzer. At the sound of the buzzer they were to stop working
on the task and estimate how long they had worked. They were also instructed to check
the clock behind them after making their estimate and record the actual time. The
checking of the clock and recording the “actual time” served to provide participants with
feedback. Craik and Sarbin suggest that the body will actually re-adapt to the new time
base and make judgments accurate to that source of time information.

Craik and Sarbin (1963) calculated the difference between actual clock time and
the perceived time of the participant. Results could range from no deviance, meaning that
their estimates were in accordance with “real time,” to complete deviance, meaning that
they adjusted fully to the new time source. The results of this study supported the idea
that altering the time source will cause participants to adopt a new timing system. In
addition, the change in deviance scores is consistent with whether the group experienced
the accelerated or decelerated timing conditions. Their last hypothesis, that the initial
under- or over-estimations will affect how adjustments are made, was also supported.
Craik and Sarbin suggest that the altered clock may serve as a valuable tool in the study
of subjective time. Unlike passive methods that rely on studying how long durations
seem, an altered clock allows the experimenter control over how time is experienced by
the participants.

Rotter (1969), led partially by the work of Craik and Sarbin (1963), continued to
look at how clock speed could be used as an independent variable. Rotter notes that his
device and procedure were actually produced prior to his awareness of the work of Craik
and Sarbin. Other studies that guided Rotter are those by Lewis, Loban, and Shaw (1956)
on altered day lengths effect on bodily process and Aaronson (1966) on personality
change from watching a metronome that changed speeds. Rotter’s hypothesis was that
time perception could be controlled by changing clock speed. Specifically, he proposed
that slowing clock speed could slow perceived time and therefore actually affect task
enjoyment.

Rotter (1969) points out that a key feature for the study of time perception is to
make the clock speed salient enough that it acts as an independent variable without
raising participants’ suspicions. A rather simple procedure was used to get participants to
take their watches off. The participants were told that they were going to be hooked up to
a device measuring galvanic skin response (GSR). The participants were fitted with bogus cords that led back to a “control room,” and were shown an example of the GSR feedback. They were then given eleven 3-min passages to read. Six of these passages were interesting, and five were dull. The participants were told that it was necessary for them to record what time they started reading each passage, so that the GSR data could be matched. Having them check the time was actually intended to make the participants aware of the clock, and thereby notice how quickly (or slowly) time was passing.

Using an analog desk clock, Rotter (1969) manipulated the movement of the hand turning motor, and in effect changed the perceived rate that time passed. His manipulations were actual time, half time, quarter time, and eighth time. The clock was changed as soon as the participant started to read the first passage, and remained constant for the entire experiment. Since each of the 11 passages took approximately three minutes to read, it was decided that the experimental trial session would last for 32 real time minutes. For example, for the people on the extreme end, the eighth-time condition, only four minutes seemed to have elapsed. At the end of the 32 real time minutes the participants were told to stop, and were then asked three questions. These questions were (1) how interesting was the reading material; (2) how quickly did time seem to flow, and (3) did the hands on the clock seem to move faster or slower than normal.

The results show that the “sensed flow of time” was actually considered “normal” for the participants in the quarter-time condition. Participants in the actual and half-speed conditions actually felt that time was moving faster than normal. In addition to sensing time as flowing differently, participants in the half-time condition reported that the clock
hand seemed to move closest to the “normal” speed. When the hands moved at normal speed, they were actually judged as moving faster than normal time. Rotter (1969) points out that although participants thought that the hands were moving differently, they still accepted the clock readings as accurate. Rotter’s hypothesis regarding task interest was not supported. Slowing time did not decrease the participants’ interest in the reading material. When the data were collapsed across conditions, however, it was found that the faster perceived flow of time, the greater the interest in the material. This result is interpreted by Rotter as the overwhelming effect of task interest on perceived time. Rotter thus concluded that there are two dimensions of time perception: affective and cognitive.

Affective and Cognitive Factors

The impact of affective and cognitive factors can be divided into two different areas. The first area is the combined impact of affective and cognitive factors. For this area two research studies will be presented. The second of these areas is the sole impact of cognitive factors. A good way to investigate cognitive influences without the impact of affective factors is to study the degree of prior experience with a task (e.g. novel vs. routine tasks).

Affective and Cognitive Interaction

Angrilli, Cherubini, Pavese, and Mantredini (1997) sought to investigate the effects of affective factors on time perception. In their literature review they identified many previous experiments that tried to identify the impact of affective factors. Each
experiment they cited had at least one confound. In an attempt to remove possible confounds they devised an experiment that utilized two different types of time estimation (i.e., analog scale and interval reproduction), heart rate, and skin conductance measures. In addition, they used the International Affective Picture System (IAPS) as stimuli. The IAPS provides normative ratings of pleasure (i.e., affective valence) and arousal for a set of color photographs that serve as stimuli for experimental investigations of emotion and attention. The IAPS, combined with the measures of heart rate and skin conductance, allowed the researchers to systematically account for the effects of both affective valence and arousal on the participants’ sense of time.

The 18 stimuli chosen from the IAPS were selected based on their valence and arousal levels (i.e. pleasant/high arousal, pleasant/low arousal, neutral, unpleasant/low arousal, and unpleasant/high arousal) (Angrilli et al., 1997). Prior to viewing the slides the participants were told that they would need to make a time judgment and rate the slides (utilizing the prospective paradigm). As the participant viewed the slides the physiological data (i.e. heart rate and skin conductance) were recorded. After viewing each slide, the participant was instructed to estimate how long they viewed the slide. These estimations were made either on an analog scale (a 20 cm long ling representing 0-10 seconds, measured to the 10th of a second) or by pressing a button to reproduce the interval. A manipulation check verified that the slides had actually produced the valence and arousal level intended. The physiological data showed that heart rate was affected by the valence of the slides, with positive slides causing an increase in heart rate and negative slides causing a decrease. Skin conductance was related to both arousal and type
of time judgment. The interval reproduction task was associated with higher skin conductance than the analog scale, but regardless of judgment condition, the high arousal stimuli were always associated with higher skin conductance than the low arousal stimuli.

The most relevant results, those on time judgments, showed two things. First, the interval reproduction condition judgments were significantly shorter than the analog scale ratings. It was also found that the analog scale ratings produced three times as much variability as the reproduction judgments. Second, the arousal and valence effects failed to reach significance. However, the interaction of valence and arousal was significant. Low arousal stimuli created shorter duration judgments for negative slides than positive slides. High arousal stimuli created longer duration judgments for negative slides than positive slides. The researchers explained that at high levels of arousal, the durations of the negative stimuli were perceived as overly long because the participants were unable to avoid them. The researchers explained this finding by inferring two different motivational mechanisms dependent upon arousal. At high arousal levels, an emotion-driven mechanism is engaged, whereas at low arousal levels an attention-driven mechanism is engaged. It is also worth noting that, consistent with the use of the prospective paradigm, all the time judgments were less than the actual duration.

In an effort to explore other ways emotion affects time perception, Noulhiane, Mella, Samson, Ragot, and Pouthas (2007) expanded on the work of Angrilli et al. (1997). Instead of using the IAPS, she and her colleagues used the International Affective Digitalized Sounds System (IADS). Similar to the IAPS, the IADS provides a set of acoustic emotional stimuli for experimental investigations of emotion and attention. This
set of standardized, emotionally-evocative, internationally accessible sound stimuli includes contents across a wide range of semantic categories. The researchers used a similar procedure to that of Angrilli et al., but two experiments were conducted. One experiment used a reproduction task, and the other experiment used a verbal estimation task. Their hypothesis was that time judgments would be longer with emotional stimuli than neutral stimuli. Similar to Angrilli et al., these researchers also investigated the effects of valence (i.e. positive or negative) and arousal (i.e. high or low).

The first experiment had twenty-four participants listen to 36 sounds from the IADS (Noulhiane et al., 2007). As with Angrilli et al. (1997), the sounds were selected based on how they fit into five different categories of valence and arousal. There were four from each possible valence and arousal interaction and twelve neutral stimuli. The participants heard each sound once for 2, 4, or 6 seconds. Once the sound stopped the "reproduction interval" began. The participants waited until they thought the same amount of time had passed and then pressed a button. A few seconds after the button was pressed, the next sound was played and the procedure was repeated.

The results of this experiment revealed that neutral sounds were perceived as shorter than low arousal positive and negative sounds for the 2 s and 4 s durations. There was no significant difference between neutral and affective sounds for the 6 s duration. The results of this experiment also showed that the reproduction of positive stimuli was shorter than that of negative stimuli in the 2 s duration, but not significantly different in the 4 s and 6 s durations. Similarly, the reproduction of high arousal stimuli was shorter than that of low arousal stimuli for the 2 s duration, but not for the 4 s and 6 s durations.
These results support their hypothesis, but only regarding short time intervals. Activation and attention clearly play a role in timing. The second experiment utilized more durations and a different time judgment task to explore this further.

The procedure for this experiment was nearly the same as that of the first experiment, except 2 s, 3 s, 4 s, 5 s, and 6 s presentations of the IADS were used (Noulhiane et al., 2007). Due to the difficulty perceiving contextual information contained in the IADS the researchers were unable to investigate durations shorter than 2 s. Instead of a reproduction interval, a “verbal estimation” task was used. This “verbal estimation” consisted of participants making a written estimation, in seconds, for each duration. Prior to the actual testing phase the participant was able to listen to one short neutral duration (i.e. 2 s) and one long neutral duration (i.e. 6 s) to familiarize them with the range of possible durations that would be presented, along with three training trials with neutral sounds to learn the procedure.

