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Exploring Passage of Time Judgment in a Social Waiting Context

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Abstract: Waiting has been associated with temporal distortions and affective experiences. However, one might think that there are as many different experiences of time as there are different waiting situations. This study investigated the determinants of the sense of time in different waiting situations, some with a social perspective (waiting for someone), and some without. 84 participants were placed in a waiting situation for a few minutes, according to three conditions: waiting i) for a familiar person, ii) for an unfamiliar person, and iii) for equipment to be ready. At the end of the waiting time, they reported on temporal experiences (i.e., passage of time judgments [POTj], attention to time, and duration estimation) and filled in various scales assessing their emotional state and some personality traits. Analyses showed that participants experienced a slowing of time while waiting, and this was stronger in one of the social condition. The slowing down of time was explained by the boredom felt during waiting, while no significant difference was observed between the waiting conditions, neither for boredom nor for the other emotions. In addition, the results showed that the POTj was not significantly related to duration estimation. Therefore, by manipulating an original social waiting situation, the present study adds to a growing literature that attempts to understand the mechanisms underlying temporal distortions.

Keywords: waiting, passage of time judgments, boredom, social expectancy.

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1. Introduction

Waiting… In a world where everyone feels that everything is moving faster and faster, waiting can seem unnatural, producing an unpleasant affect and a feeling that time is passing very slowly. Studies have shown that the feeling of a slowing of the passage of time in waiting situations is linked to people's affective experience, particularly boredom with an increase in the awareness of oneself with self-centredness (e.g., Witowska et al., 2020). However, waiting is goal-oriented (e.g., waiting for a computer application to download, waiting for a doctor, waiting in a queue to buy bread). Therefore, this raises questions about the impact of social expectancy on the sense of time. In other words: is it the same thing if the purpose of waiting is social or not; is waiting for a technical reason (non-social expectation) equal to waiting for somebody else (social expectation), whether somebody you don't know or someone close to you? This study aimed to investigate, in a waiting situation, the extent to which the social goal of waiting could be associated with differences in passage-of-time judgment. It was therefore intended to document the effect of expectations on the feeling of the passage of time.

The feeling of the passage of time is, by definition, a phenomenological experience that occurs in everyday situations in which individuals can feel time passing faster or more slowly than usual (e.g., Jones, 2019). Individuals are able to verbalize this feeling with *passage-of-time judgments* (POTj) (Wearden, 2008, 2015). While the literature distinguishes between different POTjs, depending on the period of time to which the judgment relates (Droit-Volet and Martinelli, 2023; Droit-Volet and Wearden, 2015), one of them corresponds to the *present POTj*: the temporal judgment related to the activity in progress or the activity carried out just before the judgment. In our study, we examined the present POTj, the waiting situation that the participants have just experienced. In its 'pure' operationalization, the present POTj requires special methodological considerations with a single test, because people should not be aware that they will have to make a time judgment (Martinelli and Droit-Volet, 2022a).

To the extent that emotions are inherent in all personal experience, it's not surprising that emotional phenomena play a role in different time judgments, both in duration judgments and POTj (e.g., Droit-Volet, 2018). The literature provides a general overview about the influence of emotional phenomena on time perception, but studies have rarely directly considered this influence in social contexts. For an example of studies on the effect of one kind of social context on duration estimation, Sadeghi et al. (2023) recently submitted participants to a virtual environment simulating a subway journey (from 60 to 80 seconds) with varying degrees of crowd density. Their results showed an increase in the evaluation of the duration of the trip as a function of the density of people in the train. One more person per square meter produced an average increase of 1.8 seconds, and this effect was mediated by the individuals' affective experience: a trip on a more crowded train was perceived as longer insofar as it was felt to be more negative/less positive. In addition, results suggested that attention mechanisms also took part in time perception distortions. Emotion and attention are thus two major factors that explain distortions in duration judgments depending on social context.

Many studies carried out during the social confinement imposed by the COVID-19 pandemic have also revealed the influence of emotional phenomena on the POTj. In various countries (e.g., France, Germany, Italy, UK), these studies have consistently shown that people

experienced a slowing down of time during the confinement linked to more negative/less positive emotional states (e.g., Cellini et al., 2020; Droit-Volet al., 2020, 2023; Kosak et al., 2022; Martinelli et al., 2021; Ogden, 2020; Wessels et al., 2022). In addition, the emotion of boredom, with its attention component, has been identified as a particularly influential factor (e.g., Droit-Volet al., 2020, 2023; Kosak et al., 2022; Martinelli et al., 2022a, 2022b; Wessels et al., 2022). The slowing down of time in confinement conditions was therefore related to a decrease in happiness and an increase of boredom. However, it's unclear whether these results regarding the POTj were due to a lack of effective social interaction during confinement or to the expectation of the prospect of social interaction (e.g., reuniting with friends and family).

