Master Thesis

Communication of waiting times

The effects of progress bars on the perception of waiting time and uncertainty while waiting for a train

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Abstract

Introduction: The aim of this study is to investigate the effectiveness of different types of progress bars on the perception of waiting time and perceived uncertainty in the context of an extended waiting period in an offline setting, such as while waiting for a train. Based on the attentional-gate model of prospective time estimation (Block & Zakay, 1994) it was expected that the constant progress bar will lead to lower perceived waiting time (PWT) than the interval progress bar and that the PWT would be highest in the condition without progress bar. Furthermore, it was expected that the conditions with progress bars would indicate lower perceived uncertainty, whereby the condition with the constant bar was expected to have the lowest uncertainty score.

Method: A 3x3 experimental design was employed by manipulating the objective waiting time (3, 6, and 12 minutes) and the type of progress bar (no bar, interval bar, and constant bar). The subjects, N = 228, were exposed to a video installation simulating a train wait one by one in an experimental room and had to fill in a questionnaire afterwards.

Results: Concerning the effects of progress bar type on the PWT the differences were not found to be statistically significant. However, a significant main effect was found between the three waiting time conditions. Hence, as expected the participants of the 12 minutes condition had a higher PWT than the 6 minutes condition and latter had a higher PWT than the 3 minutes condition. No interaction effect was found between progress bar type and waiting time condition.
Moreover, a significant main effect of progress bar type on perceived uncertainty was found. Hence, the subjects of the condition with no progress bar perceived significantly more uncertainty than those of the interval bar condition, and these felt significantly more uncertain than the subjects of the constant condition. There was no significant effect of waiting time condition and no interaction effect.
Finally, no mediation effect of perceived uncertainty was found neither between waiting time condition and PWT nor between progress bar type and PWT.

Conclusion: Progress bars were not found to have a significant effect on reducing peoples' PWT, however, they can indeed help to reduce overestimation and perceived uncertainty. When the main goal is to reduce the PWT using, an interval progress bar is equally effective than using no progress bar at all. The constant progress bar was found to be the most effective in reducing uncertainty.

Keywords: Objective waiting time (OWT), perceived waiting time (PWT), perceived uncertainty, progress bars, attentional gate theory (AGT)

1. Introduction

Waiting is a daily part of our lives and can occur in different kinds of situations. It starts in the morning while having to wait for the coffee machine to finish making coffee and continues throughout the day when we are stuck in traffic, until we finally wait to fall asleep. But despite their context most of the waits we experience are perceived as annoying (Gronier & Lallemand, 2013; Norman 2008; Pruyn & Smidts, 1998). Therefore, researchers have studied quite extensively how to improve operations in order to eliminate or shorten the waiting time of customers. But unfortunately, there will always be some situations in which waiting is unavoidable or unanticipated by service providers. In that case scholars stated that, if it is not possible to avoid exposing customers to a waiting situation, it is then important to make the waiting experience as pleasant as possible (Han, Luo, Wang, & Zeng, 2015; Norman, 2008). Therefore, the customer's psychological assessment of a waiting situation has to be influenced (Pruyn & Smidts, 1998). One way to do so is for instance by reducing the perceived waiting time (PWT) that has been found to affect customer's satisfaction (Cao, Ritz, & Raad, 2013; Han et al. 2015; Pruyn & Smidts, 1998).

Another way to influence one's waiting experience is by reducing uncertainty. While waiting people often experience cognitive uncertainty when being unsure about how long the wait is going to be (Dainton & Zelley, 2015; Dziekan & Kottenhoff, 2006; Han et al., 2015; Maister, 2005; Myers, 1985). According to Norman (2008) being able to see progress while waiting, such as the waiting line moving forward, has been found to influence both the perception of waiting time and the experienced uncertainty.

Unfortunately, it is not always possible for the customer to physically observe the progress of the wait, such as when there is no line to see moving forward or when the service delivery process is simply not visible (yet), such as when one is waiting for a train that is not yet in one's visual field. In those kinds of situations progress indicators are often used as metaphors for displaying the progress of a wait (Bering, 2011; Branaghan & Sanchez, 2008 & 2009; Chen, Hess & Lee, 2017; Gronier & Lallemand, 2013). Progress indicators are already widely employed in different areas of our lives, for instance in form of countdown clocks on pedestrian crossings, as real-time information systems on public transport stations, or in the shape of loading bars on websites. Until now the effects of progress indicators, and of progress bars in specific, have mainly been studied for short waiting periods up to 10 seconds in the context of Human Computer Interaction (Chen, Hess & Lee, 2017; Gronier & Lallemand, 2013; Myers 1985). Results of scientists suggest that overall progress bars have positive effects on the perception of waiting time and perceived uncertainty, but the extent of

these effects also depends on the level of distinct loading phases within the progress bar (Branaghan & Sanchez, 2009; Gronier & Lallemand, 2013).
Therefore, this study aimed to research if progress bars of different levels of segmentations (interval and constant) have the same effectiveness on the perceived duration of waiting time and the level of experienced uncertainty in a context that implies long waits (from 3 up to 12 minutes), as it is frequently encountered when waiting for a train.

This paper is structured as follows: first, the main concepts on which this research relies are described within the theoretical framework. In the second part the methodological approaches that were taken within this research are outlined. After that, the outcomes of this study are presented in the results section. Then, follows a discussion of the results and limitations of this study. Finally, practical and theoretical implications that arise from this research are expressed and recommendations for further research are formulated.

2. Theoretical Framework

This section aims to outline the main theoretical concepts on which this research relies. First, the different types of progress indicators are described. Second, the effects of progress bars and waiting time duration on perceived waiting time are explained. Third, the effects of progress bars and waiting time duration on the perception of uncertainty are addressed. Furthermore, the relation between perceived uncertainty and perceived waiting time is outlined. Finally, the research model of this study is presented.

2.1 Types of Progress indicators: the progress bar

In general progress indicators are audio or graphical indicators that are used as metaphors to communicate or visualize the progress of a service delivery when progress is not physically observable (Garcia & Peres, 2012; Gronier & Lallemand, 2013). Within this research the focus will be on the latter, the graphical progress indicators. The most common differentiation of graphical progress indicators that can be found in literature is made concerning the movement of the progress indicators (PIs). In that sense researchers differentiate between three types of indicators: 1) static PIs, that only display non-moving information such as written messages saying “5 minutes delay”; 2) cumulative PIs, that fill up at a certain rate, such as percent-done progress bars; and 3) dynamic PIs, that incorporate some constantly moving visual representations, like for instance spinning wheels or sequential dots (Branaghan & Sanchez, 2008 & 2009).

In the past, scholars have studied people's preferences towards those three types of PIs and have concluded on several occasions that cumulative PIs, and in specific progress bars are preferred the most when used to communicate in waiting situations (Branaghan & Sanchez, 2008 & 2009; Cao et al., 2013; Gronier & Lallemand, 2013). Branaghan & Sanchez (2008 & 2009) for instance compared a static display, moving dots, and a constantly progressing bar and found that the latter scored the highest concerning preference. They explained these findings by the fact that people like to be informed and want as detailed information as possible about the waiting situation. Since the progress bar is the only of all progress indicators that is able to not only show that something is in progress, but also when the wait is likely to be over, it has been found to be the best progress indicator to keep customers informed about a wait (Branaghan & Sanchez, 2009; Myers, 1985).

Thus, based on the abovementioned evidence, the progress indicators employed in this research were two differently segmented types of progress bars.

2.2 Effects on perceived waiting time

Before being able to summarize the effects of progress bars on perceived waiting time it is first important to explain what perceived waiting time is in distinction to objective waiting time.

Perceived and objective waiting time

When studying waiting time, researchers generally distinguish between the objective waiting time (OWT) and the perceived waiting time (PWT), whereby the OWT refers to the physically measurable duration of the waiting time or also the "actual waiting time" (Pruyn & Smidts, 1998), whereas the PWT reflects the subjective perception of the duration of the wait that depends on psychological factors such as uncertainty (Gronier & Lallemand, 2013; Han et al., 2015; Hornik, 1984; Norman, 2008; Pruyn & Smidts, 1998). It is important to make that distinction because the PWT does not always equal the OWT. According to Pruyn & Smidts (1998) the subjective perception of time can result in an under- or overestimation of waiting time relative to the OWT. Thus, when the PWT is shorter than the OWT it is labeled as underestimation, whereas when the waiting time is perceived as being longer than the OWT it is called overestimation.

In addition, scholars suggest that there is a linear relationship between OWT and PWT, meaning that the longer the OWT the longer the PWT (e.g. Hornik, 1984; Taylor, 1994). For instance, Pruyn and Smidts (1998) found that the PWT is depending on the OWT.

In their research on the effects of environmental cues on the waiting satisfaction in a hospital setting they found that patients that had to wait for "a considerable length of time" tended to overestimate the waiting time, whereas the patients that had to wait "relatively short" tended to underestimate the waiting period (Pruyn & Smidts, 1998, p. 7). As a consequence, the following hypothesis was formulated based on these findings:

H1: The longer the duration of the waiting period (the OWT) the more the participants will overestimate the waiting time.