The results of this experiment were similar to those of their first experiment. There were main effects for both duration and emotion. Neutral sounds were perceived as shorter than low-arousal positive and negative sounds for the 2 s, 3 s, and 4 s durations. The results for the 5 s and 6 s durations were not significant. Also, as in the first experiment, negative sounds were perceived as longer than positive sounds. No main effect was found for arousal. Last, the low arousal sounds were perceived as longer than the high arousal ones only for the 2 s duration.
Cognition: The Effects of Routine

Avni-Babad and Ritov (2003) investigated the effect of routine on the perception of time. They conducted four experiments and two field studies to test the hypothesis that routine tasks induce shorter time estimations. The first experiment investigated the effects of routine vs. non-routine presentation of stimuli. This was done by presenting participants with recordings containing filler stimuli mixed with “high priority events” (HPEs). The high priority events were stimuli that the participants were instructed to focus on when listing to the recording. Specifically, 20 Hebrew nouns were used as the filler stimuli and the names of 10 Israeli politicians functioned as HPE’s. The researchers proposed that if the HPEs are presented routinely (i.e. evenly spaced among the nouns on the recording) there would be less contextual change than for non-routine distributions (i.e. random distribution through recording, all HPE’s heard before the nouns, or all HPEs heard after hearing the nouns). This absence of contextual change will be exhibited by having the routine presentation be perceived as shorter.

To test this, four groups of participants took part in what they thought was a memory experiment. Each group listened to two recordings. The first recording was the same for each condition and contained the word “start,” followed by 15 seconds, then the word “stop.” Then, after being instructed to listen for the names of Israeli politicians, the participants listed to the second tape. The second tape contained the experimental manipulation, the differential presentation of HPE distributions.

At the end of the tape the participants were instructed to estimate the length of the second recording by comparing it to the silent interval of the first tape. Participants were
given a sheet with a short line on the top that represented the silent interval, and a long line on the bottom. They were instructed to mark off a section on the bottom line representing how long they thought the tape lasted, using the short line as a gauge. The participants were also asked to recall as many of the words from the list as possible. Participants made the shortest duration judgments during the conditions in which the HPEs were evenly spaced throughout. In addition, the recall of the HPEs was the worst for the evenly spaced routine condition. These results are consistent with the common view that routine leads to automatism that could be reflected as time passing faster.

The second experiment was also presented as a memory task (Avni-Babad & Ritov, 2003). For this study, the participants were told that the task was to count the number of times a specific underlined number appeared in a row of numbers. The full task consisted of 20 rows of 38 digits. To alter how routine or non-routine the task was, in some lists the number 5 was always underlined, whereas in other conditions a different random digit of equal occurrence to those of the “5” condition, was underlined. Consistent with previous findings, participants in the non-routine condition made longer retrospective time estimations. Since the participants were doing the same type of task in both conditions, and the segmentation was the same, the difference in time estimations was most likely due to the routine vs. non-routine tasks.

The third study is a near replication of the second study, except a prospective paradigm was used (Avni-Babad and Ritov, 2003). They suggest that the amount of attentional resources needed for non-routine tasks is much greater than routine tasks. This statement implies that there are fewer available attentional resources in non-routine
conditions. The use of the prospective paradigm means that subjects will now be aware that timing is important, and this will become an additional drain on cognitive resources. In the routine condition, since there are more cognitive resources available, the participants will be able to engage in more time-monitoring behavior. During the non-routine condition participants will be working hard on the task and not have as much time to monitor the passage of time. Avni-Babad and Ritov explain that, due to the effect of making timing salient, participants in the prospective time judgment study should perform just the opposite of participants in the retrospective time study. They found what they expected. The results suggest that continual checking of time, allowed for by lower engagement of the routine task, increases the segmentation of the task and makes it seem longer.

The fourth study was the last to utilize an experimental design. This study was framed around “professional routine.” This type of routine refers to how, as familiarity with a procedure increases, the speed and confidence in judgments increase (Avni-Babad and Ritov, 2003). The researchers were interested in seeing if routine based on exposure familiarity also affects the perception of time. Participants were instructed to watch three short videos of teachers teaching and remember as much information as possible. These videos were a carefully counterbalanced amalgamation of 18 clips grouped into three, six clip sections. After viewing a video, each participant indicated which of the three sections seemed shorter and which seemed longer. They were also asked to recall the content of the clips (e.g. how many teachers were shown). Confirming their hypothesis, the first clip was judged as being the longest by over half the participants. Similarly, the last of the
three clips was most often identified as being the shortest. These findings support the idea that viewing multiple similar clips created a sense of “professional routine.” The viewing of the second clip was more familiar, therefore “faster,” due to the viewing of the first clip. The last clip was viewed as the fastest since it was preceded by two similar clips.

The fifth study was a field study designed to examine routine in a setting with higher ecological validity (Avin-Babad & Ritov, 2003). The participants were 41 guests at a Club Med all inclusive resort. Although the guests at this resort are always free to choose which activities they want to engage in, the timing of them is under the strict control of the resort. Each day has three large meals, with scheduled activity times before and after each of the meals. During check-out after a three or four day stay at the resort, participants were asked to divide their stay into three parts: the beginning, the middle, and the end. They were then asked to rate each part of their stay on a scale from one (slow) to five (fast). Consistent with the fourth study on “professional routine,” the vacationers experienced a positive time order error. Over half of them rated the last part of their vacation as being the shortest and the first part as being the longest.

The last study was another field study (Avin-Babad & Ritov, 2003). This study examined the experiences of workers in an Israeli kibbutz. At this kibbutz the workers often help out doing jobs other than their normal job in times of need. The researchers hypothesized that non-routine jobs will have more memory anchors (i.e. unique experiences that create reference points) for retrospective memory than routine jobs. Because the actions of the routine job are anticipated, they will not create as many anchors, making similar time spent doing a routine job seems shorter than a non-routine
job. The 44 workers included in this study all had worked at temporary jobs during the previous two years. Participants were asked about how fast they remember time passing in their regular jobs, how fast they remember time passing in their temporary job, and enjoyment (i.e. how interesting is the routine job, how interesting is the temporary job). Consistent with their other findings, Avin-Babad and Ritov found that time was remembered as being shorter for the routine job. Both routine and non-routine jobs were rated as rather interesting. The average interest ratings were similar for the two types of jobs.

This work on routine verses non-routine tasks shows that prior experience can alter time perception. Tasks and activities that are routine generally require less attention and are more familiar. This decrease in attention and fewer unique experiences makes time seem to pass faster than normal. The important exception to this is conditions where timing is made salient. The decrease in need for attention on the task or activity allows for an increase in attention to the passage of time. The increase in attention tends to lengthen subjective duration judgments.

Attribution Theory

The perception that time passed faster than expected will cause participants to seek an attribution for that perception. Attribution theory focuses on how individuals “attribute” causes to events and behavior (Heider, 1944). According to attribution theory, an event or behavior gains meaning from the source to which it is attributed. In general,
people tend to overweigh internal, dispositional causes over external causes. An early exploration of this concept was done using animated geometric figures (Heider & Simmel, 1944). The researchers had female participants watch a short animated film of three small geometric figures (i.e., a large triangle, a small triangle, and a circle) moving in and around a large rectangle containing a “door” that periodically opened and closed (Figure 1).

![Figure 1. Still from the film used in the Heider and Simmel (1944) experiment.](image)

Participants were assigned to one of three groups. The first group was told simply to write down what happened in the picture. The second group was instructed to interpret the movements of the figures as actions of persons. In the third experiment, the same video was shown in reverse. These participants saw the film projected backwards, presumably without being told that the projector was running in reverse. The viewers wrote answers to ten questions. Nine of the questions were of the sort “What kind of a person is the big triangle?” Answers included aggressive, warlike, irritable, dumb, stupid, ugly, shy, sly and quick to take offense. The final item on the questionnaire was “Tell the
The stimuli were ambiguous and could have been explained as independent events, but nearly all subjects, regardless of condition assignment, described the film in anthropomorphic terms, i.e., as the social interactions of three human-like characters who possess personalities, emotions, and intentions. Virtually all participants made up a social plot in which the big triangle was seen as an aggressor. Most observers developed elaborate stories about the circle and the little triangle being in love, about the larger triangle trying to steal away the circle, about the little triangle fighting back, yelling to his love to escape into the house, and following her inside where they embraced and lived happily ever after. It is remarkable how much such stories go beyond what was seen: two triangles and a circle moving around the screen. This study demonstrated that people, on viewing a simple animation involving geometric shapes, attribute emotions and intentions to the shapes based on their movements.

Kelley (1973) explains two major principles of attribution theory. The differences in the two principles are based on the amount of information the person making the attribution has. In one case, the person knows information from multiple observations; in the second case, information is known only from a single observation. Attributions made based on multiple observations are explained by the “covariation principle.” This principle proposes that “an effect is attributed to the one of its possible causes with which, over time, it covaries” (Kelley, 1973, p.108). The “discounting principle,” on the other hand, requires the presence of only a single observation, although the person making the attribution has usually observed similar situations in the past and has some idea about the relevant causes. This principle states that the role of a particular cause in
producing a given behavior is discounted in the presence of other plausible causes (Kelley, 1973).

Valins (1966) examined the covariation principle using a procedure that exposed heterosexual male participants to either false heart-rate feedback or extraneous sound. The purpose of the study was to investigate how perceived physiological reactions impact judgments of emotional stimuli. Participants were shown photographs of semi-nude women and heard what they thought to be their own heart rates change or remain constant. Participants rated the photographs as more attractive when they believed their heart rates had reacted to the stimuli. These judgments persisted for at least one month. Consistent with the description given by Kelly (1973), the repeated pairing, i.e., covariation, of the photograph with the altered heart rate led the person to attribute attractiveness as the cause of their increased heart rate.