Waiting situations offer good conditions for studying the experience of the passage of time in different contexts, and the factors involved. Operationally, waiting situations consist of placing individuals in a situation of waiting and examining how this situation is experienced according to the characteristics of the individuals, the environment, and subsequent interactions. Fundamentally, waiting situations generally correspond to empty times, times in which individuals' activity is suspended, times in which individuals come face to face with themselves, and a stronger experience of the present passage of time. In sum, waiting is related to a lack of goal-directed action, passivity and dependency on external factors (Klapproth, 2010), resulting in two consequences. First, waiting carries negative emotional states (e.g., boredom, anxiety, anger or frustration), for instance, as consumers' satisfaction studies have revealed (e.g., Antonides et al., 2002; Carmon et al., 1995; Craig et al., 2017; Kostecki, 1996). Second, it's well documented that the less a person is absorbed in an activity (due to its complexity or novelty), the more a feeling that time is passing slowly appears (e.g., Droit-Volet and Wearden, 2015, 2016; Larson and von Eye, 2010; Nakamura and Csikszentmihalyi, 2014; Winkler et al., 2017). In sum, and according to the *Contextual Self-Duration Theory of POTj* (Droit-Volet and Martinelli, 2023; Martinelli and Droit-Volet, 2022b), the POTj for a waiting situation can be determined by changes in both individuals' internal (e.g., affect) and external (e.g., failure of activity) contexts, but also in the social context, operationalized for example by whether or not someone is waited (social expectancy), as examined in our study.

To date, relatively few experimental psychological studies have attempted to understand the factors that play a role in the feeling of the passage of time using a waiting situation that lasts for minutes. Investigating POTj in either a virtual reality (Igarzábal et al., 2021; Martarelli et al., 2024) or a real waiting situation (Ehret et al., 2020; Jokic et al., 2018; Witowska et al., 2020), researchers have confirmed a slowing of the passage of time in a waiting situation which was linked to a feeling of boredom, but also to an increase in thinking about time (Ehret et al., 2020; Igarzábal et al., 2021; Martarelli et al., 2024; Witowska et al., 2020). Moreover, their results were not consistent regarding the relationship between POTj and duration judgments (when measured). Igarzábal et al. (2021) and Witowska et al. (2020) found no significant correlation between POTj and duration estimates. In contrast, Jokic et al. (2018) obtained a significant correlation between POTj and duration estimates. Furthermore, Martarelli et al. (2024) found that boredom was strongly associated with POTj but only moderately with duration estimates.

The present study examined the effect of waiting on the POTj and its determinants, by manipulating individuals' social perspective. Waiting situations involve affective experiences,

and particularly boredom. Boredom is a volitional phenomenon depending on people's desires and aims. Indeed, boredom is also defined as "both a crisis of meaning (a state of perceived meaninglessness) and an attempt to recover lost meaning" (Elpidorou, 2023, p. 9). Consequently, waiting with a social perspective (i.e., waiting for another person such as a stranger or a close relation) and waiting with no social perspective (waiting for the material to be ready) do not have the same meaning for individuals and may generate different waiting experiences, and therefore different experiences of the passage of time.

Concerning time experience assessment, five questions were used in the present study: three on POTj, one on focusing attention on time and one on duration estimation. Concerning different affective evaluations—both based on their current affective state and some personality traits—participants reported their emotional states (i.e., emotional valence, arousal, happiness, sadness, tiredness, annoyance, anger, fear, worry, satisfaction and boredom) and completed questionnaires about life satisfaction, proneness to boredom and anxiety. In addition, we chose to collect a measure of time perspective as this is considered to be "the often-nonconscious process whereby the continual flows of personal and social experiences are assigned to temporal categories, or time frames, that help to give order, coherence, and meaning to those events" (Zimbardo and Boyd, 1999, p. 18).

In the present experiment, some participants (conditions 1 and 2) were told by the experimenter that they would have to wait because the study was collaborative and a second person would join them. This second person was described as either another participant enrolled in the study (condition 1, hereafter referred to as the 'Social perspective with an Unfamiliar person' – 'Soc_Unfam' condition), or as someone very close to the participant (condition 2, hereafter referred to as the 'Social perspective with a Familiar person' – 'Soc_Fam' condition). In the latter case, the experimenter explained that the people in charge of the study had conducted research on the participant and had contacted someone very close to them (such as a best friend, someone close in life) to take part. In a third condition (condition 3, hereafter referred to as the 'Non-Social condition' – 'NoSoc' condition), the experimenter explained that the delay was due to the study materials not being ready yet. Obviously, all three conditions were invented; the experimenter lied about each one.