Furthermore, in the past researchers were divided about whether it was more important to either reduce the PWT rather than the OWT. Past studies suggested that OWT was as important as PWT, but in recent studies more and more scholars claimed that the perception of waiting time seems to have a bigger impact on the evaluation of the waiting experience, which in the end determines customer satisfaction (Han et al., 2015; Hornik, 1984; Pruyn & Smidts, 1993 & 1998). And isn't satisfying customers the ultimate goal of every service delivery? Therefore, this research focuses on how to positively influence the perception of waiting time instead of researching solutions on how to reduce the OWT.

Effects of progress bars on perceived waiting time

Concerning the effectiveness of progress bars on the PWT compared to other types of progress indicators scholars have found quite similar results suggesting that progress bars can reduce the PWT. According to the attentional gate theory (AGT) of Block and Zakay (1994) the individuals' perception of waiting time is highly influenced by the level of arousal and degree of focus on the passage of time. Several scholars agree that progress bars are the only progress indicators that allow participants to take their minds of the passage of time (Branaghan & Sanchez, 2008 & 2009; Gronier & Lallemand, 2013; Han et al., 2015; Myers, 1985). This effect has been explained due to the fact that the progress bar enables individuals to anticipate at a glance how long the wait is still going to take. Thus, one does not have to constantly watch the progress bar, what makes people take their minds of the passage of time (Branaghan & Sanchez, 2009). However, Chen, Hess and Lee (2017) found that progress bars with a high amount of temporal information can also induce the opposite effect and focus attention even more on the passage of time.

In contrast, the spinning wheel or sequential dots are moving constantly and do not provide any information when they will stop. Therefore, sequential dots lead to higher levels of

arousal. Cao et al. (2013) confirmed those findings by finding that the use of a progress bar resulted in underestimation of the waiting time, whereas the use of a spinning wheel caused the participants to overestimate the waiting time.
Moreover, the use of static progress indicators also seems to have less influence on PWT than progress bars or in some cases not any effect at all (Branaghan & Sanchez, 2009). Han et al. (2015) found that when no filler interface, such as a progress bar was used, users paid more attention to waiting time, which was then perceived as longer.

Consequently, the findings seem to support the AGT and show that progress bars can reduce PWT compared to other types of progress indicators. In that sense, the next hypothesis was formulated that:

H2: As opposed to the conditions featuring progress bars, the participants of the no-bar condition will tend to overestimate the OWT.

Furthermore, researchers also studied the effects of different kinds of progress bars on the level of arousal. The results suggested that the amount of change or level of segmentation in a progress bar influences the level of arousal of an individual, which according to the AGT in turn influences the PWT. In another experiment within the same study Branaghan & Sanchez (2009) compared a constant-rate progress bar to a variable-rate progress bar, which was split in four different phases and therefore stopped at four times. The results suggested that the PWT of the participants that were exposed to the variable-rate progress bar was higher than for the constant-rate progress bar. Constant progress bars that fill up continuously and in a foreseeable manner have thus been found to create the least level of arousal. Thus, not every progress bar has the same effect on PWT; instead the level of segmentation of a progress bar also must be taken into account. Therefore, a constant progress bar and an interval progress bar that consists of 5 intervals were employed in this study.

Hence, in accordance with the AGT and the findings presented above the third hypothesis is:

H3: The PWT will be higher in the conditions with the segmented interval progress bar than in the conditions with the constant progress bar.

Additionally, scholars suggested that the speed with which a progress bar fills up helps people to better estimate how much waiting time is left and thus leads to more accurate time

estimates (Branaghan & Sanchez, 2009; Norman, 2008). In other words, by observing the speed of the progress bar individuals are able to more accurately predict the real waiting time and thus do less over- or underestimate the waiting duration. In order to do so it is important that the speed at which a certain percentage of the bar fills up proportionally corresponds to the same percentage of the OWT. Therefore, at a waiting duration of 3 minutes for instance a progress bar should visually be filled 50% at 50% of the time, so at 90 seconds. But the interval progress bar fills up in jumps and hence the graphically displayed progress only corresponds to the OWT right when a new interval filled up. Thus, the interval bar makes it harder to estimate the OWT because it leaves room for speculation between intervals. Therefore:

H4: The PWT of the participants exposed to the constant progress bar will be closer to the OWT than for the interval bar conditions.

2.3 Effects on perceived uncertainty

First, the relation of progress bars and perceived uncertainty is outlined. Then, the possible effects of objective waiting time on perceived uncertainty are presented. Finally, the link between perceived uncertainty and perceived waiting time is elaborated.

Progress bars and perceived uncertainty

Not knowing when a waiting situation is going to end can cause a lot of uncertainty (Branaghan & Sanchez, 2008 & 2009; Han et al., 2015). In the setting of waiting for a delayed nationwide train uncertainty plays a very important role, because in that context of a rather long journey people have and want to fulfill certain needs while waiting such as buying food or coffee, and going to the toilet for instance. But the problem in those waiting situations is that despite the announcements, travelers are still often unsure about the exact remaining waiting time and thus would not dare to leave the platform to fulfill such a need being afraid to eventually miss their train. This uncertainty thus impacts travelers' psychological well-being, which can further affect the overall satisfaction with the service (Pruyn & Smidts, 1998). Hence, it is important to try to reduce uncertainty.

As a matter of fact, the use of progress bars has been found to help reduce uncertainty by managing peoples' expectations of waiting time durations. Scholars have concluded that the key of the ability of progress bars to manage peoples' waiting expectations lies in the high amount of information that can be communicated through the design of the progress bar

(Branaghan & Sanchez, 2009; Chen, Hess & Lee, 2017; Dziekan & Kottenhoff, 2006; Myers, 1985). In contrast to other progress indicators, such as the sequential dots, the progress bar allows people to anticipate the end of the waiting time based on the fact that it has a finite ending towards which it is progressing. According to Dziekan and Kottenhoff (2006, p. 492) "Simply knowing the actual departure time or time remaining until departure removes uncertainty […]." Bering (2011) also supports this claim. Thus, a progress bar shows a light at the end of the waiting tunnel, what, as everybody knows, already boosts the moral. But as explained earlier, due to the loading in several jumps the interval bar makes it harder between intervals to accurately estimate the waiting time that is left. Thus, the hypotheses are made that:

H5: The uncertainty will be highest in the condition without progress bar.
H6: The participants in the conditions with a constant progress bar will experience the least uncertainty.

Moreover, after having formulated those two hypotheses it becomes clear that perceived uncertainty is acting as a mediator in the relationship between type of progress bar and the PWT.

Objective waiting time and perceived uncertainty

Furthermore, the duration of the waiting time is also supposed to have an effect on the level of uncertainty. It is commonly known that the longer a wait endures, the more uncertain people get about how long the wait is still going to last, because people infer that the longer the wait already took, the more likely it is to end soon. However, when the wait endures longer than the time span, in which the wait was estimated to end people's uncertainty is growing. Thus, the longer the waiting duration will be, the more people will be worrying. Therefore, the last hypothesis claims that:

H7: The longer the OWT the higher the level of uncertainty.

Perceived uncertainty and perceived waiting time

Furthermore, the feeling of uncertainty has also been found to affect the perception of waiting time. Maister (2005, p. 5) stated that uncertain waiting situation may make waits feel longer because people are in a constant "state of nervous anticipation". Therefore, when the wait is not clearly defined, individuals are not able to relax, hence focusing more on the

passage of time, which makes the wait feel longer according to the AGT explained earlier (Block & Zakay, 1994; Maister, 2005). Thus, a positive relationship is expected between the level of uncertainty and the PWT.

H8: The higher the level of uncertainty the higher the PWT.

2.4 Research model

Figure 1 displays the research model that was created based on the analyzed literature in the theoretical framework and the hypotheses that were consequently deducted.

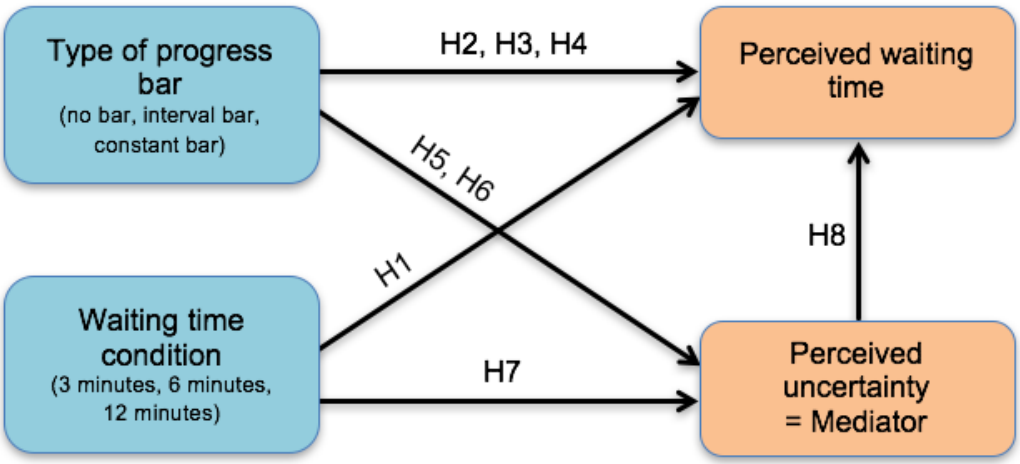

Figure 1: Research model

3. Methodology

In the following part of this paper, the methods section, the details will be outlined how this research was conducted. Therefore, first a description of the research design will be given, followed by an outline of the experimental setting and a discussion of the display of the progress bars, which were used as stimulus material. Then, the next two sections constitute of the procedure and measurements employed in this study and finally, the participants and sample characteristics concludes this chapter.