This work may be relevant to what happens when one’s time perception is distorted. The ambiguous situation created by the incongruence of perceived time (e.g., from an accelerated time source) and actual time (based on an internal clock) should lead to the need to attribute a cause (Heider, 1944). Csikszentmihalyi (1975; 1991) showed that pleasurable experiences are often accompanied by distortions in time perception, in that time seems to accelerate during performance of an enjoyable task. The covariation of the enjoyable task and the accelerated time, like the covariation of the photographs and heart rates (Valins, 1966), may lead participants to attribute the lost time to a pleasurable experience.
Misattribution

Misattribution occurs when people mistakenly attribute arousal produced by one source (e.g., exercise) to a different stimulus in the environment (e.g., photographs of semi-nude women). The Valins (1966) study cited above was one of the first studies to demonstrate the phenomenon of misattribution. Men misattributed the supposed increase in their heart rates to the photos of the semi-nude women, and therefore labeled their apparent arousal as sexual.

Dutton and Aron (1974) conducted the most famous experiments on misattribution. In a series of three experiments they were able to show that males in fear-inducing situations were significantly more attracted to a female interviewer than men in a control condition. In the first of their studies, an attractive female interviewer approached participants on two different suspension bridges. Both bridges were in the same geographic area, but one was high and wobbly and the other was lower and very sturdy. A manipulation check showed that the high wobbly bridge was significantly more fear inducing than the lower sturdy bridge. The interviewer had participants at each bridge complete a questionnaire containing a Thematic Apperception Test (TAT) item. The TAT presents participants with a series of provocative yet ambiguous pictures about which the participant must tell a story. The participant is asked to tell as dramatic a story as they can for each picture presented. After completing the questionnaire, the participants were thanked and given a slip of paper with the interviewer’s phone number so they could contact her later if they wanted to talk more about the study. The TAT stories generated were then scored for “sexual content.” The subjects approached on the
high and wobbly bridge wrote stories with significantly higher sexual content, and attempted post-experimental contact with the interviewer significantly more often than participants approached on the low and sturdy bridge. Participants contacted by a male interviewer showed no significant differences between bridges on either measure. These results suggest that the participants in the high arousal condition misattributed their arousal from the bridge as attraction to the woman.

A second experiment using a very similar procedure supports these findings (Dutton & Aron, 1974). The researchers were concerned that the results of the first study were confounded by the different populations on the two bridges. For example the wobbly bridge population may have been more predisposed to risk-taking behaviors, and therefore more likely to risk telephoning the woman than the sturdy bridge participants. Study 2 therefore recruited all participants from the wobbly bridge. The only difference between Studies 1 and 2 was that the control group for Study 2 were participants who were contacted 10 min after they crossed the bridge, after the physiological arousal they experienced while crossing the bridge had presumably subsided. The results were the same as those for Study 1, in that participants in the experimental group (i.e., those contacted while crossing the bridge) obtained higher sexual imagery scores than those in the control group. The behavioral results of Study 1 were also replicated: significantly more experimental participants contacted the interviewer than control participants.

In a third experiment, Dutton and Aron (1974) attempted to show similar effects in a laboratory setting. In this experiment male participants were placed in a room with an attractive female confederate. Both the participants and the confederate were told that
they were to receive a series of either strong or weak electric shocks, presumably to examine the effects of electric shock on learning. There was also a condition without the female confederate present. Participants were then instructed to fill out a questionnaire that included an anxiety measure (as a manipulation check), a scale rating attraction to the confederate, and instructions to write about the same TAT item used in Studies 1 and 2. The participants did not actually receive any shocks. The questionnaire results showed that the fear of strong shock was less anxiety inducing when the female confederate was present. Also, participants who believed they were to receive a strong shock reported feeling greater attraction to the confederate than those who believed they were to receive a weak shock. This suggests that the arousal generated by the threat of a strong shock was misattributed to the confederate. Last, the TAT sexual imagery scores were significantly higher when the participant believed he was to receive a strong shock, but only when he also thought the female confederate would receive the strong shock as well—a situation in which arousal would likely be at its highest. From these three studies, Dutton and Aaron concluded that “strong emotion per se increases the subject’s sexual attraction to the female confederate” (p.516).

The results of Dutton and Aaron (1974) show that people sometimes tend to misattribute physiological arousal invoked during arousal-inducing situations to other causes, in the case of their studies, sexual attraction. This is similar to the misattribution that is expected from participants in the “time flies” condition of the proposed experiment. The “correct” attribution for this experiment would be “time flew because something was wrong with the clock.” However, because participants will have no reason
to suspect that the clock was accelerated, they will tend to look for an alternative explanation for the incongruity between their internal clock and the time displayed by the altered clock. We expect they will resolve this incongruity by increasing the attractiveness of the task.

**Flow Research**

The idea of “flow” is nearly synonymous with the name Mihaly Csikszentmihalyi. Csikszentmihalyi’s original research interest was on intrinsically motivated activity. Of particular interest was how artists would work very obsessively, to the point of not eating or sleeping, on one painting. Yet, once finished the painting is not nearly as important (Getzels & Csikszentmihalyi, 1976). From this Csikszentmihalyi (1975/1991) began to study the experiences of people ranging from rock climbers to chess players to people that work in highly demanding workplaces (e.g. operating rooms). While engaged at their top level, a common state of being was described by the different people. This state came to be known as “flow.”

Csikszentmihalyi (1975/1991) describes flow as having a sense of complete control over one’s actions and being completely immersed in the activity. This immersion is so deep that there is often a loss of reflective self-consciousness. The most important quality of flow is the change in how time is experienced. When in flow it often seems that time has passed much more rapidly than normal. A common statement reflecting on the
passage of time would be, “Wow, I got so caught up in my work I didn’t realize it was already 6:00.”

According to Csikszentmihalyi (1975/1991) entering into flow was achieved most often when the activity engaged in was appropriately matched to the skill of the person. A high school football player may enter flow while playing at homecoming, but if he were to play in the Super Bowl, the experience would probably not lead to flow. The actual experience would much more likely be one of anxiety and worry. Entering into flow is also dependent upon having goals and receiving feedback about the progress that is being made. Without some way to judge achievement (e.g. a climber getting closer to the summit, a chess player approaching checkmate) the activity is not as rewarding.

Some research relies solely on interviewing people about times in which they experience flow-like states (Getzels & Csikszentmihalyi, 1976; Perry, 1999). These accounts provide qualitative data about what type of activities induce flow, and how the person feels, but are subject to both interviewer and interviewee bias. Questionnaires are also sometimes also used gather information about flow (Csikszentmihalyi I. and Csikszentmihalyi M., 1988). They often contain explicit questions asking how often the person enters into flow.

The Experience Sampling Method (ESM) was developed as an alternative to interviews and questionnaires for assessing flow (Csikszentmihalyi & Larson, 1987). The ESM utilizes electronic pagers to quasi-randomly beep the person. When beeped, the person is to fill out a questionnaire about what they are currently doing and how they
were feeling. Analysis of Csikszentmihalyi’s first wave of ESM data led to the development of the first model of flow (Csikszentmihalyi, 1975/1991).

Figure 2: First Model of Flow. Adapted from Csikszentmihalyi M. (1991)

Figure 2 shows the relationship between challenge (a factor of the task) and skill (a personal characteristic). Csikszentmihalyi suggests that, depending on the interaction between challenge and skill, there are three possible outcomes: anxiety, flow, and boredom. If the level of challenge far exceeds the level of skill the person will experience anxiety. Conversely, if the level of skill exceeds the level of challenge the person will become bored. Flow, according to this model, is achieved in any situation where the level of challenge is the same as the level of skill. This first model was found to be lacking because some mundane tasks, like watching television, were found to induce flow (Kubery, R., & Csikszentmihalyi, M., 1990). While television often makes one lose track of time, it does not require any skill or present any challenges.

Utilizing the ESM, Csikszentmihalyi was able to gather data from participants at many different times of the day (e.g. at work, while driving, cooking). A broad spectrum
of different affective states were captured, not simply anxiety and boredom. These affective states began to be paired with data gathered about perceived challenge of activities and level of skill. This enabled Csikszentmihalyi to further refine his model of flow (1997).

![Figure 3: Second Model of Flow. Adapted from - Csikszentmihalyi M. (1997)](image)

This new model incorporates the idea that true flow is only present when above average skills are being used on above average challenges (Csikszentmihalyi, 1997). The basic ideas of just anxiety, flow, and boredom are further divided into many different states. These states (e.g. arousal and relaxation) more accurately capture the subtle experience difference. These refinements enable the model to be applied to many more experiences.

The proposed research attempted to create a situation where participants experience time moving more rapidly than normal. One of the main experiences in a flow state is a sense of accelerated time, or even timelessness (Csikszentmihalyi, 1975/1991).
Csikszentmihalyi also notes that people report being in flow when they are at their peak level of performance. Therefore, along with examining how much enjoyment participants are getting from the activity, the study examined if participants in flow also reported higher levels of skill. This study allowed us an examination of the interaction between task enjoyment and skill level as a function of perceived accelerated time.

Along with examining how much enjoyment participants are getting from the activity, this research addressed if participants in this flow mimicking state experience any difference in or perceived level of challenge. Csikszentmihalyi notes that people describe being in flow when they are at their peak level of performance (1975/1991). Analyzing performance measures (i.e., number of letters used and complexity of words created) can reveal if participants in a flow mimicking state show any difference in performance than participants experiencing time normally.