In accordance with previous works, it was predicted that waiting situations produce a subjective slowing down of the passage of time associated (or not) with a lengthening of duration estimates. These temporal judgments were predicted to be linked to negative affective experiences, mainly boredom. In an original way, we assumed that the social nature of the wait influences the context of the waiting experience (perspective of social interaction or not), and therefore the POTj and perhaps the evaluation of the waiting duration. We expected that waiting for someone familiar and close to us means time passing more slowly.

2. Method

2.1. Participants

The protocol was run in accordance with principles outlined in the Declaration of Helsinki. All participants gave their informed consent before starting the experiment. The minimum total

sample size of 70 participants was determined using G*Power 3.1 (Faul et al., 2009). This calculation was based on multivariate analyses of variance (MANOVA, allowing for special effects and interactions) for three groups (waiting conditions) and five response variables. Based on previous research, we estimated the effect size as medium to large, and used $f^2 = 0.20$ for the sample size calculation (Cohen, 2013), an alpha error of 0.05 and a power of 0.80. The calculation included three groups (waiting conditions) and five response variables.

Initially, 91 participants took part in the study, with compensation for taking part using course credits toward their first year at university. Among this initial sample, seven were not included in the subsequent analyses as they didn't trust the waiting for someone scenario—see section 3.1. Results. Finally, the data from 84 participants (3 identified as men) were considered in the subsequent analyses with a mean age of 19.04 (*SD* = 4.08): 30 participants in the 'waiting for another participant' and the 'waiting to wait' condition respectively, and 24 in the 'waiting for someone who is close' condition.

2.2. Material

Two experimental rooms of the laboratory were used. The experimenter welcomed the participant in the first room, while the participant waited in the second room. A stopwatch was also used to measure the wait time, but this information was, of course, not made available to participants (see the 2.3. Procedure section). In each room, different self-reported scales were administered.

2.2.1. Time experience

Participants answered different questions on time judgment on visual analogue scales (VAS), all on a continuous 14-cm line. Participants marked the position that best corresponded to their responses with a pen. Three questions were about the passage of time during the waiting situation, from the experimenter's departure until their return: i) speed of the passage of time from 'time passed slowly' to 'time passed quickly'; ii) acceleration of the passage of time from 'time slowed down a lot' to 'time sped up a lot'; and iii) quantity of the passage of time from 'very little time passed' to 'a lot of time passed'. It should be noted that the two first questions (speed/acceleration of time) are the most common in the literature (e.g., Wearden, 2015). In accordance to FAIR principles, one can note that these two different formulations and a supplementary question (i.e., 'quantity') were used to take advantage of the opportunity to examine whether the way in which the question is phrased has an impact on the answer, and this in a French population. The fourth question dealt with the focus of attention on the temporal dimension (attentional focus) from 'I didn't think about time at all' to 'I thought about time very often'. Then, participants were asked to give their verbal estimate of the waiting duration (duration estimation): 'how much time did you spend in this room?' with answers ranging from '0 mins' to '14 min'.

2.2.2. Mood experience

Participants' emotional states were assessed with 11 questions, with a 14-cm response line. Two scales corresponded to emotional dimension assessments: arousal (from 'calm/not awake' to 'dynamic/alert') and valence (from 'not happy/unsatisfied' to 'happy/satisfied'), inspired from the Self-Assessment Manikin (SAM [Bradley and Lang, 1994]). The other scales corresponded

to discrete emotional assessments: happy, sad, bored, annoyed, angry, afraid, worried, satisfied, and tired, from 'definitely do not feel' to 'definitely feel'.

2.2.3. Trait personality

The Satisfaction with Life Scale (SWLS [Diener et al., 1985]; French validation [Blais et al., 1989]) was used to assess global satisfaction with one's life. It included five items with seven response options on a Likert scale ranging from 1 'do not agree at all' to 7 'fully agree'. Total scores range from 5 to 35 with high scores indicating people who are very satisfied with their life. Internal consistency was high, with McDonald's omega of 0.863 (Dunn et al., 2014).

The short version of the Anxiety Inventory (Trait) (STAI-Y [Spielberger, 1971]; French validation [Gauthier and Bouchard, 1993]) was also used to assess 'anxiety in general', with six-items and a four-point response scale going from 1 'not at all' to 4 'a lot', with one reverse item. The higher the score, the more people have the anxiety trait. McDonald's omega was 0.759.

Boredom proneness was assessed using the Short Boredom Proneness Scale (SBPS [Struk et al., 2017]; French validation [Martarelli et al., 2022]). For each 8 items, participants answered on a seven-point Likert scale ranging from 1 'do not agree at all' to 7 'fully agree'. High scores indicate high boredom proneness. McDonald's omega was 0.847.