3.1 Research design

This study researched the effects of the two independent variables, type of progress bar and duration of waiting time, on the dependent variables perceived waiting time and perceived uncertainty. The type of progress bar was manipulated in three different ways: 1) control condition with no progress bar, 2) an interval progress bar, 3) a constant progress bar.

Moreover, the independent variable of the duration of the wait was manipulated in three steps by using waiting periods of 3, 6, and 12 minutes. These time intervals were chosen based on the moment when European railway companies consider their trains to be delayed. For German regional trains, for instance, that depart every 5 or 10 minutes a delay is registered when the trains reach their destinations 3 or 6 minutes later than anticipated, respectively. However, the moment when nationwide trains are considered as delayed ranges from a belated arrival at the destination of 3 minutes in The Netherlands, over 5 to 15 minutes in France, until up to 16 minutes in Germany (Collet & Maligorne, 2017; Deutsche Bahn, 2017; Treinreiziger.nl, 2017). As follows the waiting periods of 3 and 6 minutes were chosen based on the aforementioned data and the 12 minutes interval was chosen because the difference between 6 and 15 minutes would have been disproportionally long compared to the other two waiting periods.

Thus, the study consisted of a 3x3 experimental design that consequently resulted in 9 experimental conditions as can be seen in Table 1. The participants were assigned randomly to one of these conditions by means of the website https://www.randomizer.org/.

Table 1: Number of participants in each of the nine experimental conditions

		Duration of waiting time		
		3 minutes	*6 minutes*	*12 minutes*
		n	n	n
Type of progress bar	*No bar (control condition)*	26	26	25
	Interval progress bar	25	26	26
	Constant progress bar	24	25	25

3.2 Experimental setting

The research was conducted in an experimental setting in order to control for as many third variables as possible. Therefore, the context of a train wait was simulated using a video that was filmed on the train platform of Enschede, The Netherlands. However, the use of a real-life video always carries the risk that the distractions provided by the environment, such as people walking by, are not the same in all conditions. Therefore, it was important to ensure

that participants in the longest waiting condition would be exposed to the same environmental cues than those in the shortest waiting period. This was achieved by first cutting the 3 minutes video and then lengthening it to the respective 6 minutes and 12 minutes version by copy-pasting neutral parts of the video, in which there was practically no movement.
Furthermore, the perspective of the video focused on the information display that is normally installed on a platform to inform passengers about the time of arrival and the destination of the train because that is where the progress bar was going to be inserted.
Finally, the experiment was conducted in the same room for all 9 experimental conditions and the video was shown to the participants by using the same computer monitor.

3.3 Stimulus material: Display of progress bars

First of all, the choice was made to digitally recreate the whole information display, and not just the progress bars, so that it was less obvious to the participants which part of the display was manipulated. Therefore, the Microsoft program PowerPoint was used, because it made it possible to display the continuous movement of the constant progress bar. In general, the size of all progress bars was set at 0,8 cm height and 9 cm length. Moreover, the edge of all progress bars was outlined by a blue line in order to give a visual indication when the progress bars would be fully filled. The constant progress bars filled up by a carefully calculated width every three seconds (for the 3 / 6 / 12 minutes condition the bar respectively filled up for 0,15 cm / 0,08 cm / 0,04 cm every 3 seconds). However, the interval progress bar filled up by consecutively displaying 5 progress blocks representing 20% each of the whole progress bar. That means that for the waiting duration of 3, 6, and 12 minutes the interval bars respectively filled up by another 20% every 36 seconds, every 72 seconds, and every 144 seconds.

Furthermore, the information screen, in which the progress bars were imbedded, was carefully recreated by trying to match the design as close as possible to the original. However, the clock that hung to the right of the original screen was left out on purpose in the recreated PowerPoint screen in order to not influence the participants' subjective perception of the waiting time. In the control conditions without a progress bar only the recreated information screen was used and the part where the progress bars were inserted in the other conditions was left blank.

Lastly, the progress bars had to be converted from PowerPoint format to a movie format so that they could be inserted into the video. This was achieved by making a screencast of each PowerPoint on-screen presentation. Except for the control conditions, where simply a photo of the recreated information screen could be used because no movement had to be represented. Figure 2 displays a screenshot of the video after the recreated information screen was inserted.

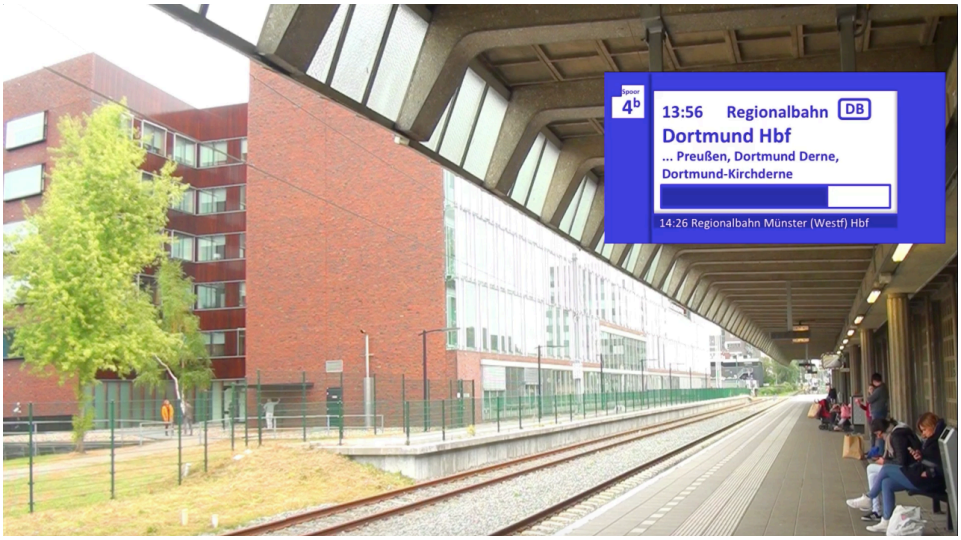

Figure 2: Screenshot of the 6 minutes video featuring a constant progress bar.

3.4 Procedure

The procedure of the experiment was as follows: First, the participants were greeted and asked to sign a form of informed consent. Therefore, participants were only told that the experiment aimed to study different types of information provision, but the complete aim of the study about time perception and perceived uncertainty remained undisclosed. The form of informed consent that was employed in this study can be found in the Appendix I.

Moreover, the participants were informed that the experiment would take a maximum of 30 minutes, but the exact duration of the experiment was not disclosed because that might have had an influence on their subjective time perception.

Furthermore, participants were ensured that all personal data were treated confidentially. Then, the participants were asked to leave all their personal belongings (including jackets, bags, and especially mobile phones and watches) in the researcher's office area outside of the experimental room. When entering the experimental room where the participants were exposed to the video, participants were only instructed to stay in the room

until the train arrived in the video and were told not to touch the keyboard because any touch would have made the bar indicating the length of the video appear. A plain piece of paper was placed over the keyboard to prevent them from touching it.

Finally, at the end of the video, the subjects were presented with a questionnaire that aimed to measure the dependent variables. The entire questionnaire can be found in the Appendix II.

3.5 Measurements

To start with, the first part of the questionnaire aimed to measure the cognitive and affective appraisal of the wait. The cognitive perception of the wait was measured in two ways. First, the perceived waiting time was measured by an open question asking the participants to indicate in minutes how long they estimated that they had to wait until the train arrived. Second, the participants had to indicate on a five-point-scale ranging from "very short" (1) to "very long" (5) how they perceived the wait.

Moreover, the affective appraisal of the wait was assessed using ten semantic differential items on which participants were asked to indicate the level of **boredom**, enjoyableness, **stress**, interest, excitement, **irritation**, **fairness**, **annoyance**, pleasantness and rapidness that they experienced during the wait (**Pruyn & Smidts, 1998**[1]). Therefore a 7-point Likert-Scale was employed ranging from "totally disagree" (1) to "totally agree" (7).

Then a Principal Component Analysis (PCA) was conducted in order to assess the validity of the newly employed questions. The PCA showed that two components had an Eigenvalue above 1 (1,35 and 3.14) and also the scree plot-test suggested that two components should be retained. The two components that were retained explain 64.14% of the variance in the affective appraisal of the wait. However, due to cross loading, three variables (Q3_7, RQ3_8 and Q3_10) were deleted and hence not included in further analysis. Thus, two components of the affective appraisal of the wait were retained: entertainment and disturbance. Table 2 underneath shows of which items the two components are composed.

[1] The bold items were used from the cited literature source. Other items that are not bold were created by the researcher herself.