“You’re Having Fun When Time Flies”

Sackett, Meyvis, Nelson, Converse, & Sackett (2010) performed five studies to examine a research question very similar to the one being explored by the proposed research: the effect of altered time on hedonic experience. These researchers manipulated time perception to make tasks more engaging, annoying noises seem less irritating, and music more enjoyable. They also showed that manipulating how much one believed that “time flies when you’re having fun” influenced how strong the effect was.
Studies 1a and 1b. The focus of the first study was on the effects of time perception on the enjoyment of a mundane task, i.e., underlining words in a passage containing double letters (Sackett et al., 2010). To manipulate the subjective passage of time, the researchers utilized a stopwatch displaying a time inconsistent with the actual amount of time the participants had been working on the task. The study manipulated time perception in two ways. The first manipulation (Study 1a) involved telling participants that they were to work for exactly 10 minutes. The experimenter started a stopwatch as soon as the participants began the task, and then left the room with the stopwatch. After either 5 min (time flies) or 20 min (time drags), the experimenter re-entered the room with the stopwatch erroneously displaying 10 min. For the second time perception manipulation (Study 1b), some participants were told the study would last 5 min (time drags) and others were told it would last 20 min (time flies). In both cases the experimenter came back after 10 min. Manipulation checks revealed that participants experienced time as having either flown or dragged in a direction consistent with the manipulation. Results revealed that participants in the time-flies conditions rated the task as more enjoyable than participants in the time-drags conditions, and had higher scores on a composite measure of “enjoyment.”¹

Study 2. Sackett et al. (2010) continued their investigation in a second study (Study 2) by using a less obvious manipulation of time and a task that was less likely to

¹ The composite score was created by combining ratings of enjoyment, challenge, engagement, fun, skill required, and excitement to reengage in the activity.
induce flow. This study had people passively listening to irritating “printing sounds” (p. 113) while sitting at a computer on which a timer counting each second of elapsed time was displayed. This timer was either accelerated (time flies) or decelerated (time drags) by 20%. Consistent with the findings of Studies 1a and 1b, participants in the time-flies conditions rated the sounds less negatively than those in the time drags condition. In addition, when given the opportunity to switch to listening to a different irritating sound clip (i.e., an electric drill), participants in the time flies condition were less likely to switch.

Study 3. A third study attempted to make an already pleasurable experience, listening to music, even more enjoyable (Sackett et al., 2010). Participants were asked to choose their favorite song from among a set of 12 popular songs, and to rate their enjoyment of that song on a 201-point slider scale. Using a procedure similar to that of Study 2, acceleration or deceleration of time was manipulated by 20% using a timer presented on the computer screen while the song was being played. The timer either counted up, displaying elapsed time, or down, displaying remaining time. When the timer counted up the participant was unaware of how much time had passed until the conclusion of the song. This would result in feelings of surprise at the incongruity between alleged and expected elapsed time. However, when the timer counted down participants were aware of the alleged duration from the very beginning of the song. These participants would experience no surprise when the song ended and the timer had counted down to 0. The purpose of this timer up/down manipulation was to determine if eliminating the surprise induced by the incongruence of time would nullify the effects of
time perception on task enjoyment. After each listening condition, participants were asked to re-rate the song. An analysis of covariance (with initial song enjoyment entered as a covariate) found that the music was rated as more enjoyable when the timer showed elapsed time in the time flies (i.e., timer counted up) condition than in the time drags (i.e., timer counted down) condition. As predicted, participants in the “timer counted down” condition were not surprised that the song ended when it did, and consequently rated the song as less enjoyable than participants in the “time counted up” condition.

Studies 4a and 4b. Sackett et al. (2010) then proposed that the strength of time distortion is dependent upon the extent to which participants believe the adage “time flies when you’re having fun.” Study 4a asked participants to solve as many anagrams as they could in either 10 min (time flies) or 5 min (time drags) conditions. The experimenter returned after 7.5 minutes, telling participants that either 10 or 5 min had elapsed. They were then asked to indicate their enjoyment of the task, as well their belief that “time flies when you’re having fun.” Prior enjoyment of anagrams task was entered as a covariate in the analysis. Results revealed that participants in the time-flies condition enjoyed the task more than did participants in the time-drags condition. The effect was strongest for participants who strongly believed in the adage “time flies when you’re having fun.”

Study 4b actually manipulated participants’ belief in the “time flies” adage. The design was identical to that used in Study 1a with the following exception: Prior to their participation the subjects read a fabricated article providing scientific evidence either supporting or refuting the “time flies” theory, along with an unrelated scientific article.
Although there was no main effect for article type on task enjoyment, there was a significant interaction between article type and time perception. Participants who read the article supporting the adage reported enjoying the task significantly more in the time-flies condition than participants who read the article refuting the theory. Most interestingly, there was no statistically significant difference between the time-flies and the time-drags conditions for participants who read the article refuting the adage.

_Study 5._ In their last investigation, Sackett et al. (2010) once again utilized the procedure from Study 1a, in which they worked for either 5 min or 10 min on a word task that purportedly took 10 min. However, in this study participants wore earplugs. The earplugs were given under the guise of reducing distractions. At the beginning of the task evaluation questionnaire, half of the participants were presented with a mock survey question implying that the earplugs may induce feelings of time flying or dragging, depending on the time condition. The remaining participants were not given this mock item. The participants were also asked whether they would be willing to participate in a future study utilizing the same task, only lasting 60 min rather than 10 min. Results were consistent with previous research, in that participants rated the word task higher in the time-flies condition than in the time-drags condition. This effect, however, was eliminated for participants in the earplugs-explanation conditions. The difference in task enjoyment between the time-flies and time-drags conditions for participants who were told that earplugs either induce feelings that time flies or drags was not significant. Finally, participants who were assigned to the time-flies condition with no earplugs explanation were more likely to indicate that they would be willing to participate in
future research than subjects assigned to the time-drags condition. It seems that providing participants with an alternative explanation for their distorted time perception eliminated the group differences in task enjoyment. Taken together, these studies suggest that “feelings of time distortion can cue inferences of enjoyment, but only when subjective time progression is surprising (Study 3), when one holds the belief that enjoyment accelerates time progression (Studies 4a and 4b), and when no alternative attributions are available” (p. 116).

Sackett et al. (2010) acknowledge that the findings of these studies are weakened by the lack of a control condition. Their use of two experimental conditions, time flies and time drags, makes it impossible to identify whether the task actually became more fun, or if time dragging just made it much worse. They attempted to solve this problem in Study 3, but they changed from a mundane task to an enjoyable one. They also switched modalities from reading and underlining to listening to music. The results of Study 3 certainly seem clear, but changing multiple factors (the tasks and the base enjoyment valence) makes it impossible to link the results of Study 3 to the results of Study 1. Studies 4a and 4b, showing that strength in the belief in “time flying” has an effect is difficult to interpret, also because of the use of two experimental conditions. The final study by Sackett and his colleagues, which provided participants with the earplugs attribution, showed that participants certainly do search for explanations for the temporal inconsistencies they experienced. Unfortunately, the reliance on the procedure used in Study 1 does not allow for judgments based on how time perception impacted the enjoyment of a mundane task.
The current study examines differences in task enjoyment between a “timeflies” condition and a control condition. The task, an anagrams-based game called Bananagrams®, is one that is considered by most to be enjoyable (Toy of the Year 2008 nominee, Play Matters 2006 Good Toy Award, Oppenheim Toy Portfolio Gold Seal Award). The perception that time flies will theoretically increase this enjoyment. As in Sackett et al. (2010) Study 3, the participants will be working in the presence of an accelerated clock. Having the participants work in the presence of either an accelerated or accurate clock will increase the external validity of the study.
HYPOTHESES

Hypothesis 1: Participants in the accelerated clock condition will rate the task as more enjoyable (using a composite measure of enjoyment, see Analyses section) than participants in the normal clock condition.

Hypothesis 2a: Participants in the accelerated clock condition who strongly agree with the adage “time flies when you’re having fun” will rate the task as more enjoyable than participants in the accelerated clock condition who do not strongly agree with the adage.

Hypothesis 2b: Participants in the accelerated clock condition who strongly agree with the adage “time flies when you’re having fun” will show a significantly higher level of enjoyment than participants in the veridical clock condition who do not strongly agree with the adage.

Hypothesis 3: Participants in the accelerated clock condition will show a higher level of skill (measured by number of words and letters used and number of letters per word) than participants in the normal clock condition.
Hypothesis 4: Reported skill level and perceived level of challenge will be positively correlated for participants in the accelerated clock condition.

Hypothesis 5: Actual skill level (measured by number of words and letters used and number of letters per word) will be positively correlated with how fast participants perceive time to have passed while performing the task.
METHODS

Participants

Sixty-two undergraduate male and female psychology students from the University of Wisconsin Oshkosh participated. Participants utilized the Sona® experimental management system to self-enroll in this study. At the time of their enrollment they were only informed that the experiment would last less than 30 minutes and they would be working on a task and filling out a survey.

Due to the nature of the task, non-native English speakers and people with learning disabilities were not included in the analysis. Since there was no system in place to prevent signups from people who fall into those categories, a post task demographics questionnaire was used (Appendix A). This post task questionnaire also assessed if they had correctly followed the directions. Based on the responses to this questionnaire, six subjects were eliminated. One was eliminated for not being a native English speaker, another person was removed because he indicated that he did not understand the directions and simply sat in the room most of the time, and the last four all had learning disabilities. This left fifty-six participants for the analysis.

Materials

Bananagrams® is a tile-based anagram game. The game contains 144 plastic letter tiles in a banana shaped pouch. The tiles each have a letter on one side and are blank on the other. The distribution of tiles is such that the more commonly used letters,
when chosen randomly, appear more often. The exact distribution can be seen in Appendix B.

The experiment utilized two externally identical Velleman® MK151 Digital LED clocks. One clock was built to the manufacturer’s specifications, and the other one had the internal crystal oscillator replaced to cause it to run at an accelerated rate. This specific model clock was selected for two reasons. First, it is a “build from kit” clock. The circuit boards and pieces of this kit clock are made slightly larger than machine-built clocks. The pieces are therefore much easier to assemble by hand, and likewise replace. Even though it was a kit, the outside appearance of the clock is standard. Naive observers are unlikely to detect that it is not a normal store-purchased clock. The second reason this model was selected is because it only displays minutes and hours. The presence of seconds moving at an accelerated rate would likely be detected.