The short version of the Zimbardo Time Perspective Inventory (ZTPI [Zimbardo and Boyd, 1999]; French validation [Fritsch and Cuervo-Lombard, 2022]) was also used to measure time perspective profiles. It consists of 15 items corresponding to five subscales: Past Negative (PN), Past Positive (PP), Present Hedonistic (PH), Present Fatalistic (PF), and Future (F). Participants gave their responses on 5-point Likert scale from 1 'very uncharacteristic' to 5 'very characteristic'.

2.2.4. Manipulation check questions: Effectiveness of experimental manipulation of the waiting context

In order to check the effectiveness of the waiting for someone scenarios (condition 1: 'Social perspective with an Unfamiliar person' – 'Soc_Unfam' condition; and condition 2: 'Social perspective with a Familiar person' – 'Soc_Fam' condition), in these conditions two questions were asked at the end of the experiment to the participants. First, they were asked (in writing) to 'tell us who you think you are waiting for; who you think should join us; and describe that person in a few words'. Second, the Inclusion of Other in the Self scale (IOS [Aron et al., 1992]) was used as a pictorial measure of closeness between two individuals. Two circles, labelled 'self' and 'other', respectively, were represented in 7 pictures, which represented degree of closeness from 1 (i.e., no overlap, no relationship) to 7 (i.e., complete overlap, close relationship). Participants had to indicate which picture best illustrated their relationship with the awaited person. These two measures enabled us to exclude from the statistical analyses participants who clearly stated that they were not expecting anyone.

2.3. Procedure

Each participant was welcomed in the first experimental room. After signing the consent form, they were asked to complete the mood scales (baseline). The experimenter then explained to some participants (conditions 1 and 2) that they would have to wait because the study was

collaborative and that a second person would be joining them. This second person was described as another participant enrolled in the study, an unfamiliar person (condition 1: 'Soc_Unfam' condition), or as someone very close to the participant (condition 2: 'Soc_Fam' condition). In condition 2, the experimenter explained that the people in charge of the study had carried out investigations of the participant and that they had contacted someone very close to them to take part. In a third condition, the experimenter explained that the delay was due to the study material not yet being ready (condition 3: 'NoSoc' condition). In all conditions, the participant thought they had engaged in an hour-long experiment. Obviously, the three conditions were pure inventions.

Before going to an adjacent room to wait, the participant had to leave all of their belongings in the first room, including any connected objects (watch, telephone), pretending that these objects would interfere with the computer equipment used in the task. The participant was then invited to wait in the second experimental room, where there were only two chairs. The experimenter closed the door and started the stopwatch for either 6 min 30, 7 min 30 or 8 min 30.

Once the time had elapsed, the experimenter re-entered the room, indicating that the expected person is sorry but will be arriving shortly (conditions Soc-Unfam and Soc-Fam), or that the equipment is almost ready (condition NoSoc). However, the experimenter explained that in order not to let this delay disrupt the observations of the forthcoming task, it was necessary to fill out different questionnaires again. The participant then started by completing the scales on temporal judgments. Half of them started by estimating the waiting duration, then gave their POTjs and the level of attentional focus, and the other half the reverse. The questions relating to mood were then completed, followed by the individual trait questionnaires. The last questions dealt with the two manipulation check questions about the waiting situation (whether participants believed they were waiting for another participant or someone close to them.

Finally, the experimenter apologized, claiming that the person could not come or that the equipment was not working. They thanked the participant and still validated the course credit for their participation. It should be noted that the manipulation was not disclosed to participants immediately after their participation, to prevent the information from being shared with other potential participants. However, for ethical reasons, once the entire study had been carried out, participants who were in the waiting conditions for another person received a message from the experimenter to explain the trickery.

3. Results

3.1. Manipulation check and analytical reasoning

The experimental effectiveness of the waiting conditions lay in the fact that each participant believed they were waiting for someone in the two social conditions (conditions Soc_Unfam and Soc_Fam), compared to the non-social condition (condition NoSoc). For the question 'tell us who you think you are waiting for; who you think should join us; and in a few words who that person is', seven participants didn't trust the waiting for someone scenario (one participant in the Soc_Unfam condition, and six in the Soc_Fam condition). They explicitly answered something

like 'I don't think anyone's coming'. After the exclusion of these participants, the mean IOS scores in the Soc_Unfam condition (IOS: M = 2.13, SD = 1.43) and those in the Soc_Fam condition (IOS: M = 5.17, SD = 1.49) were significantly different, $t(52)$ = -7.59, *Cohen's d* = -2.08. This suggests the distinctiveness of the social waiting conditions: as expected in the manipulation, participants in Soc_Fam condition reported waiting for someone who was closer to them than participants in Soc_Unfam condition.