Table 2: Components of the variable affective appraisal of the wait

Component 1: Entertainment	Component 2: Disturbance
RQ3_1_experiencing_wait_as_boring	RQ3_3_experiencing_wait_as_stressful
Q3_2_ experiencing_wait_as_enjoyable	RQ3_6_experiencing_wait_as_irritating
Q3_4_ experiencing_wait_as_interesting	
Q3_5_ experiencing_wait_as_exciting	
Q3_9_ experiencing_wait_as_pleasant	

The second part of the questionnaire intended to assess the perceived uncertainty that the participants experienced during the wait. Hence, the participants had to rate five semantic differential items on a 7-point Likert-Scale again ranging from "totally disagree" (1) to "totally agree" (7). Those five semantic differential items were based on a questionnaire developed by Ajzen (2002) and were formulated such as following sentence: "I felt confident that I could estimate when the train was going to arrive". Because the items were not exactly copied from Ajzen's work another PCA was conducted. The results of the PCA suggested deleting the item Q4_4 in order to heighten Cronbach's alpha from .75 to .83. Thus, the component perceived uncertainty comprised 4 items. Table 11 in the Appendix V lists all items that were included in the component perceived uncertainty.

The third part of the questionnaire aimed to check whether or not the participants had noticed the loading bars on the information board. For the manipulation check the participants were presented with a list of eight answering possibilities, including five types of progress indicators (a spinning wheel, a clock, a countdown clock, a loading bar, or loading dots), from which they had to tick the options that they had seen. When participants ticked a progress bar option that they were not really confronted with, they were excluded from the analysis.

Furthermore, participants were asked to give their opinion about the way information was provided about time progress. Therefore, the questions were formulated as follows "The way information about time was presented was …" and following ten semantic differential items were employed: pleasant, useful, annoying, interesting, boring, exciting, difficult to understand, precise, correct, easy to understand. Moreover, participants were asked if they felt adequately informed by the railway company. Once again, all eleven items were assessed with a 7-point Likert-Scale ranging from "totally disagree" (1) to "totally agree" (7).

The PCA revealed that two components had an Eigenvalue above 1 (1.6 and 4.2) and that hence the items measuring the appraisal of information provision should be split into two

components. The first component consisted of the cognitive appraisal of the provided information, how well the information was understood, and included seven items after the cross loading item Q6_1 was deleted. The final Cronbach alpha of was .85. The second component referred to the affective appraisal of the information provision, in other words how much the provided information was liked, and comprised three items with a Cronbach alpha of .72. Table 12 and Table 13 in the Appendix V display all items that were included in both components for rating the appraisal of the information.

Finally, the fifth section of the questionnaire assessed the perceived attractiveness of the waiting environment, with which the participants were confronted in the video scenario. Therefore, ten semantic differential items were used on which participants were asked to indicate if they thought the platform was attractive, busy, quiet, empty, exciting, **clean**, **spacious**, looked nice, had a nice **atmosphere**, or if they disliked it (**Pruyn & Smidts, 1998**). Also, here the same 7-point Likert-Scale was used. However, the PCA suggested that the appraisal of the environment contains two components with Eigenvalues of 1.6 and 3.3, which explained 55.6% of variance in the appraisal of the environment; and indicated that the item Q7_6_exciting should be removed due to cross loading. Furthermore, two more items (Q7_7_clean and Q7_8_spacious) were also deleted in order to increase Cronbach's alpha of the component appraisal of the environment_attitude, that measured the participants' attitude towards the environment. The final Cronbach's alpha of appraisal of the environment_attitude was .87. The other component appraisal of the environment_crowdedness assessed the participants' feeling of how crowded the environment was and was composed of three items with a Cronbach's alpha of .60. Table 14 and Table 15 in the Appendix V show all items that were constituted both components for measuring the appraisal of the environment.

Last but not least, the questionnaire ended with some demographic questions concerning age, gender, country of origin, and educational background so that it was possible to check that all experimental conditions were demographically comparable and homogenies. Besides, if they wished the participants could enlist in a contest in order to win a 15 Euro bol.com voucher and they had the opportunity to leave their e-mail address in order to be informed about the real aim and the outcomes of the study afterwards.

3.6 Participants and sample characteristics

Eventually a total of 243 participants took part in this research from which 228 valid responses could be used for analysis. The age of the participants ranged from 18 to 37 years and the mean age of the sample was 20.96 years. Furthermore, most of the participants' highest obtained educational level was the high school level (82.0%), plus the majority was female (70.2%) and originated from Germany (63.3%). For more detailed information the participants' distribution across the different age groups, educational groups, and origin groups, as well as gender categories can be found in Table 8 in the Appendix III.

Besides, the participants were sampled through convenience sampling using the SONA system of the University of Twente and were also directly recruited by the researcher on the university campus. This sampling method represents a bias and therefore has to be taken into consideration.

Test of Homogeneity

In addition, Table 3 below shows the distribution of number of subjects as well as their age, gender, educational level, and country of origin within all nine experimental conditions.

Table 3: Demographical distribution across all nine experimental conditions

			3 min	6 min	12 min	Total
Control Conditions	*n*		26	26	25	77
	Female Percentage[1]		69,2	69,2	80,0	72,2
	Age[2]	Mean	21,19	21,35	20,60	21,05
		SD	3,05	3,88	2,08	3,08
	Education[1]	High school	73,10	88,5	88,0	83,1
		Undergraduate	26,9	3,8	12,0	14,3
		(Post-) Graduate	0,0	7,7	0,0	2,6
	Country of origin[1]	NED	30,8	38,5	32,0	33,8
		GER	57,7	57,7	64,0	59,7
		Other EU	7,7	3,8	4,0	5,2
		Other world	3,8	0,0	0,0	1,3
Interval bar conditions	*n*		25	26	26	77
	Female Percentage[1]		68,0	73,1	65,4	68,8
	Age	Mean	20,72	20,46	20,92	20,70
		SD	1,72	1,88	2,00	1,86
	Education[1]	High school	76,0	92,3	88,5	85,7
		Undergraduate	24,0	3,8	7,7	11,7
		(Post-) Graduate	0,0	3,8	3,8	2,6
	Country of Origin[1]	NED	40,0	26,9	3,8	23,4
		GER	56,0	69,2	76,9	67,5
		Other EU	4,0	3,8	11,5	6,5
		Other world	0,0	0,0	7,7	2,6
Constant bar conditions	*n*		24	25	25	74
	Female Percentage[1]		54,2	64,0	88,0	68,9
	Age	Mean	21,87	21,72	19,80	21,12
		SD	2,80	3,22	1,16	2,69
	Education[1]	High school	70,8	68,0	92,0	77,0
		Undergraduate	25,0	20,0	8,0	17,6
		(Post-) Graduate	4,2	12,0	0,0	5,4
	Country of Origin[1]	NED	37,5	28,0	16,0	27,0
		GER	50,0	64,0	76,0	63,5
		Other EU	4,2	4,0	8,0	5,4
		Other world	8,3	4,0	0,0	4,1
Total	*n*		75	77	76	228
	Female Percentage[1]		64,0	68,8	77,6	70,2
	Age	Mean	21,25	21,17	20,45	20,96
		SD	2,60	3,11	1,84	2,59
	Education[1]	High school	73,3	83,1	89,5	82,0
		Undergraduate	25,3	9,1	9,2	14,5
		(Post-) Graduate	1,3	7,8	1,3	3,5
	Country of Origin[1]	NED	36,0	31,2	17,1	28,1
		GER	54,7	63,6	72,4	63,6
		Other EU	5,3	3,9	7,9	5,7
		Other world	4,0	1,3	2,6	2,6

[1] Indicated in percent.
[2] In years.

Overall the mean age between the conditions ranged from a minimum of 19.8 years to 21,87 years, however, this difference was not found to be statistically significant.

Unfortunately, it must be acknowledged that the subjects were not distributed very evenly across the conditions concerning the other three demographical criteria. The percentage of high school graduates ranges from 70.8% to 92.3% between the experimental

conditions and the percentage of German subjects fluctuates between 50.0% in one condition to 76.9% in another condition. Moreover, the percentage of female subjects varies between 54.2% and 88.0% between conditions. Therefore, three Chi-Square tests for goodness of fit were performed. The results that are displayed in Table 4 below revealed that the participants were not evenly distributed concerning educational level, country of origin, as well as gender within the 9 experimental conditions.

In conclusion, the demographic criteria must be taken into account when discussing the results in order to analyze if any found effects might have occurred due to the big demographic fluctuations between the nine experimental conditions.

Table 4: Results of the Chi-Square tests performed to test the goodness of fit of the participants concerning educational level, country of origin, and gender across all 9 experimental conditions.

	N	Chi-Square	df	p-value	Cohen's w
Educational level	228	247.29	2	< .001	1.04
Country of origin	228	216.316	3	< .001	0.97
Gender	228	37.12	1	< .001	0.40

4. Results

In this section, the results of the statistical analyses that were conducted using SPSS version 23 will be presented. First, the effects on the main dependent variables were analyzed. Then the effects on the secondary variables were tested. Finally, hypotheses testing concludes this section.

Table 5 below gives an overview of all the means and standard deviations of the main dependent variables across the nine experimental conditions. But before diving into the analyses some results are worth highlighting.

To start with, in contrary to the expectations it was not the condition with no progress bar, but the interval bar condition that induced the highest average perceived waiting time with 8.36 minutes with a standard deviation (SD) of 4.45 minutes.

In addition, for the longest waiting condition, which endured 12 minutes, progress bars seem to be counterproductive as the overestimation rose with the progress bar becoming more precise. Hence, contrary to the other two waiting conditions the overestimation was lowest for the 12 minutes condition when no progress bar was present.