The rate of clock acceleration was determined by two factors. First, it was important to ensure that the clock would be moving distinctly faster than real time without having the manipulation obvious. Using both extremes as an example, if a minute were to last either 59.99 s or 1 s the differences would be either not noticeable or extremely obvious, respectively. The second factor impacting the decision was the physical ability to manipulate the clock. The crystal oscillators, the devices that generate the pulses that are measured and manipulated inside a clock, are only available in certain frequencies. The accelerated clock ran at 142% normal clock speed. We anticipated that this speed would give participants the impression that time passed faster than they expected, but would not make the manipulation obvious.
A post-task questionnaire was designed to measure the participants’ subjective experience while working on the task. It contained a yes/no question on whether they have ever played the game Bananagrams® in the past, along with several 7 point Likert-type questions asking about their experience while playing. The questions were designed based on the flow research of Csikszentmihalyi. Specifically, the questions attempted to determine factors like boredom, feeling “in control,” and feeling general arousal while working on the task. Some other distracter questions were included in the questionnaire that are irrelevant to the purpose of the study, but served to help minimize the chance of the subject identifying the purpose of the study. The complete questionnaire is included in Appendix C. A demographic questionnaire was also administered requesting participants’ age, sex, and ethnicity, as well as what they believe the experiment was about (Appendix A).

A stopwatch (Yellow Ultrack 330) was used to measure the amount of time that the participants worked on the task. This model is yellow and has an audible start and stop beep. The display on the stopwatch is accurate to the hundredth a second.

A digital camera (Cannon PowerShot SD600) was used to photograph the tiles after the participant was finished. Prior to taking the picture, a card containing the participant number was placed on the table near the spread of words. This ensured that the correct participant information was matched with the picture. To account for possible image troubles, at least two pictures were taken of each set of words. All photographs were stored on the secure digital card contained in the camera and backed up on the experimenter’s password protected computer.
Finally, two dictionaries were used. The first was Webster’s Dictionary which is an archetypal dictionary that was placed on the table after the task. The second was the Merriam-Webster Online Dictionary, which actually checked any questionable words. If the word was not listed in Merriam-Webster Online Dictionary it was considered an invalid arrangement and not counted.

**Procedure**

Participants were run individually, and were randomly assigned to one of two conditions. This random assignment was done using a table of random numbers. On the way to the experiment room, the experimenter asked participants if they had ever participated in an experiment before. When they said yes, the researcher explained that this study is like most other studies. They will sign a consent form (Appendix D), participate, and then they will receive their participation credit. None of the participants were participating for the first time, so they all received the same basic explanation.

The participant was then led into the experiment room. The experiment room contained two desks and two chairs. On one desk, there were two copies of the informed consent form (one for them to keep, and one for the experimenter’s records) and two questionnaires, placed face down. On the other desk was either the accelerated clock or the normal clock on the table, depending upon condition assignment, and the Bananagrams® puzzle, still in the bag. The participant was seated at the desk containing
the consent forms and questionnaires. The experimenter explained the content of the consent form and ensured participants that participation is strictly voluntary. Once the participant signed the consent form, they were thanked and the experiment began.

Participants were then told that “Since this is a study about cognitive tasks and information processing it is necessary that there are no distractions.” They were also told that they will be performing a motor task that might be hindered by wrist jewelry, such as watches and bracelets. They were then asked to turn off their cell phones and other portable electronic devices and place them, along with their wrist jewelry, in a basket that would be taken outside. If the participant was hesitant, the experimenter assured them that their items will be safe, and the only purpose of this is to help ensure the reliability of the results. No participants refused to remove watches and bracelets or surrender electronic devices. The removal of watches and cell phones was not only to prevent distractions but, more important, to remove external time references.

After the items were placed in the basket, the experimenter seated the participant at the desk with the clock and Bananagrams® puzzle. Participants were told that their task is to play a solitaire version of the game Bananagrams®. He or she was told that inside the bag there are 144 lettered tiles. The experimenter then dumped the tiles on the table and flipped them over until no letters were visible while explaining the rest of the procedure.

The participant was told that once their time starts they should flip over 21 tiles. It was explained that the letters should be used to make an interconnected block of words. The participants were told that once they use up all their letters they should take another
one. Additionally, if they come across a letter they find difficult to place, they may exchange it for three new letters. The participants were told that the purpose of the game is to create as many words as possible, and that length and complexity are irrelevant. No proper names, place names, or abbreviations would be accepted. Last, they were told that they could re-arrange their words at any time. The decisions they made are not locked in, but when their time is up only words they have completed will count.

At this time the experimenter directed the participant’s attention to the clock. Depending on condition assignment, the clock was either running at accelerated speed (experimental condition) or normal speed (control condition). The participant was told that they have either 15 min (normal clock) or 21 min (accelerated clock) to work on the task. In reality, all participants were given 15 min. After instructing the participants, the experimenter exited the room while the participant performed the task.

The experimenter started a stopwatch immediately upon closing the door behind him. After precisely 15 min the experimenter re-entered the room with a dictionary to check the spelling of the words and to photograph the completed puzzle, ostensibly for his records. The experimenter placed the Webster’s dictionary and camera on the table with the puzzle, and asked the participant to be seated at the table containing the questionnaires. The experimenter then placed the Bananagram® questionnaire (Appendix C) face up in front of the participant, and requested that he/she complete it. The experimenter left the room while the questionnaire was being completed. Prior to the experimenter leaving, participants were instructed to knock on the door when they have completed the questionnaire. They were also asked to complete a second questionnaire
requesting demographic information (i.e., age, sex, and ethnicity) (Appendix A). This questionnaire also asked them to indicate what, if anything, they thought the study was about. The experimenter again left the room during completion of this questionnaire, and the participant again was asked to knock on the door when the questionnaire was completed.

Prior to debriefing, the participants were asked not to share any information about the study with anyone. In addition, they were also asked to sign a statement (Appendix E) indicating their agreement to keep the study’s design and purpose entirely confidential. All of the participants agreed to sign the statement and were thoroughly debriefed, both orally and in writing (Appendix F), and any questions they had about the experiment were answered. At this time the experimenter asked if they had any recommendation for changes that might be made to the study. Their personal items were then returned to them, and they were thanked for their participation and dismissed. After the participant left, the experimenter photographed the work. These pictures were examined later to determine the number of words the participant made, and that number was entered into a spreadsheet along with the participant number. If words were not spelled correctly they were not counted. The experimenter then gathered the tiles back into the banana bag and reset the accelerated clock to the correct time.
RESULTS

An alpha level of .05 was used for all statistical tests. Means and standard deviations for Bananagrams® Questionnaire items are presented in Table 1. A composite variable (“Fun Composite”) was created from four questionnaire items. (10 - Exciting, 13 - Fun, 15 - Enjoy, and 19 - Play Again). There items were selected prior to the analyses as being questions that all relate to “fun.” As expected the items are highly related (Cronbach’s alpha = .944).

Table 1: Summary of Means and Unpaired T-Tests on Bananagrams® Questionnaire Items

<table>
<thead>
<tr>
<th>Questionnaire Item</th>
<th>Accelerated Mean</th>
<th>Veridical Mean</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3- Progressed</td>
<td>5.53 (1.41)</td>
<td>4.62 (1.20)</td>
<td>.012*</td>
</tr>
<tr>
<td>4- Challenging</td>
<td>4.20 (1.30)</td>
<td>3.77 (1.39)</td>
<td>.237</td>
</tr>
<tr>
<td>5- In Control</td>
<td>5.63 (1.25)</td>
<td>5.00 (1.44)</td>
<td>.083</td>
</tr>
<tr>
<td>6- Relaxing</td>
<td>4.67 (1.47)</td>
<td>4.62 (1.72)</td>
<td>.905</td>
</tr>
<tr>
<td>7- Boring</td>
<td>2.47 (1.38)</td>
<td>2.88 (1.48)</td>
<td>.280</td>
</tr>
<tr>
<td>8- Perform Care</td>
<td>3.27 (1.84)</td>
<td>3.23 (1.58)</td>
<td>.938</td>
</tr>
<tr>
<td>9- Worry</td>
<td>3.53 (1.59)</td>
<td>3.92 (1.77)</td>
<td>.389</td>
</tr>
<tr>
<td>10- Exciting</td>
<td>4.63 (1.40)</td>
<td>4.35 (1.09)</td>
<td>.402</td>
</tr>
<tr>
<td>11- Lost Time</td>
<td>4.73 (1.53)</td>
<td>4.35 (1.81)</td>
<td>.389</td>
</tr>
<tr>
<td>12- Anxious</td>
<td>3.23 (1.59)</td>
<td>3.92 (1.79)</td>
<td>.132</td>
</tr>
<tr>
<td>13- Fun</td>
<td>5.47 (1.28)</td>
<td>4.85 (1.22)</td>
<td>.070</td>
</tr>
<tr>
<td>14- Surprise</td>
<td>4.90 (1.69)</td>
<td>3.73 (1.54)</td>
<td>.009**</td>
</tr>
<tr>
<td>15- Enjoy</td>
<td>5.50 (1.14)</td>
<td>4.92 (1.32)</td>
<td>.085</td>
</tr>
<tr>
<td>16- Worked Full</td>
<td>4.70 (1.32)</td>
<td>5.04 (1.18)</td>
<td>.319</td>
</tr>
<tr>
<td>17- Focused</td>
<td>5.77 (1.07)</td>
<td>5.58 (1.21)</td>
<td>.536</td>
</tr>
<tr>
<td>18- Felt Good</td>
<td>4.67 (1.30)</td>
<td>4.50 (1.48)</td>
<td>.654</td>
</tr>
<tr>
<td>19- Play Again</td>
<td>5.47 (1.25)</td>
<td>4.92 (1.52)</td>
<td>.148</td>
</tr>
<tr>
<td>20- Adage Agree</td>
<td>6.30 (0.75)</td>
<td>5.85 (0.93)</td>
<td>.048*</td>
</tr>
<tr>
<td>Fun Composite</td>
<td>5.27 (1.17)</td>
<td>4.76 (1.20)</td>
<td>.116</td>
</tr>
</tbody>
</table>

* indicates significance at .05, ** indicates significance at .01
As a manipulation check, unpaired t-tests were performed to determine if participants in the accelerated clock condition reported faster time progression than participants in the veridical clock condition (Item 3: “Progressed”). As seen in Table 1, there was a significant difference between the perceived progression of time for the accelerated clock (M= 5.53, SD= 1.41) and the veridical clock (M= 4.62, SD= 1.20) conditions; \( t(54) = .215, p = .012 \). People in the accelerated clock condition rated perceived time as progressing faster than participants in the veridical clock condition.