Prior to the statistical analyses, variables were normalized. For the verbal estimation of waiting duration, duration estimates were normalized using the formula: (estimated time – clock time)/clock time (e.g., Ehret et al., 2020). Values below zero indicate a temporal underestimation, and above zero a temporal overestimation. The values for POTjs and attentional focus on time were divided by the total length of the line scale (14 cm) and multiplied by 100. Higher scores mirror that 'time passed quickly', 'a lot of time passed', 'time sped up a lot', and that 'I thought about time very often', respectively. The other variables were z-standardized. Finally, as mood was assessed at two times (T1: baseline; T2: after the waiting situation), a difference index was measured in order to be taken into account in the regression model. All analyses were performed with jamovi version 2.0.0.0 (jamovi project, 2021).

First, analyses on variance were performed on personality traits indices to ensure the equivalence of manipulated groups. Second, Multivariate Analyses of Variance (MANOVA, to compare group differences on a set of dependant variables simultaneously) were performed to investigate the impact of the waiting conditions on i) each mood experience dependant variable, and on ii) each temporal judgment (i.e., POTj, attentional focus on time and duration estimation—note that there was absence of multicollinearity between these dependant variables, with all correlations above r = .90 (Tabachnick and Fidell, 2012) (see Tables 3 and 4, respectively). Third, Pearson' correlations and a linear regression model allowed us to explore the predictors of temporal judgments. In order to report the results clearly, we have only included the descriptive statistics or correlation tables relevant to the significant results. However, all the data and more general correlation matrices are freely accessible on the page dedicated to the project on OSF: https://osf.io/rz6qv.

3.2. Analysis

Table 1 shows the raw mean scores obtained on personality traits measurements. As expected, analysis of variance on the corresponding Z-scores, with waiting condition as a between-subjects IV, showed that there was no difference between groups (all *ps* >.1). Waiting conditions were thus equivalent in terms of individual's characteristics.

Table 1. Mean scores and standardized deviations (SD) for each personality trait measurement as a function of group situation manipulations (Soc_Fam, Soc_Unfam, NoSoc).

	Zimbardo scale										Proneness to boredom		Life satisfaction		AnxietyTrait	
	ZPP		ZPN		ZH		ZF		ZPF							
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Soc_Fam	10.71	2.16	10.42	2.32	9.46	2.52	10.54	1.79	6.67	1.74	24.63	7.87	22.75	5.45	10.13	2.85
Soc_Unfam	10.50	3.34	10.67	3.15	10.37	2.34	10.37	2.91	6.90	2.66	25.24	10.06	23.16	6.81	9.67	3.36
NoSoc	10.25	2.73	10.43	2.86	10.27	2.50	10.53	2.32	7.27	2.97	26.67	10.63	21.83	7.94	10.47	3.86

Table 2 shows the mean Z-scores differences for all mood scores, and Table 3 shows the matrix correlation between them. The MANOVA run on the eleven mood Z-scores values as a function of waiting condition was not significant at the multivariate level and no factor reaches the significance threshold at the univariate level. Therefore, the analysis suggested that self-reported mood experiences didn't differ between conditions of waiting. In fact, paired-sample T-tests (with $p < .05/11$) comparing each mood score, reported on the 14-cm response line, between the first measure (before the waiting time: baseline, T1) and the second measure (after the waiting time, T2) showed that—whatever the condition of waiting—participants reported a more negative mood (*MT1* = 9.68, *SD* = 2.31, *MT2* = 8.56, *SD* = 2.90, $t(83) = 4.13$, $p < .001$), less happiness (*MT1* = 9.59, *SD* = 2.66, *MT2* = 7.12, *SD* = 3.78, $t(83) = 6.49$, $p < .001$), more boredom (*MT1* = 3.07, *SD* = 3.25, *MT2* = 6.75, *SD* = 4.18, $t(83) = -8.16$, $p < .001$), and less satisfaction (*MT1* = 6.94, *SD* = 3.60, *MT2* = 4.69, *SD* = 3.79, $t(83) = 5.34$, $p < .001$).

Table 2. Mean Z-scores difference and standardized deviations (SD) for each mood measurement as a function of waiting situation (Soc_Fam, Soc_Unfam, NoSoc).

	Valence		Arousal		Happy		Sad		Bored		Annoyed	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Soc_Fam	0.124	1.090	0.298	0.925	0.238	0.880	0.251	0.850	-0.026	0.892	1.120	3.484
Soc_Unfam	-0.091	0.815	-0.143	0.809	-0.142	0.900	-0.137	1.090	-0.093	1.010	0.909	2.837
NoSoc	-0.008	1.110	-0.098	1.200	-0.049	1.170	-0.063	1.010	0.114	1.090	0.997	3.111

	Angry		Afraid		Worried		Satisfied		Tired	
	M	SD	M	SD	M	SD	M	SD	M	SD
Soc_Fam	0.015	0.686	0.099	1.210	0.069	1.120	0.164	1.080	-0.167	1.090
Soc_Unfam	0.002	1.120	-0.351	0.832	-0.279	0.972	-0.180	0.875	0.222	0.993
NoSoc	-0.014	1.050	0.271	0.885	0.224	0.883	0.049	1.050	-0.088	0.920

Table 3. Correlation matrix between mood experience measurements for all participants across the conditions.