Furthermore, the constant bar condition induced the least perceived uncertainty whereby the waiting duration of 6 minutes seems to have been the most effective of all conditions.

The following statistical analyses are going to show the statistical significance of these results.

Table 5: Overview of the means and standard deviations of the main dependent variables and the perceived uncertainty across the nine conditions

	Perceived waiting time		Overestimation		Perceived uncertainty	
	Mean[1]	SD[1]	Mean[1]	SD[1]	Mean[2]	SD[2]
No bar						
3 min	5.08	2.78	2.08	2.77	.73	.20
6 min	8.23	3.29	2.23	3.29	.82	.10
12 min	11.82	4.35	-.18*	4.35	.73	.19
Total	8.33	4.44	1.40	3.64	.76	.17
Interval bar						
3 min	5.16	3.65	1.80	4.17	.52	.17
6 min	7.90	3.30	1.71	3.48	.52	.18
12 min	11.90	3.62	-.10	3.62	.50	.15
Total	8.36*	4.45	1.13	3.82	.51	.17
Constant bar						
3 min	3.94	1.75	.56	2.68	.47	.18
6 min	6.42	2.74	.02	3.04	.38*	.16
12 min	12.64	4.92	1.12	4.83	.46	.16
Total	7.72	5.00	.57	3.63	.44	.17
Total 3 min	4.74	2.86	1.50	3.30	.58	.21
Total 6 min	7.53	3.18	1.34	3.37	.58	.24
Total 12 min	12.12	4.28	.28	4.27	.56	.21

[1] In minutes.
[2] Ranging from 0 to 1 with 1 being the highest level of perceived uncertainty.
*Significant findings.

4.1 Analysis of the main dependent variables

First, the effects on perceived waiting time and perceived uncertainty were tested. Then the effects on the overestimation variable were analyzed. Afterwards the mediation effect of perceived uncertainty on the perceived waiting time was tested.

In order to evaluate the effects of the two independent variables and the two dependent variables perceived waiting time and perceived uncertainty two separate factorial between groups analysis of variance (ANOVA) were performed.

4.1.1 Perceived waiting time: Factorial between groups ANOVA

The first factorial between groups ANOVA was used to compare the average time estimates of the aforementioned nine groups of participants. Shapiro-Wilk and Levene's tests

were used to assess the assumptions of normality and homogeneity of variance respectively. The assumption of normality was violated, however, due to the fairly big sample size the factorial between groups ANOVA was still conducted in order to test for any interaction effects.

The results suggest that there was no main effect of progress bar type on perceived waiting time, hence there was no significant difference between the time estimates of the participants of the no bar condition (M = 8.33 minutes, SD = 4.44), interval bar condition (M = 8.36 minutes, SD = 4.45), and constant bar condition (M = 7.72 minutes, SD = 5.00), F (2,219) = .96, df = 2, N = 228, p = .38, η^2 = .01.

Further, the results indicate that there is a significant main effect of waiting time condition on perceived waiting time, F (2,219) = 86.51, df = 2, N = 228, p < .001, η^2 = .44. Thus, a One-Way ANOVA was performed in order to find out which average perceived waiting time scores differ significantly among the waiting time conditions. In line with what can be expected the results of this follow-up test showed that the duration of the wait was perceived as significantly shorter in the 3 minutes condition than the 6 and 12 minutes conditions. Also, the waiting time in the 6 minutes condition was estimated as significantly shorter than in the 12 minutes condition. The average time estimates are displayed in the first two columns of the aforementioned Table 5. Figure 3 below graphically expresses the abovementioned results.

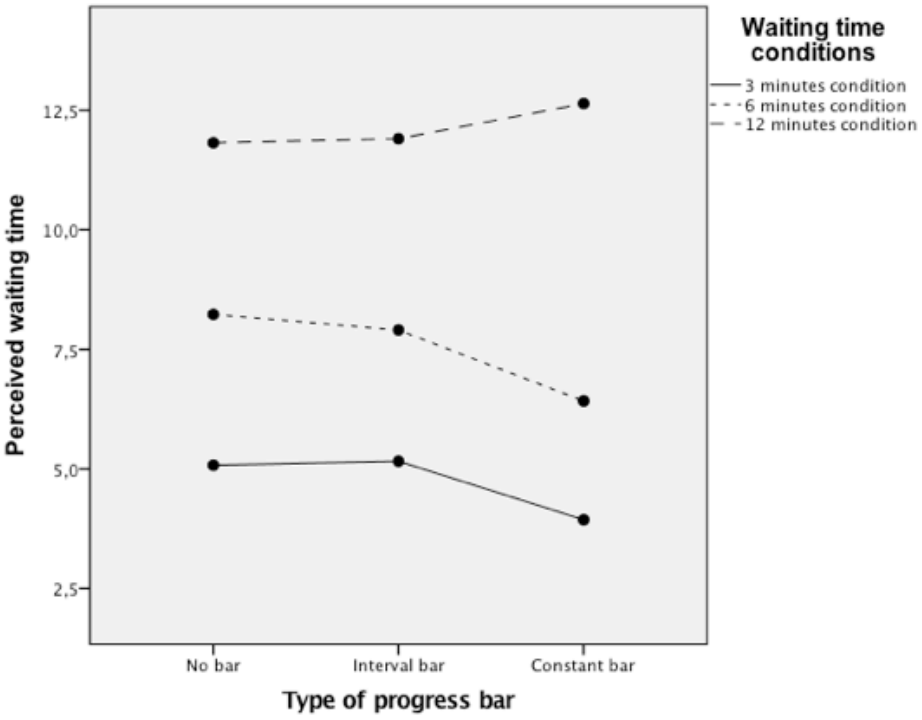

Figure 3: Graphical visualization of the means of the dependent variable perceived waiting time for all nine conditions

Moreover, there was no interaction effect of progress bar type and waiting duration on perceived waiting time, F (4,219) = 1.17, df = 4, N = 228, p = .33, η^2 = .02.

4.1.2 Perceived uncertainty: Factorial between groups ANOVA

In order to analyze the second dependent variable perceived uncertainty another factorial ANOVA was computed to compare the mean total scores of perceived uncertainty of the nine groups of participants. Shapiro-Wilk and Levene's tests were used again to evaluate the assumptions of normality and homogeneity of variance respectively. After evaluating the skewness and kurtosis it was concluded that the data is fairly normally distributed.

Based on the results of the second factorial ANOVA there is a significant main effect of progress bar type on perceived uncertainty, F (2, 219) = 78.63, p < .001, and η^2 = .42. Three One-Sample T-tests confirmed that participants that were exposed to the waiting conditions with a constant progress bar (M = .44, SD = .17) experienced significantly less uncertainty than participants that were presented with an interval bar (M = .51, SD = .17), and these in turn still experienced significantly less uncertainty than the participants of the no-bar conditions (M = .76, SD = .17). Hence, the participants that had to wait without a progress bar felt the most uncertain. Figure 4 below visualizes the effect.

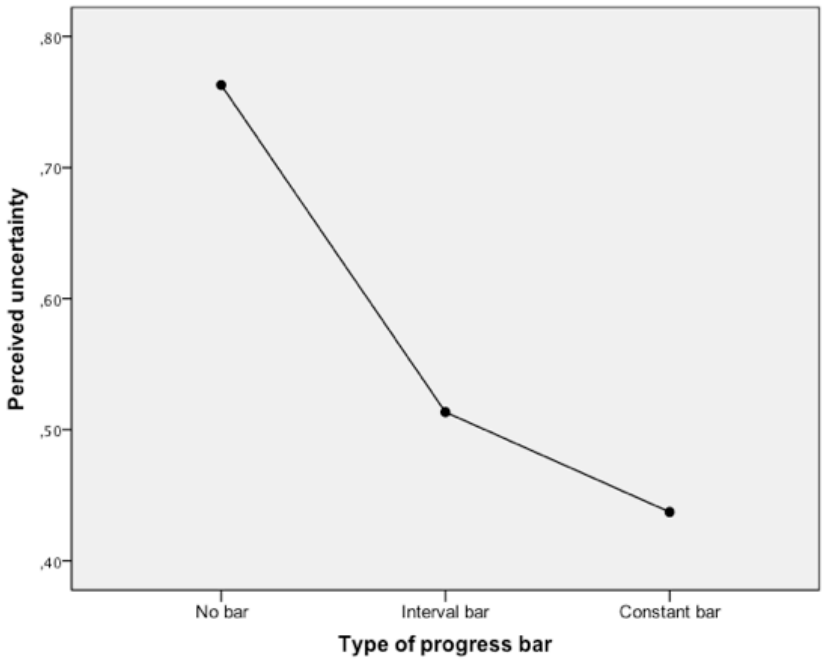

Figure 4: Graphical visualization of the means of perceived uncertainty across the progress bar conditions

In addition, the main effect of waiting time condition on the perceived uncertainty was not statistically significant with F (2, 219) = .13, p = .88, and η^2 = .001.

Moreover, there was no interaction effect between progress bar type and waiting time condition concerning perceived uncertainty, F (4,219) = 2.17, p = .07, and η^2 = .038.