Table 1 shows that there is a general trend that supports the idea that the participants in the accelerated clock condition enjoyed the task more than those in the veridical clock condition. For example, for Questionnaire Item 13, “Playing Bananagrams® was fun,” there was a mean difference of .62 between participant ratings in the accelerated clock and the veridical clock conditions (Figure 4), with a p value of .070.
The four item fun composite variable (items 10, 13, 15, 19) is graphed in Figure 5. An unpaired t-test showed that although the change in means is in the expected direction, the composite variable failed to reach statistical significance; $t (54) = .160, p = .116$.

Further analysis was done using the fun composite to determine if participants in the accelerated clock condition who strongly agreed with the adage “time flies when you’re having fun” (as determined by ratings of 7 on Questionnaire Item 20) showed higher levels of enjoyment than participants who less strongly agreed with the adage (as determined by ratings of less than 7). Once again the relationship was in the expected direction, (Strongly Agree: $M = 5.71, SD = .80$, Less Strongly Agree: $M = 4.62, SD = 1.20$), but failed to reach significance; $t (28) = .190, p = .068$. 

![Figure 5: Mean of Fun Composite Variable by Condition](image_url)
An unpaired t-test was then performed to determine if participants in the accelerated clock condition who strongly agreed with the adage showed a significantly higher level of enjoyment (M= 5.71, SD= .80) than participants in the veridical clock condition who did not strongly agree with the adage (M= 4.63, SD= 1.12). The difference was significant. The accelerated clock participants who strongly believed in the adage enjoyed Bananagrams® more than the veridical clock participants who did not strongly believe in the adage; $t(29) = 2.79, p = .009$.

Measures of skill were calculated next. The Bananagrams® Reaction Questionnaire contained one subjective measure of skill (Item 18 – Felt Good). This measure had the participants indicate how good they felt they were at the playing Bananagrams®. As shown in Table 1, the mean of the accelerated clock condition is slightly higher (M = 4.67, SD = 1.30) than that of the veridical clock condition (M = 4.50, SD = 1.48), but this difference is not statistically significant; $t(54) = .450, p = .654$.

Actual performance of the game was determined from the word arrangements the participants created. Each instance of two or more tiles touching either vertically or horizontally was considered a possible word. The spelling of each possible word was then checked for accuracy using the Merriam-Webster Online Dictionary 2010 (http://www.merriam-webster.com/). If the group of letters did not appear in the dictionary it was not counted as a word, and the letters were not included in the measure of total correct letters. As mentioned earlier, multiple “words” were removed due to extensive errors in tile placement (Appendix I). Table 2 shows the relevant statistics for number of correct words, number of correct letters, and number of letters per word.
Overall, performance was lower in the accelerated clock condition for both correct words (MD = 3.72) and correct letters (MD = 9.03), but these mean differences were not statistically significant; $t(50) = -1.55, p = .126$ and $t(50) = -1.61, p = .114$. The number of letters per word was nearly identical across conditions (MD = .01); $t(50) = -.05, p = .964$.

A bivariate correlation was run on perceived skill and perceived level of challenge for the 30 participants in the accelerated clock condition. This analysis showed that in the accelerated clock condition participants’ perceived skill and perceived level of challenge were significantly negatively correlated, $r(30) = -.513, p = .004$.

The final analysis investigated the relationship between actual skill and perceived flow of time. This bivariate correlation failed to reach statistical significance. Actual skill level was not related to how fast time was perceived to pass; $r(56) = .047, p = .743$.

Table 2: Summary of Means and Unpaired T-Tests for Skill Level By Tile Use

<table>
<thead>
<tr>
<th>Tile Usage</th>
<th>Accelerated</th>
<th>Veridical</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correct Words</td>
<td>16.41 (7.77)</td>
<td>20.13 (9.48)</td>
<td>.126</td>
</tr>
<tr>
<td>Correct Letters</td>
<td>47.38 (19.74)</td>
<td>56.41 (21.76)</td>
<td>.114</td>
</tr>
<tr>
<td>Letters / Word</td>
<td>2.96 (0.46)</td>
<td>2.97 (0.56)</td>
<td>.964</td>
</tr>
</tbody>
</table>
DISCUSSION

The goal of this research was to determine if altering someone’s experience of elapsed time will affect task enjoyment. Our major findings (Table 1) suggest that there may be a relationship between the perception of time moving quickly and the enjoyment of Bananagrams®. The results did not reach significance, but the trends were in the predicted direction.

The design of this experiment is firmly rooted in previous research (Craik & Sarbin, 1963; Rotter, 1969; Sackett et al., 2010), but unlike any of the previous work this study focused solely on altering the enjoyment of an already enjoyable task by manipulating the perception of time. In addition, the manipulation used in this experiment was much more subtle than that used in previous research. For example, Sackett et al. (2010) used a similar but much more obvious manipulation. Time perception was manipulated by having an experimenter with a stopwatch tell the participant how much time had passed, or by having a computer count time up or down. In the current study participants were not only informed when their time was up by the experimenter, but they also had visual affirmation of the time during their entire performance of the task.

The 142% increase in time in the accelerated clock condition shifted how participants felt time progressed. On average, the veridical clock participants felt that time moved slightly faster than it actually did. This slight increase over actual time progression was expected, since the participants were working on an engaging task. In the accelerated clock condition participants rated time passing approximately one point faster on a 7 point Likert-type scale than the veridical clock participants (MD = .91). All
other factors remained the same, suggesting that the faster progression of time reported by the participants in the accelerated clock condition was probably caused by the experimental manipulation.

Equally important to the manipulation working was that participants did not suspect that the clock was altered. None of the participants suspected that time was manipulated, as shown by the last question on the demographics questionnaire. The participants in the accelerated clock condition did not attribute the increase in subjective time progression to the actual cause (i.e. the clock running faster). Thus, consistent with Heider’s (1944) attribution theory, some explanation had to be found for the discrepancy between perceived time and actual time detected by the participants. (1975; 1991) has shown that people often experience altered time progression while performing tasks they enjoy. In addition, most people are aware of the adage “time flies when you’re having fun.” Thus, the most plausible explanation for the discrepancy was that time flew because the task was fun.

Our first hypothesis was that participants in the accelerated clock condition would rate Bananagrams® as more enjoyable (using the composite measure of enjoyment, “Fun Composite”) than participants in the veridical clock condition. This hypothesis was not supported ($t (54) = .160, p = .116$), although each of the questions contributing to the composite measure showed the same trend. Ratings for each of the questions contributing to the composite in the veridical clock condition were slightly higher than neutral; in the accelerated clock condition the ratings were slightly higher than “somewhat agree.”
The next two hypotheses relate directly back to the work done by Sackett et al. (2010). In Study 4a, Sackett et al. found that when fun was manipulated by making time fly, the effect was strongest for those who strongly believed in the adage “time flies when you’re having fun.” Study 4b found that this effect could be enhanced by having the “time flies” participants read an article supporting the adage, or eliminated by having participants read an article refuting the adage.

The first part of our second hypothesis was that participants in the accelerated clock condition who strongly agree with the adage “time flies when you’re having fun” (Bananagrams® Questionnaire Item 20) would rate the task as more enjoyable than participants in the accelerated clock condition who do not strongly agree with the adage. Any rating below “strongly agree” was counted in the “do not strongly agree” condition. The results showed a similar trend to that found by Sackett et al. (2010). The mean “fun composite” score for participants who did not strongly agree with the adage was 4.62; the mean “fun composite” score for participants who strongly agreed with the adage was 5.71. Although this was a difference in the expected direction of over 1 full point, the difference between the means was not statistically significant; $t(28) = .190, p = .068$.

The second part of our second hypothesis was that participants in the accelerated clock condition who strongly agreed with the adage “time flies when you’re having fun” would show a significantly higher level of enjoyment than participants in the veridical clock condition who did not strongly agree with the adage. Participants in the accelerated clock condition who agreed with the adage should have had the highest scores, and
participants in the veridical condition who did not believe in the adage should have had the lowest scores. This portion of Hypothesis 2 was supported; $t (29) = 2.79, p = .009$.

An important difference between our findings and the results of Sackett et al.’s (2010) Studies 4a and 4b is that Sackett compared participants in “time dragged” and “time flew” conditions. Specifically, the actual time Sackett’s participants were given to work on the task was 7.5 minutes, but participants were told that either 5 minutes (time dragged) or 10 minutes (time flew) had passed. Our study compared participants in the accelerated time condition to participants in the veridical time condition. It is reasonable to expect that it would be easier to detect a difference between the two extremes of the spectrum (time dragged and time flew) than the middle and the end (veridical and time accelerated).

The last three hypotheses are directly related to the flow research of Mihaly Csikszentmihalyi. All of the hypotheses have their theoretical foundations in the idea that flow is a condition of total absorption and a feeling of timelessness created while engaged in an activity that matches the person’s skill with the challenge of the task. It was believed that because the manipulation used in this experiment would artificially create a feeling of engagement (which subsequently was not statistically supported) and altered time (which was significantly supported), it is possible that it also could create a change in skill or perceived challenge of the task.

Our third hypothesis was that participants in the accelerated clock condition would show a higher level of skill (measured by number of words and letters used and number of letters per word) than participants in the veridical clock condition.
Unexpectedly, the results show a trend in the opposite direction than that which we predicted. Instead of the participants in the accelerated condition performing better, as expected from someone in a flow state, they actually performed worse. This trend towards lower performance was seen in both correct words (MD = 3.72) and correct letters (MD = 9.03), but the differences were not statistically significant; t (50) = -1.55, p = .126 and t (50) = -1.61, p = .114.