	Valence	Arousal	Happy	Sad	Bored	Annoyed	Angry	Afraid	Worried	Satisfied	Tired
Valence	-										
Arousal	0.244 *	-									
Happy	0.388 ***	0.214 we	-								
Sad	-0.26 *	-0.13	0.003	-							
Bored	-0.43 ***	-0.35 ***	-0.34 **	0.336 **	-						
Annoyed	-0.42 ***	-0.3 **	-0.16	0.392 ***	0.262 *	-					
Angry	-0.37 ***	-0.22 we	-0.07	0.365 ***	0.393 ***	0.452 ***	-				
Afraid	-0.2	-0	0.039	0.274 *	0.239 *	0.214 we	0	-			
Worried	-0.2 we	0.174	-0.05	0.212 we	0.134	0.134	0.102	0.628 ***	-		
Satisfied	0.198 we	0.334 **	0.662 ***	0.052	-0.13	-0.13	0.091	0.053	0.042	-	
Tired	0.083	-0.34 **	-0.08	0.027	0.064	0.064	-0	-0.02	-0.05	-0.02	-

Note. we(weak evidence) $p<.1$; *$p < .05$; **$p < .01$; *** $p < .001$

The mean scores for POTj, duration estimation and attentional focus on time for the three waiting conditions are presented in Figure 1. The MANOVA performed on time experience measurements revealed significant differences at the multivariate level: as data were not normally distributed, Roy's Largest Root = 0.17, $F(5, 78) = 2.66$, $p = .028$. It showed a significant difference at the univariate level as a function of waiting condition only for the question about the acceleration of the passage of time (scale from 'time slowed down a lot' to 'time sped up a lot'), $F(2, 81) = 4.084$, $p = .02$, although the scores on the different questions on the passage of time were significantly correlated (Table 4). Post-hoc comparisons (with Bonferroni correction) showed that participants felt that time sped up significantly more in the NoSoc condition ($M = 40.6$, $SD = 2.59$) than in the Soc_Unfam condition ($M = 30.1$, $SD = 2.59$), $t(81) = 2.86$, $p = 0.016$, with Soc_Fam condition being intermediate with no significant difference ($M = 35.2$, $SD = 2.90$) ($p > .05$). In other words, time slowed down in the social compared to the non-social condition.

Figure 1. Mean scores for the different POTj and attentional focus on time (i.e., value divided by the total length of the line scale (14 cm) and multiplied by 100); and mean scores for duration estimation (i.e., estimated time – clock time)/clock time), as a function of waiting condition (Soc_Fam, Soc_Unfam, NoSoc).

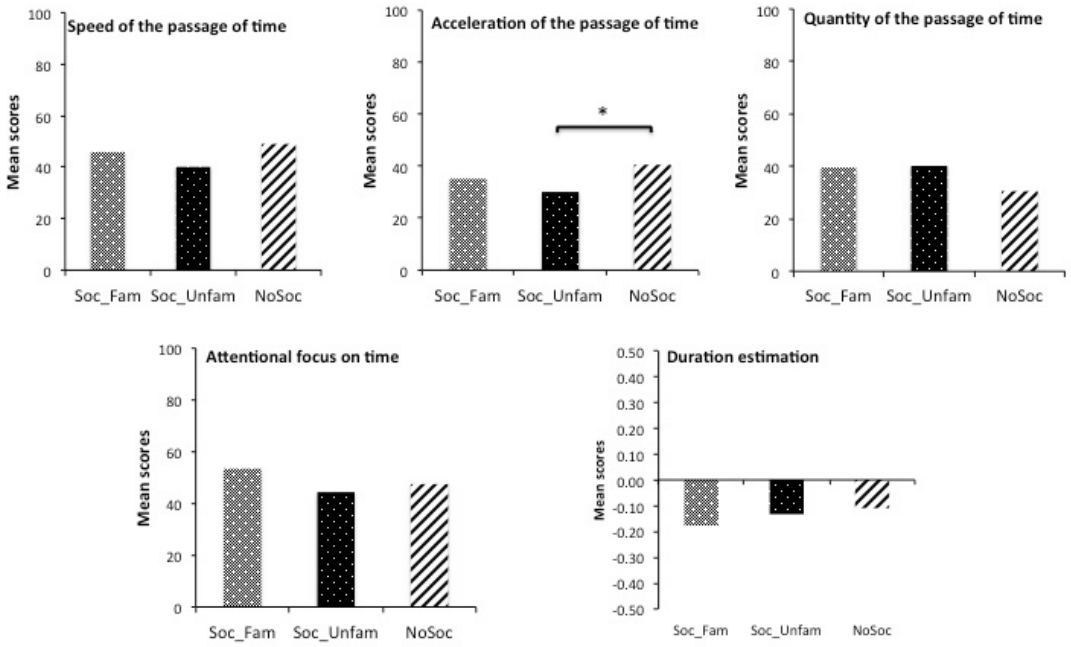

Table 4. Matrix correlation between time experience measurements for all participants across the conditions.