Finally, non-parametric tests were conducted in order to make sure, that the significance of the results was the same. Hereby also no main effect was found for progress bar type, H (corrected for ties) = 2.54, df = 2, N = 228, p = .28, η^2 = .0112, Cohen's f = .106; and the significant effect of waiting time condition was supported, H (corrected for ties) = 121.86, df = 2, N = 228, p < .001, η^2 = .537, Cohen's f = 1.077.

4.1.3 Overestimation: One-Way ANOVA

By measuring the perceived waiting time the goal was not only to measure the participants' subjective time estimates of the waiting duration but most importantly to compare these subjective estimates to the OWT in order to establish if they over- or underestimated the waiting time. Therefore, a new variable called "Overestimation" was computed, which individual scores were calculated by subtracting the respective objective waiting time from the participants' subjective time estimates.

In the following two One-Way ANOVAs were performed in order to test the effects of the two IV's on the mean overestimation scores. The originally attempted factorial between groups ANOVA could not be performed because the assumption of normality was violated for all conditions, with all Shapiro Wilk statistics p < .001.

The results of the first ANOVA indicated that the mean overestimation score of at least one waiting condition significantly differed from the other waiting conditions, H (corrected for ties) = 14.17, df = 2, N = 228, p = .001, η^2 = .06, Cohen's f = .26. Thereupon three Mann-Whitney U tests were conducted in order to find out which mean overestimation scores differ from each other. Against the expectation the results showed that the participants of the 12 minutes condition (M = .28, SD = 4.27) significantly less overestimated the waiting duration than the participants of the 6 minutes (M = 1.34, SD = 3.37) and 3 minutes (M = 1.50, SD = 3.30) conditions, with U = 2127.00, z = -2.94 (corrected for ties), p = .003 (two-tailed) and U = 1937.00, z = -3.43 (corrected for ties), p = .001 (two-tailed) respectively.

The results of the second ANOVA indicated that there was no statistically significant difference between the mean overestimation scores of the no bar (M = 1.40, SD = 3.64), interval bar (M = 1.13, SD = 3.82), and constant bar (M = .57, SD = 3.63) conditions, H (corrected for ties) = 3.45, df = 2, N = 228, p = .18, η^2 = .01, Cohen's f = .12

4.1.4 Mediation effect: Regression analysis

The mediation effect of the perceived uncertainty on the perceived waiting time was tested by using several regression analyses. Therefore, a linear regression between the independent variables and dependent variable perceived waiting time was conducted first. The results of the first regression analysis between the type of progress bar and time estimate showed that their relation was not significant (F (1, 14.06) = .66, p = .42) and thus the mediation of perceived uncertainty on the effect of progress bar type on the time estimate could not be tested. However, the regression between waiting time condition and perceived waiting time was significant (F (1, 2057.33) = 166.69, $p < .001$) and thus mediation analysis could be performed.

Then a second linear regression between the dependent variable time estimate and both the independent variable waiting time condition and mediating variable perceived uncertainty was performed in order to isolate the mediation effect. When the regression between the mediating and dependent variable is significant and the earlier significant relationship between the independent and dependent variable becomes insignificant when the mediator is taken into consideration then a mediation effect is taking place. However, the second regression analysis including the mediator perceived uncertainty showed that the relation between the mediator and perceived waiting time is not significant, ß = .03, t = .67, p = .50; and that the relation between waiting time condition and perceived waiting time is still significant, ß = .65, t = 12.91, $p < .001$. In conclusion, the relation between waiting time condition and perceived waiting time was not mediated by perceived uncertainty.

4.2 Analysis of secondary dependent variables

In order to disguise the real aim of the study the questionnaire comprised three more dependent variables than the ones displayed in the research model. These were labeled affective appraisal of the wait, appraisal of the information, and appraisal of the environment. Nevertheless, these secondary dependent variables were analyzed out of curiosity. However, due to relevance their detailed analysis was not included in the main text of this paper and can be found in the Appendix VI. Yet, some main findings must still be pointed out at this point. Table 6 below gives an overview of all the means and standard deviations of the aforementioned variables across all nine experimental conditions.

Table 6: Overview of the means and standard deviations of the secondary dependent variables across the nine conditions

	Affective appraisal of the wait				Appraisal of provided information				Appraisal of the environment			
	Entertainment		*Disturbance*		*Cognitive*		*Affective*		*Affective*		*Crowdedness*	
	Mean[1]	SD[1]	Mean[1]	SD[1]	Mean[1]	SD[1]	Mean[1]	SD[1]	Mean[1]	SD[1]	Mean[1]	SD[1]
No bar												
3 min	.38	.12	.82	.13	.64	.17	.41	.10	.58	.14	.58	.13
6 min	.35	.13	.72	.20	.62	.18	.43	.13	.64	.14	.54	.13
12 min	.34	.12	.69	.23	.58	.17	.39	.13	.57	.13	.51	.14
Total	.36	.12	.74	.19	.61	.17	.41	.12	.60	.14	.54	.14
Interval bar												
3 min	.36	.15	.81	.15	.63	.14	.47	.13	.62	.15	.57	.15
6 min	.38	.10	.84	.14	.64	.15	.48	.15	.62	.12	.46	.14
12 min	.34	.14	.79	.16	.59	. 14	.44	.17	.61	.12	.47	.15
Total	.36	.13	.81	.15	.62	.14	.46	.15	.62	.13	.50	.15
Constant bar												
3 min	.44	.14	.84	.16	.72	.14	.49	.15	.67	.10	.56	.13
6 min	.41	.14	.79	.19	.76	. 13	.54	.14	.64	.11	.43	.14
12 min	.28	.09	.78	.14	.65	.19	.45	.17	.59	.13	.45	.09
Total	.38	.14	.80	.16	.71*	.16	.49*	.16	.63	.12	.48	.13
Total 3 min	.39	.14	.82	.15	.66	.15	.46	.13	.62	.13	.57	.13
Total 6 min	.38	.13	.78	.18	.67	.17	.48*	.15	.63	.12	.48	.14
Total 12 min	.32*	.12	.75	.18	.61*	.17	.43	.16	.59	.12	.48	.13

[1] Ranging from 0 to 1 with 1 being the highest.

* Significant findings.

First, our results suggest that participants' affective appraisal of the wait significantly drops when waits endure longer than 6 minutes, since the subjects of the 12 minutes condition perceived the wait as significantly less entertaining (M = .32, SD = .12) than the subjects of the 3 and 6 minutes conditions (M = .39, SD = .14 and M = .38, SD = .13, respectively).

Second, the results of this study show that the different types of progress bars and hence the different forms of waiting time information did not have an effect on how entertaining the wait was perceived and when information about the wait duration was included, the wait was even perceived as more disturbing than when no duration information was employed.

Third, it must be noted that participants that were exposed to the constant bar condition (M = .71, SD = .16) understood the information that was provided significantly better than the participants of the interval bar condition (M = .62, SD = .140) and no bar condition (M = .61, SD = .17).

Further, they indicated that the participants exposed to the 12 minutes waiting condition (M = .61, SD = .17) did experience the provided information as significantly less understandable

and accurate than the participants in the 6 minutes and 3 minutes conditions (M = .67, SD = .17).

Fourth, participants that were assigned to the constant bar condition (M = .49, SD = .16) liked the information that they were provided with significantly more than participants assigned to the no bar condition (M = .41, SD = .12). However, the subjects of the interval bar condition (M = .46, SD = .15) did not significantly more like or dislike the provided information than those from the two abovementioned conditions.

Moreover, participants of the 6 minutes waiting condition (M = .48, SD = .15) did like the provided information significantly more than the participants of the 12 minutes waiting conditions (M = .43, SD = .16), whereas the affective informational appraisal of the participants of the 3 minutes condition (M = .46, SD = .13) did not statistically differ from either of the other conditions.

Finally, the results pointed out that participants from the constant bar condition (M = .48, SD = .13) experienced the environment in the video as significantly less crowded than participants of the no-bar conditions (M = .54, SD = .14). The crowdedness score of environmental appraisal of the interval bar condition (M = .50, SD = .15) did not significantly differ from neither of the aforementioned conditions. Thus, the participants of the shortest waiting condition experienced the simulated environment in the video as significantly more crowded than the participants of the 6 minutes and 12 minutes conditions.

4.3 Hypotheses testing

Table 7 on the next page shows an overview of the results of the hypotheses testing.

Table 7: Overview of the results of the hypotheses testing.

Hypothesis	Outcome
H1: The longer the duration of the waiting period the more the participants tend to overestimate the waiting time.	Not supported, the opposite seems to apply
H2: In the condition featuring no progress bar participants will tend to overestimate the OWT.	Supported
H3: The PWT will be higher in the conditions with the interval bar than in the conditions with a constant progress bar.	Not supported
H4: The PWTs of the participants exposed to the constant bar will be closer to the OWT than for the interval bar conditions. So, they will less overestimate the waiting duration.	Not supported
H5: The perceived uncertainty will be highest in the condition without progress bar.	Supported
H6: The participants in the conditions with a constant progress bar will experience the least perceived uncertainty.	Supported
H7: The longer the OWT the higher the level of perceived uncertainty.	Not supported
H8: The higher the level of uncertainty the higher the PWT.	Not supported

5. Discussion and limitations

The aim of this study was to investigate the effectiveness of different types of progress bars on the perception of waiting time and perceived uncertainty in the context of an extended waiting period in an offline setting, such as while waiting for a train. As expected, the PWT scores were indeed higher the longer the wait endured. However, against the expectation the results showed that the participants of the 12 minutes condition significantly less overestimated the waiting duration than the participants of the 6 minutes and 3 minutes conditions. Moreover, the subjects felt less uncertain with the amount of information provided by the progress bar type increasing.