A measure of complexity was devised to determine if there was a difference between the groups in the size of the words being created. The total number of letters the person used was divided by the number of words created. Since words share a letter at the intersection point, this measure can function as a simple estimate of complexity, but is under-representative of the average word length. The difference between the two conditions was not significant; (MD = .01); t (50) = -.05, p = .964. If participants in the accelerated clock condition had been in flow their words should have been longer, which would have increased the calculated level of complexity. It thus appears that the participants in both conditions were not in a state of flow.

The trend toward decreased performance for participants in the accelerated clock condition compared to those in the veridical clock condition is difficult to explain. The first explanation that came to mind was that participants in the accelerated clock condition did not worry as much about how well they were performing because they were enjoying themselves more. The data did not support this. The difference between the two conditions on Item 8 of the Bananagrams Reaction Questionnaire, assessing how much participants cared about how they performed, was not significant (p = .938). The only
other explanation that seems reasonable is that because participants in the accelerated clock condition believed they would have a longer amount of time to work (i.e., 21 minutes) they did not work as quickly as those in the veridical clock condition (who were told they had 15 minutes). As a result, participants in the accelerated clock condition produced fewer words and used fewer letters.

The fourth hypothesis was that reported skill level and perceived level of challenge would be positively correlated for participants in the accelerated clock condition. As with the last hypothesis, this is directly related to the idea of flow. The accelerated clock condition, which was supposed to induce flow, should have created a feeling of skillfulness in participants who felt challenged. The data do not support this. The two variables were negatively correlated; $r(30) = -.513, p = .004$. Without experimental manipulation it is impossible to determine if the challenge caused the change in perceived skill or if the level of perceived skill affected challenge. In either case it seems that a state of flow was not present.

The final hypothesis was that actual skill level (measured by number of words and letters used and number of letters per word) would be positively correlated with how fast participants perceived time to have passed while performing the task. The theory behind this correlation has its foundation in the flow diagrams created by Csikszentmihalyi. One of his ideas is that within a flow state there can be varying degrees of engagement and performance. This idea can be interpreted as a positive correlation between perceived time flow and performance, as we had hypothesized. For the Bananagrams® task the two were not correlated; $r(56) = .047, p = .743$. 
Overall, two of the five hypotheses were supported. Although these results are less than ideal there is still a significant amount of useful information that can be taken from this experiment. Clearly, an important result is that the manipulation designed for this study was able to affect how people perceived the flow of time without raising suspicion. This finding may be useful in the design of future experiments.

One weakness of this study is that the task selected was much more fun than originally expected. Many of the previous studies used laboratory tasks (Craik & Sarbin, 1963; Rotter, 1969; Sackett et al., 2010). In an effort to increase ecological validity and perhaps induce a state of flow, we selected a popular game, Bananagrams®, instead of a tightly controlled laboratory task. However, the overall high enjoyment of the task may have led to a ceiling effect. This may account for the lack of a significant difference in enjoyment ratings between the veridical clock condition and the accelerated clock condition.

The inclusion of only veridical clock and accelerated clock conditions is a further limitation of this study. As mentioned before, Sackett et al. (2010) compared time flew to time dragged conditions. We opted for the more risky comparison, time flew (i.e., accelerated clock) and time did not fly (i.e., veridical clock). The difference between the conditions in the current study would need to have been much larger than that of Sackett’s conditions in order to detect a significant effect. A time dragged condition would have allowed us to compare a time flew condition, a time dragged condition, and a time neither flew nor dragged condition. We would expect that by artificially making time drag a task could actually be made less fun. Each of the three conditions (time flew,
time did not fly, time dragged) could be tested using tasks of different types (i.e. word puzzles, object manipulation, reading) and enjoyment valences (i.e. fun, neutral, and boring).

Extending the period of time participants perform the task could help determine if the magnitude of the effect remains the same as with shorter performance times. It may be possible that working over a longer duration will cause the participant’s internal sense of time to synchronize with the altered time, supporting the research of Craik and Sarbin (1963). If this were to occur, the effects would disappear. On the other hand, the extended exposure to an altered time condition may strengthen the effects. It may also be possible that increasing duration does not affect the magnitude of the effect, and that only the percent of deviation from veridical time is important.

Another interesting avenue of research would be to explore how increasing or decreasing cognitive load affects awareness of the time manipulation. Similarly, how would adding a physical component to the task affect the outcome? To use Bananagrams® as an example, if the pieces were on one side of the room and their work was on the other they would have to walk back and forth while working on the task. It is likely that like in bridge experiment done by Valins (1966) the increase in heart rate would be misattributed. In this case though, it would not be thought of as attraction but as a signal of fun. We would expect there to be an interaction with the different timing conditions possibly strongly enhancing the effect. Last, it would be interesting to explore how participants are affected physiologically by the altered time conditions. We would
expect that altering time to the point that it affects a person’s subjective enjoyment of a task would cause some type of detectable physiological change.

Taken together, these results show that changes in subjective time are able to influence one's interpretation of a task. While the results do not fully support the expected increase in fun, a pattern towards increased fun can be seen. However, from the analysis of how suspicious the participants were and how they interpreted the altered time this procedure could be useful in future experiments.
Appendix A

Demographics Questionnaire
Demographics Questionnaire

Please answer the following questions:

What is your age? ___________ Years

What is your gender? Male    Female

Are you a native English speaker? Yes    No

Do you have a learning disability? Yes    No    If Yes what? __________________________

Please select the ethnicity that describes you the best:

Caucasian    African American    Asian    Other

Native American    Pacific Islander    Hispanic

While playing Bananagrams® what set of instructions did you follow?  A    B    C

A- I drew one tile when all my letters were used and continued working, if I got stuck would switch the tile for three new ones.
B- I drew three tiles when all my letters were used and continued working, if I got stuck I would switch the tile for three new ones.
C- I drew tiles whenever I wanted new letters.

Other – Please explain below

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Briefly, what did you think this experiment was about?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
Appendix B

Bananagrams® Tile Distribution
Bananagrams® Tile Distribution

144 Total Tiles

2: J, K, Q, X, Z


4: G

5: L

6: D, S, U

8: N

9: R, T

11: O

12: I

13: A

18: E
Appendix C

Bananagrams® Reaction Questionnaire
BANANAGRAMS® REACTION QUESTIONNAIRE

Using the choices below each question please circle the value corresponding to the response that most accurately describes how you feel.

1. Do you enjoy playing word-based games? (Examples – Scrabble and Boggle)
   YES       NO

2. Have you ever played BANANAGRAMS® before today?
   YES       NO

3. While playing BANANAGRAMS® how did you feel time progressed?
   1 2 3 4 5 6 7
   Time Dragged       Time Passed Normally       Time Flew

4. BANANAGRAMS® is a challenging game.
   1 2 3 4 5 6 7
   Strongly Disagree Disagree Somewhat Disagree Neutral Somewhat Agree Agree Strongly Agree

5. While playing BANANAGRAMS® I felt in control.
   1 2 3 4 5 6 7
   Strongly Disagree Disagree Somewhat Disagree Neutral Somewhat Agree Agree Strongly Agree

6. Playing BANANAGRAMS® was relaxing.
   1 2 3 4 5 6 7
   Strongly Disagree Disagree Somewhat Disagree Neutral Somewhat Agree Agree Strongly Agree

7. Playing BANANAGRAMS® was boring.
   1 2 3 4 5 6 7
   Strongly Disagree Disagree Somewhat Disagree Neutral Somewhat Agree Agree Strongly Agree

Please continue to the next page.
8. As I was working on the words, I really didn’t care how many I made.

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<tr>
<th></th>
<th>1</th>
<th>2</th>
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<th>4</th>
<th>5</th>
<th>6</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Somewhat Disagree</td>
<td>Neutral</td>
<td>Somewhat Agree</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

9. I got worried about being able to use up all the letters.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
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<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<tr>
<td></td>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Somewhat Disagree</td>
<td>Neutral</td>
<td>Somewhat Agree</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
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</table>

10. Playing Bananagrams® was exciting.

<table>
<thead>
<tr>
<th></th>
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<th>4</th>
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<td>Disagree</td>
<td>Somewhat Disagree</td>
<td>Neutral</td>
<td>Somewhat Agree</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
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</table>

11. While playing Bananagrams® I “lost track of time.”

<table>
<thead>
<tr>
<th></th>
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12. Playing Bananagrams® made me feel anxious.

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13. Playing Bananagrams® was fun.

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14. I was surprised when my time was up.

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15. I enjoyed playing Bananagrams®

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16. I felt that I worked to my full capacity while playing Bananagrams®.

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17. While playing Bananagrams® I felt focused on the game.

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18. While playing Bananagrams® I felt that I was good at the game.

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19. If given the opportunity I would like to play Bananagrams® again.

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20. How much do you agree with the adage, “Time flies when you’re having fun!”?

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Appendix D

Informed Consent
Informed Consent

By participating in this study you will be working on a cognitive task and then filling out a questionnaire about the tasks. Approximately 30 minutes will be required to complete the full procedure. We do not anticipate that the study will present any risk to you. Additionally, participation in this study may not benefit you directly.

The information we gather through the questionnaires will be recorded in an anonymous fashion. If you do choose to participate your signed consent form will be stored separately from your questionnaires to further safeguard your identity. If the results of this study lead to publishable findings the information will be presented in aggregate form with no identifying information.

If you want to withdraw from the study at any time, you may do so without penalty. Upon your request the information collected from you can be destroyed at that point. Once the study is completed, we would be glad to share the results with you. In the meantime, if you have any questions, please ask us or contact:

Travis R. Maciejewski
Department of Psychology
UW Oshkosh
Oshkosh, WI 54901
MACIE735@uwosh.edu

If you have any complaints about your treatment as a participant in this study, please call or write:

Frances Rauscher
Chair, Institutional Review Board
For Protection of Human Participants
c/o Grants Office
UW Oshkosh
Oshkosh, WI 54901
920/424-1415

Although the chairperson may ask for your name, all complaints are kept in confidence.