	Speed of POT	Quantity of POT	Acceleration of POT	Attentional focus on time	Estimation of duration
Speed of POT	-				
Quantity of POT	-0.348 **	-			
Acceleration of POT	0.685 *	-0.24 *	-		
Attentional focus on time	-0.234 *	0.223 *	-0.2	-	
Estimation of duration	-0.11	0.181	-0.09	0.087	-

Note. *$p < .05$; **$p < .01$; *** $p < .001$

As there was only a significant waiting condition effect on scores on the time acceleration question and that the POTjs were not significantly related to duration estimation (Table 4), only this dependent variable (i.e., acceleration of the passage of time) was considered in subsequent data exploration. As a first step to understand the connections between this POTj and the different components of our study, a correlation matrix was drawn up with all the scores of the different mood experiences and traits. The subjective acceleration of time passage was only significantly correlated with two measures of mood: valence (r = 0.289, p = .008) and boredom (r = -0.301, p = .005). The more positive mood participants reported, the more they said that time was accelerated, and conversely, the less they said that time was slowing down. Furthermore, the more they reported boredom, the less they said that time was accelerated, and the more they said that time was slowing down.

To examine these factors' contribution to variance in subjective time acceleration experience, hierarchical linear regression analysis was performed. The model included boredom and valence as covariates, and waiting conditions as factor (all VIF < 1.12), R2 = .22, $F(4, 79)$ = 5.67, $p < .001$. It revealed that the subjective acceleration of time judgment was only significantly driven by boredom, *Beta* = -3.78, 95% CI [-7.02, -0.55], t = -2.33, p = 0.02.

4. Discussion

Waiting situations are a good way to explore the mechanisms involved in experiencing time, but one might think that there are as many different experiences of time as there are different waiting situations. We therefore created different waiting scenarios, some of which involved a social perspective (waiting for someone), and another that did not (waiting for a technical question). The analyses revealed that participants experienced a slowing of time while waiting, but that time passed nevertheless relatively more quickly in the non-social waiting condition than in the social waiting condition, in particular when waiting for an unfamiliar person. In other words, participants experienced a stronger slowing down of the passage of time in the social condition. The slowing down of time was explained by felt boredom during waiting, while no significant difference was observed between waiting conditions both for boredom and other emotions. In addition, our results showed that the POTj was not significantly linked to duration judgment. Therefore, this work suggests that waiting is the condition in which individuals have a strong subjective experience of the passage of time (slowing down) associated with the boredom they feel, and that this should be accentuated when individuals are waiting for someone to arrive.

One might have thought that the waiting situation would have accentuated negative affective experiences that in turn would have explained the subjective temporal experience. Effectively, the participants reported a more negative feeling state after waiting, but this whatever the waiting condition. Moreover, no emotional feeling was involved in the final explanation of the POTj, with the exception of boredom. Therefore, this suggests that the waiting situation is a situation of conscious confrontation with time. Waiting is a moment when time is at the heart of consciousness: we live time, we suffer time! Moreover, the awareness that time was dragging on stronger when the purpose of the wait was social. One possible explanation is that social waiting may have developed a stronger expectation that involved the feeling that the present was dragging

on. In the present study, participants who were waiting for another person may have been pressed to find out the outcome of this wait. Therefore, the social prospect of another person joining them may have applied a stronger focus on the passage of time: the eagerness to know the outcome in the near future implied a heaviness of the present time. However, our manipulation—on relation to a social expectation—does not seem effective enough to really distinguish between social and other expectations. In fact, our results are clearly in line with previous results relating to a waiting situation, but future research should enable us to make the design of the experiment more concrete.

Our study suggested that the consciousness of time was not related to duration estimates. Indeed, we did not observe a significant correlation between POTj and duration judgment, even if we used long durations (6m30 to 8m30). This is consistent with some experimental works demonstrating the dissociation between mechanisms involved in the experience of the passage of time and duration estimations in waiting situations (Igarzábal et al., 2021; Witowska et al., 2020) and other tasks (Droit-Volet and Wearden, 2016; Wearden, 2008; Weiner et al., 2016). Therefore, it is not time *per se* (duration) that is at the basis of POTj but rather the suffering it causes in its extension when it is empty (waiting without doing anything) (Martinelli and Droit-Volet, 2022b; Droit-Volet and Martinelli, 2023).