In this chapter, the abovementioned results are discussed and limitations of this research are brought forward. First, the effects on the PWT are discussed, followed by a reflection on the effects on the perceived uncertainty and the mediation effect of perceived uncertainty on perceived waiting time. Within each section the effects of both independent variables progress bar type and waiting time condition are discussed separately.

5.1 Effects on the perceived waiting time

Effects of the waiting time condition on the perceived waiting time

By measuring the PWT the goal was not only to measure the participants' subjective time estimates of the waiting duration but most importantly to compare these subjective estimates to the OWT in order to establish if they over- or underestimated the waiting time. In this research, like in many others such as Pruyn and Smidts (1998), a positive linear relationship between the OWT and the PWT was expected (H1). However, our results seem to contradict this expectation as the average overestimation progressively diminished the longer the wait endured. In fact, the subjects of the 3 minutes condition overestimated the waiting time more than twice as much as the 6 minutes condition and almost 25 times as much as the 12 minutes condition.

One explanation for this discrepancy could lie in the different amount of change that was provided in the videos used in the two studies. Whereas the subjects in Pruyn and Smidts (1998) research were exposed to a TV-program, which was composed of several clips, the subjects of this study were exposed to continuous videos, that aimed to simulate a waiting situation on a platform. Hence, in Pruyn and Smidts' (1998) research the longer the subjects waited, the more information they had seen, however, in this study the opposite was the case. The longer the subjects had to wait the less action / change they had seen. And according to the AGT (Block & Zakay, 1994) the level of change influences the arousal, which in turn influences the perception of time.

As a matter of fact, the subjects reported that the environment in the video of the 3 minutes condition felt significantly more crowded than in the videos of the 6 and 12 minutes conditions. This is probably due to the fact that the 6 and 12 minutes videos were created by stretching the 3 minutes video with low action scenes until the desired length was reached. Thus, the 3 minutes videos were packed with action, whereas the 6 and 12 minutes videos comprised more neutral passages giving the subjects the opportunity to get bored. Hence the difference in arousal could explain why the shortest waiting condition overestimated the waiting time the most, however, conclusion based on arousal must be considered carefully since it was not directly measured. As a consequence, a pretest would have been helpful to ensure that the amount of action was comparable in all videos.

To conclude, future waiting time research that deals with the relation between OWT and PWT should carefully reevaluate if a linear relation is the right assumption to go with.

Effects of progress bar type on perceived waiting time

Firstly, it was hypothesized that the absence of a progress indicator would lead to the subjects overestimating the waiting duration (H2) (Branaghan & Sanchez, 2009; Cao et al., 2013). However, the findings show that on average the subjects overestimated the waiting time no matter if a progress bar was present or not.

Moreover, it was expected that the PWT would be highest in the condition without any progress bar (H2) because people that don't have any indication when a wait is going to end are not able to relax and constantly focus on the passage of time, hence making it feel longer (Block & Zakay, 1994). Instead, the interval bar was expected to reduce people's PWT by putting peoples' minds at ease by providing a visual frame indicating the end of the wait. However, the PWT of the interval bar condition did not significantly differ from the no bar condition. This might be due to the fact that the way the interval bar operates makes it a complex stimulus, which according to Hogan (1978) may increase the perceived duration. First, because the interval bar fills up in intervals it is necessary to constantly monitor the progress bar in order to get a feeling of how long it takes for one interval and consequently the whole progress bar to fill up. Accordingly, the mean cognitive appraisal of the information scores of the no bar and interval bar conditions support this argumentation by confirming that the two conditions were equally confusing to the subjects. This underlines that the understandability of progress bars should be considered beyond their preferences when studying their effectiveness on waiting time estimates. Most studies that had dealt with the effects of progress indicators compared them by measuring which one was liked the most and then inferred that the preference of the progress bar depended on its preciseness without really measuring the indicators' cognitive appraisal (e.g. Branaghan & Sanchez, 2008 & 2009; Cao et al., 2013; Gronier & Lallemand, 2013).

To sum up, the results suggest that not only did the interval bar not permit the subjects to take their minds of the passage of time but it even seem to have reminded them more of the passage of time than the no bar condition. Hence indicating that when the main goal is to reduce the PWT using an interval progress bar is not more effective than using no progress bar at all.

In addition, according to scholars the level of segmentation within time fillers and especially progress bars influences the perception of waiting time (Block & Zakay, 1994; Branaghan & Sanchez, 2009; Hogan, 1978; Ornstein, 1969; Zakay & Hornik, 1992).

Consequently, it was expected that the more a progress bar is segmented the more arousal it creates, what in turn makes time feel longer (H3 & H4). As a matter of fact, the results of this study are in line with the expectation. The average PWT of the constant bars, which were computed to be perceived as single continuous events, was indeed lower than for the roughly segmented interval bar condition, in spite of the difference not being statistically significant. However, the constant progress bar seems to have had a contrary effect in the 12 minutes condition since the time estimate of the 12 minutes constant bar condition was even higher than for the no bar and interval bar conditions.

An explanation could lie in the fact that proportionally all the time conditions had the same level of segmentation (20 slides per wait length minute), but effectively the 12 minutes constant progress bar was segmented 4 times as much as in the 3 minutes condition and twice as much as in the 6 minutes condition. As a result, this higher amount of segmentation of the 12 minutes constant bar condition could have led to a higher level of arousal, which could explain the difference in perceived waiting time as explained above.

In addition, Branaghan and Sanchez (2009) and Chen, Hess and Lee (2017) had similar findings suggesting that providing more information in the form of more frequent updates, actually made the wait seem longer. However, due to its very small intervals the 12 minutes constant condition was expected to be perceived as the most continuous movement of all constant conditions, hence keeping the level of arousal to a minimum. But on the contrary, it appears that this slow visually perceivable progress (0.375 mm per 3 seconds) might have confused the subjects, as findings show it was the least understood and liked of all three constant conditions, hence maybe leading to a higher level of arousal, which in turn could explain the raised PWT.

Subsequently, further research is needed to find out where exactly the cutting point is for a progress bar to be perceived as several distinct events or one event in combination with varying waiting durations.

5.2 Effects on the perceived uncertainty

Effects of progress bar type on perceived uncertainty

The results have shown that there is a main effect of progress bar type on perceived uncertainty, consequently the conditions featuring the interval and constant progress bars experienced considerably less uncertainty than the conditions with no progress bar. Accordingly, our findings are in line with the findings of Bering (2011) and Dziekan and

Kottenhoff (2006) that claimed that the ability to anticipate the end of a wait lowers the feeling of uncertainty (H6).

Furthermore, our findings support that the amount of information that is transmitted through a progress bar considerably helps to manage peoples' waiting expectations (Branaghan & Sanchez, 2009; Myers, 1985). In that sense, the subjects that were exposed to the constant progress bar featuring the most detailed wait time information felt significantly less uncertain about the waiting situation than the subjects that were only exposed to a visual hint indicating when the wait would be over (interval bar). In other words, the effect of progress bars on the perceived uncertainty becomes stronger with the amount of information about the wait increasing (H7).

Besides, after examining the distribution of countries of origin across the different progress bar conditions it must be noted that the impacts of the different progress bars on perceived uncertainty are unlikely to have been influenced by the differences in distribution of country of origins.

To summarize, progress bars can indeed lower people's perceived uncertainty in a waiting situation, however, the effectiveness of progress bars depends on the accuracy and detailedness of the displayed information that can lower uncertainty even further.

Effects of waiting time condition on perceived uncertainty

Moreover, against the expectation formulated in section 2.3 the perceived uncertainty did not augment with the OWT rising (H8). As a matter of fact, the perceived uncertainty was almost the same in the three waiting time conditions, what might indicate that the participants' level of uncertainty does not augment beyond a certain waiting time. Hence, it might be that the participants' uncertainty manifests in the first 3 minutes of the wait and then does not increase any further because, as mentioned before, at a certain point the subjects seem to stop thinking about the passage of time and start relaxing. However, this is only a speculation, thus it is also possible that the subjects are just equally uncertain during a 12 minutes wait than during a 6 or 3 minutes wait.

Besides, the differences in distribution of subjects based on their countries of origins between the three waiting conditions might have influenced these findings. In short, the discrepancy in distribution of country of origin between the different waiting time conditions might have cancelled the effects of waiting time condition on perceived uncertainty out. Hence, this underlines how important it is to control for any geo-demographical differences between the experimental conditions when researching effects on perceived uncertainty.

Consequently, it would be interesting to further research how uncertainty does develop in waiting situations using for instance neuroscientific research such as measuring the sweat level of the skin also called skin conductance (Lewis, 2016).

Finally, the 6 minutes constant condition seems to be the most effective because the average time estimate was closest to the real OWT and it creates the least uncertainty of all nine experimental conditions. Furthermore, the time information was understood and liked the most by the subjects.