I have received an explanation of the study and agree to participate. I understand that my participation in this study is strictly voluntary.

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<th>PRINTED NAME</th>
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This research project has been approved by the University of Wisconsin Oshkosh IRB for protection of Human Participants for a 1-year period, valid until February 25th 2011.
Appendix E

Confidentiality Statement
Confidentiality Statement

I understand that some psychological research (e.g. this study) relies on having naïve participants. In an effort to allow future students the opportunity to participate in this study, and to ensure that the results of this experiment are valid, I promise not to discuss anything about this experiment with anyone.

Signature - ______________________ Date - ______________
Appendix F

Written Debriefing
Written Debriefing

First, thank you very much for your participation in this research. Without participation the research process would stop.

This research is being done because most time perception research studies the effects of task enjoyment on the perception of time (“time flies when you’re having fun”), not time perception on task enjoyment (“time flew so I must be having fun”). By studying the effect of time perception on task enjoyment, we will be able to more fully understand how time perception and task enjoyment interact.

In this experiment the independent variable, the variable being manipulated, was actually the passage of time. This was controlled by manipulating the clock that was in the room with you. In the control condition participants worked in the presence of a clock running at normal speed. In the experimental condition participants worked in the presence of a clock that has been modified to run faster than normal. Both groups worked for the same amount of time, one just thought that more time had passed. You were in the (control/experimental) condition. The dependant variables, the variables being measured, are both your responses to the questionnaire and the amount of tiles that were used. We hypothesized that people experiencing time moving faster would rate playing Bananagrams® more positively, and be able to use more tiles. The motivation behind this procedure was not to trick you, but to elicit the most natural responses possible. If, for example, you had been told that the clock was running fast you probably would not have been affected by it.

Once again, thank you for your participation. Additionally, I would like to ask you not to share any of the information about the study with anyone until the end of the semester. By preserving confidentiality it is more likely that the results gathered will be helpful in producing meaningful results. Any questions?
Appendix G

Experiment Script
Experimenter: Hello, are you here for study 088?

Participant: Yes

Experimenter: Are you first name of expected participant?

Participant: Yes

Experimenter: You are in the correct place, please follow me. (Skip to 017)

Participant: No

Experimenter: It appears as if there is some confusion, what is your name? (Participant will give the experimenter his/her name. The experimenter will then attempt to figure out if the participant is at the wrong study, or came at the wrong time)

Participant: No

Experimenter: Ok, you are not here for my study; you may want to make sure you have your time and location correct.

Participant: 

Experimenter: Please follow me.

*** The experimenter will then lead the participant through the door into the experiment room and seat the participant at the desk with the questionnaire, two copies of the consent form, and a pen. ***

Experimenter: Like all psychological research at the University of Wisconsin-Oshkosh your participation is voluntary. The form that is on the desk in front of you is an informed consent document. There is one copy of this document for you and one for university records. This information will not be used to connect your name with the results, only to show that you agreed to participate. This document explains the study and your rights as a participant. I will leave the room while you read over the document and sign it. If you have any questions you can ask me them when I return. Please knock on the door when you are finished.

*** The experimenter will then leave the room and wait until the participant knocks. If over 3 minutes elapses without hearing a knock the experimenter will re-enter the room and check on the participant. ***

Experimenter: Do you have any questions?

Participant: Yes

Experimenter: What do you have a question about?

Participant: I do not understand __________.

Experimenter: The answers to these types of questions are too specific to be scripted. The experimenter will attempt to answer the question as directly as possible, and similarly for all participants.

Participant: No
Experimenter: Good, please move to the other table.

The participant is now seated at the other table. This table contains a clock, blocked by a small basket. Inside this basket is the Bananagrams® game bag. To ensure there are no distractions, turn off your cell phone and any other electronic devices and place them in the basket. Additionally, due to the motor component of this task, it is necessary that you are not wearing any wrist jewelry. Please remove any wrist jewelry and place it in the basket.

The participant will now place their cell phone, portable electronic devices, and jewelry in the basket located on the corner of the desk.

To further eliminate possible distractions, such as a cell phone ringing because it is on vibrate instead of being completely off, I will be taking this basket out of the room. Your items will be safe.

If the participant is reluctant to follow the directions explained in 052-065, he/she will be reassured that their items will be safe. If the refusal continues the participant will be told that their participant is over.

The experimenter will now remove the Bananagrams® game bag from the basket and begin explaining the task to the participants.

Experimenter: For your task you will be playing a solitaire version of the game Bananagrams.

The experimenter will then dump out the Bananagrams® pieces and ask the participant to help flip over the tiles so that they are all face down.

Experimenter: For this version of the game you will begin by drawing 20 tiles. When I instruct you to you will flip over all your tiles and begin making words. Once you use up all your tiles, you will draw three new tiles and place those. If you get stuck on a letter you may return it face down and draw three new tiles. The words created may go left to right or top to bottom. The words must build off each other, but, unlike Scrabble, you can rearrange your words at any time. Let me show you a quick example.

The experimenter will then flip over some of the Bananagrams® pieces and make interlocking words, then demonstrate how it can be rearranged if necessary.

The following passage is different based on condition, to ensure it is read smoothly it is being written out twice, once for each condition.
instructions begin on 096, the fast clock instructions begin on 101)###

Experimenter: The object of this game is to use as many letters as possible making as
many real English words as possible in 15 minutes. These words may not be
the names of people, the names or places, or abbreviation. All the words
must be able to be found in a standard dictionary.

Experimenter: The object of this game is to use as many letters as possible making as
many real English words as possible in 21 minutes. These words may not be
the names of people, the names or places, or abbreviation. All the words
must be able to be found in a standard dictionary.

Experimenter: Do you have any questions?

Participant: Yes

Experimenter: What do you have a question about?

Participant: I do not understand ______. 

Experimenter: The answers to these types of questions are
too specific to be scripted. The experimenter
will attempt to answer the question as directly
as possible, and similarly for all participants.

Participant: No

Experimenter: Great, please draw 20 tiles leaving them face down.

***The experimenter will then pick up the basket contain the participant’s belongings and
walk toward the door. The experimenter will take this time to pick up the informed consent
form off the desk.***

### Once again the following passage is different based on condition

(verbatim clock instructions begin on 126, the fast clock instructions begin on
130)###

Experimenter: When I start the stopwatch your 15 minutes will begin and you may start
flipping over the tiles and working. I will come back in when your time is
up.

Experimenter: When I start the stopwatch your 21 minutes will begin and you may start
flipping over the tiles and working. I will come back in when your time is
up.

***The experimenter will then click the stopwatch and gently shut the door. After 15
minutes has elapsed the experimenter will knock and re-enter the room holding a large
dictionary and a camera***

Experimenter: Your time is up. Please move back to the other table.
The experimenter will very deliberately set the dictionary and the camera on the table and comment "I will check your words once we are done". The participant will now be sitting at the other desk that contains two questionnaires and a pen. The experimenter will place the Bananagrams® Reaction Questionnaire face up in front of the participant.***

Experimenter: Please complete this questionnaire and knock on the door when you are finished.

***The experimenter will leave the room shutting the door gently. Upon hearing a knock the experimenter will re-enter. The Bananagrams® Reaction Questionnaire will be collected and the Demographics questionnaire will be placed in front of the participant.***

Experimenter: As with the last questionnaire, please complete this and knock on the door when you are finished.

### If either questionnaire takes excessively long (more than 5 min) the experimenter will assume the participant has forgotten to knock and re enter the room. As with the removal of personal items if a participant refuses at any point to complete the questionnaires they will be removed from the study. At this point though they will be debriefed prior to dismissing them. ###

***When a knock is heard the experimenter will re enter the room holding the confidentiality form and two copies of the written debriefing.***

Experimenter: Your participation is almost finished.

***The participant will be given the confidentiality form.***

Experimenter: We would like you to sign this. Is that alright with you?

***The participant will be given time to read the form.***

Participant: Yes

Experimenter: Great thanks!

Participant: No

Experimenter: This form is optional but it is really important that you do not discuss this research. Do you understand?

Participant: Yes

Experimenter: Great!

Participant: No

Experimenter: The experimenter will attempt to explain why confidentiality is important. The participant will not be forced, only educated on sound research methods.

***The experimenter will then take the confidentiality form, completed or not, and hand
Experimenter: This study did have you work on a cognitive task but the true purpose of the study is slightly more complicated than originally presented. Please follow along while I read you this explanation of the study.

Participant: Alright

***The experimenter will then read the written debriefing***

Participant: No

***The experimenter will inform the participant that the debriefing is very important and ask again if they would listen to it. If the participant is worried that the 30 minute participation time is done he/she will be told that the clock is not accurate***

Experimenter: Thank you again for participating; do you have any comments or suggestions?

***The experimenter will take a few minutes to address any comments or concerns of the participant and then show them to the door. The experimenter will also return all of the participants items.***
Appendix H

IRB Approval
February 10, 2010

Travis Maciejewski
309 Second St.
Neenah, WI 54956

Dear Mr. Maciejewski:

Based on the additional materials that you provided, your request for a modification has been approved for the study “The Effects of Time Perception on Cognitive Task Enjoyment.” You request for an extension is also approved. The new expiration date for this protocol is February 25, 2011. (One year from the previous date.)

Sincerely,

[Signature]

Dr. Frances Rauscher
IRB Chair
Appendix I

Scoring Diagrams
This Bannanagrams® word configuration was scored as having 13 words, all correct and using 35 letters, all correctly.

This Bannanagrams® word configuration was unable to be scored, and thus not included in the analysis. Ignoring the illegal spacing would produce many errors.
REFERENCES