According to the attention-based time model, the more attention is allocated to time (duration) the more time is judged longer, and the inverse (e.g., Block and Zakay, 1997; Nobre and Coull, 2010). The predictions of this model can therefore also be applied to awareness of the passage of time via the emotion of boredom that is characterized by an emotional component but also an attention component (e.g., Van Tilburg and Igou, 2017a; Westgate and Wilson, 2018). Our results clearly showed that felt boredom plays a crucial role in this feeling that time seems to pass more slowly. This is consistent with a growing literature on waiting situations (Ehret et al., 2020; Igarzábal et al., 2021; Martarelli et al., 2024; Witowska et al., 2020). Interestingly, Igarzábal and colleagues (2021) found that waiting in a virtual room was more boring than in a real room, even though they expected the exact opposite results. These authors suggested that a virtual reality room, with its originality and its normally playful side, created expectations, which did not ultimately correspond to the experimental session lived by the participants. There is therefore an increase of boredom when participants have initially a strong expectation (particularly in the virtual room), this produces an increase in thinking about the passage of time in the present and gives the feeling of a slower passage of time judgment.

Boredom has been conceptualized mainly in terms of its attentional and emotional/meaning components (e.g., Van Tilburg and Igou, 2017a; Westgate and Wilson, 2018). In the present work, a third component of interest is proposed: the POTj. In this context, the flow theory—as its author has basically emphasized ‘beyond boredom’ (Csikszentmihalyi, 2000)—would provide a more global approach to the particular mental state in the waiting situation, placing the emphasis on a holistic experience characterized by the concentration allocated to a task, its autotelic nature and temporal transformations.

Regardless of the component considered, the functional approach to boredom puts forward the idea that it constitutes a driving force to engage people in a more satisfying and meaningful situation (Danckert and Elpidorou, 2023; Elpidorou, 2023; for a review see

Moynihan et al., 2021); feeling bored when you're waiting for someone else thus arises from the social nature of humans and its relationship to social engagement (e.g., Van Tilburg and Igou, 2017b). This is also consistent with some observations during the COVID-19 pandemic, suggesting a link between the slowing down of time and limited social interaction (e.g., Droit-Volet et al., 2020; Kosak et al., 2022; Ogden, 2020; Wessels et al., 2022). In this context, it would have been interesting to test a condition in which the participant waited for a person in the presence of another person rather than alone. Future work could explore more closely the effect of social presence vs. social expectation of others on the sense of time.

Some limitations have to be acknowledged in this original study in order to be of benefit in setting up future protocols. First, it relates to the social perspective manipulation in the controlled setting of the laboratory. It should be noted that the participants were recruited in their first year of university and at the beginning of the year, since they are naiver when they arrive at university. Even though we took care to check the effectiveness of the experimental manipulation with the scenarios told to participants, our manipulation may not be robust enough to produce a difference between familiar and unfamiliar social conditions. Indeed, one could think that the situation was not concrete enough from the participant's point of view (i.e., which person close to me?). Some participants point out that they were thinking of a particular person (e.g., their best friend), but that it would be complicated for them to come because they were geographically far from the university. The lack of concreteness might explain also the non-difference obtained in affective measures. The present study recruiting students who participate in return for course credit may have also reduced the expected effects. It is possible that an ecological situation may have enhanced the observation of the expected effects (e.g., see Perroy et al., 2024, for a recent study in public transport). Therefore, and second, future directions of research would need to challenge that i) boredom can be apprehended differently than other 'traditional' negative affects (e.g., Van Tilburg and Igou, 2012), suggesting that the affective measures we used might be not relevant. ii) Indeed, boredom can be considered as inherent to experimental control studies (for a recent discussion, see Meier et al., 2024). Third, we did not replicate some effects (particularly correlations) found in other works. This can constitute a limitation linked to our relatively small sample of individuals (N = 84) for a between-participants design. Finally, we used three different questions to ask participants about the subjective passage of time, one of which is conventionally used (i.e., speed of time) and the other two are less so. Our aim was to try to capture this subjective dimension by testing different possible wordings, since, to our knowledge no study has systematically investigated the effect of different wordings on participants' understanding and therefore response. It turned out that the question we called 'acceleration of the passage of time' was the only one that was significant as a function of the manipulation condition, although scores on this question were significantly correlated to scores on other temporal questions. Indeed, this question was very close to the one commonly used which did not lead to results. The question of how to formulate questions put to participants on such a subjective dimension deserves more light shed on it by dedicated research.

In conclusion, our study adds to a growing literature dealing with the judgment of the passage of time and its relationship to time perception in a waiting situation. It showed that the POTj in a waiting situation is related to the feeling of boredom. It is our hope that this work will

spark further investigations evaluating the sense of time and the emotional/cognitive mechanisms at play.

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