5.3 Mediation of perceived uncertainty on perceived waiting time

The fact that the time estimates did not significantly differ between the different progress bar types even though all perceived uncertainty scores significantly differ from each other within the three progress bar conditions suggests that perceived uncertainty does not mediate the effect of progress bar type on time perception (H5). Hence, the findings from Maister (2005) about the influence of uncertainty on time perception seem not to apply when employing progress bars, what suggests that they must be other variables that have an influence on the effectiveness of progress bar type on time perception.

One assumption why this could have occurred is that respondent bias might have taken place for the questions measuring the perceived uncertainty. Accordingly, it is possible that the subjects felt like they had to say that the interval and constant bar helped them to better estimate the time and so forth because they had confirmed their presence in the questionnaire beforehand, even though this was not effectively the case.

In addition, when examining the cognitive appraisal scores of the provided information, that is how understandable and accurate the respective type of progress bar was perceived, the interval bar seems to have been as confusing to the subjects as when no progress bar was present. This makes it questionable that the progress bars could have had the indicated effect on the perceived uncertainty. In turn, the perceived uncertainty is then also unlikely to have had the expected effect on the PWT.

6. Implications and recommendations for further research

This last section deals with the implications and recommendations for further research, that submerged from the results of this study. First, the practical implications are addressed; then the theoretical implications are outlined; and finally, recommendations for further research are formulated.

Practical Implications

In this study, a new way of communicating waiting times in offline environments was introduced to social sciences. Until now progress bars were mostly studied and employed in the field of Human Computer Interaction, which is characterized by short interactions of several seconds. This is the first study to research the effects of progress bars for communicating waiting times up to 12 minutes. Besides, this study employed progress bars beyond the digital context of Human Computer Interaction and used it to visualize a physical process of the offline world.

However, in the context of extended waits up to 12 minutes progress bars seem not to have the same effectiveness on the PWT than in short interactions of several seconds. Even though the subjects of the constant bar indicated a reduced PWT compared to the interval bar and no bar condition, the ANOVA indicated that the difference was not big enough to be statistically significant. Further, when the goal is to reduce peoples' PWT it seems even better not to employ any progress bar than employing an interval bar. Hence, this study suggests that there is no additional use in employing progress bars for waits ranging from three to twelve minutes when wanting to reduce peoples' PWT.

In addition, this study suggests that the understandability of progress bars should be considered beyond their preferences when studying their effectiveness on waiting time estimates. Most studies that had dealt with the effects of progress indicators compared them by measuring which one was liked the most and then inferred that the preference of the progress bar depended on its preciseness without really measuring the indicators' cognitive appraisal (e.g. Branaghan & Sanchez, 2008 & 2009; Cao et al., 2013; Gronier & Lallemand, 2013).

Moreover, progress bars seem not to have the ability to make the wait more entertaining, instead they even seem to make the wait being perceived as significantly more disturbing. Hence, this study suggests that employing progress bars to better the affective appraisal of the wait seems counterproductive.

Furthermore, there was a main effect of progress bar type on perceived uncertainty suggesting that progress bars can indeed lower people's perceived uncertainty in a waiting

situation. However, the effectiveness of progress bars depends on the accuracy of the displayed information that can lower uncertainty even further. Thus, progress bars were found to be an effective tool to give people the feeling of having a better sense of wait time control.

Finally, the waiting time was less overestimated the longer the wait endured, what suggests that reducing the OWT in order to reduce the PWT seems not to be such an imminent goal anymore for industries seeking to reduce their customers' PWT. However, waits under twelve minutes were perceived as significantly more entertaining, hence the OWT plays an important role in the wait's appraisal.

Theoretical Implications

In addition, this study suggests that future waiting time research should carefully reevaluate if the linear relation between OWT and PWT that was long assumed by scholars, is the right assumption to go with, or if this relation is not better described by a power function like Aalst et al. (2002) already pointed out.

Besides, this research made it clear how important it is to control for the demographics gender, educational background, and country of origin when conducting research about wait time perception. Hence, this research suggests not to randomly assign participants to experimental conditions but to assign them in a way that the aforementioned demographics have the same quota in each experimental condition. Although, this could dramatically impact the validity of the research.

Further research

First, this study gives first insights in the influence of the degree of segmentation of progress bars on the PWT, but further research is needed to find out where exactly the cutting point is for the loading phases of a progress bar to be perceived as several distinct events or one event and its subsequent influence on the PWT.

Second, more research is necessary to clarify the importance of the understandability of progress bars on the effect of wait time information on the PWT. Because this study was the first to take this cognitive aspect into consideration there is no pre-existing work to this issue, but more research is needed in order to support our findings.

Third, it would be interesting to further research how uncertainty of time estimation does develop in a waiting situation in order to find out if this kind of uncertainty is built at the start of a waiting situation or evolves throughout the wait. And if so, how long does it take for uncertainty of time estimation to manifest? We propose to do so using for instance physiological measures such as measuring the sweat level of the skin (skin conductance) or

pupil dilation, which were found to be indicators for uncertainty (Braun, Donner, & Urai, 2017; Lewis, 2016).

Finally, a last suggestion for further research could be to study how a lowered sense of uncertainty encourages real behavior (like leaving the platform to buy a sandwich), which in turn is assumed to influence the PWT since filled time is perceived as shorter than unfilled time (Maister, 2005).

To sum up, this research brought some new light into waiting time research, however, more research is needed on certain topics.

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Appendices

Appendix I – Form of informed consent

Informed consent form

Title research:
Responsible researcher:

To be completed by the participant

I declare in a manner obvious to me, to be informed about the nature, method, target and [if present] the risks and load of the investigation.

I know that the data and results of the study will only be published anonymously and confidentially to third parties. My questions have been answered satisfactorily.

[If applicable] I understand that film, photo, and video content or operation thereof will be used only for analysis and / or scientific presentations.

I voluntarily agree to take part in this study. While I reserve the right to terminate my participation in this study without giving a reason at any time.

Name participant: ……..

Date: …… Signature participant: ……

To be completed by the executive researcher

I have given an spoken and written explanation of the study. I will answer remaining questions about the investigation into power. The participant will not suffer any adverse consequences in case of any early termination of participation in this study.

Name researcher: ……..

Date: …… Signature researcher: ……..

Q1 Please estimate how long you had to wait in the room until the "train arrived"? (Please indicate a number in minutes)

Q2 Please indicate how you perceived the wait. (Please choose one option)

The wait was...
- ❍ ... very long
- ❍ ... long
- ❍ ... neither long nor short
- ❍ ... short
- ❍ ... very short

Q3 Please indicate how you experienced the wait.

	Totally disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Totally agree
The wait was boring.	❑	❑	❑	❑	❑	❑	❑
The wait was enjoyable.	❑	❑	❑	❑	❑	❑	❑
The wait was stressful.	❑	❑	❑	❑	❑	❑	❑
The wait was interesting.	❑	❑	❑	❑	❑	❑	❑
The wait was exciting.	❑	❑	❑	❑	❑	❑	❑
The wait was irritating.	❑	❑	❑	❑	❑	❑	❑
The wait was fair.	❑	❑	❑	❑	❑	❑	❑
The wait was annoying.	❑	❑	❑	❑	❑	❑	❑
The wait was pleasant.	❑	❑	❑	❑	❑	❑	❑
The wait went by fast.	❑	❑	❑	❑	❑	❑	❑

Q4 Please indicate how much control you had over the waiting situation.

	Totally disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Totally agree
I was unable to predict when the train was going to arrive.	❍	❍	❍	❍	❍	❍	❍
I felt confident that I could estimate when the train was going to arrive.	❍	❍	❍	❍	❍	❍	❍
I felt in control to estimate at any time if it was possible to leave the platform to get a coffee and return in time before the train arrives.	❍	❍	❍	❍	❍	❍	❍
Being able to anticipate the duration of the wait makes me feel in control of the situation.	❍	❍	❍	❍	❍	❍	❍
The provided information helped me to estimate the duration of the waiting time.	❍	❍	❍	❍	❍	❍	❍

Q5 Please indicate what type of information you have seen on the information board. Tick the options that apply.

The information board featured…
- ❍ ... a spinning load wheel.
- ❍ … the destination of the train.
- ❍ ... a clock indicating the time.
- ❍ … the arrival time of the train.
- ❍ … the number of the platform.
- ❍ ... a countdown clock.
- ❍ ... a loading bar.
- ❍ ... three loading dots.

Q6 Please indicate what you think about the way information was provided about time progress.

	Totally disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Totally agree
The way the information about time was presented was pleasant.	❍	❍	❍	❍	❍	❍	❍
The way the information about time was presented was useful.	❍	❍	❍	❍	❍	❍	❍
The way the information about time was presented was annoying.	❍	❍	❍	❍	❍	❍	❍
The way the information about time was presented was interesting.	❍	❍	❍	❍	❍	❍	❍
The way the information about time was presented was boring.	❍	❍	❍	❍	❍	❍	❍
The way the information about time was presented was exciting.	❍	❍	❍	❍	❍	❍	❍
The way the information about time was presented was difficult to understand.	❍	❍	❍	❍	❍	❍	❍
The way the information about time was presented was precise.	❍	❍	❍	❍	❍	❍	❍
The way the information about time was presented was correct.	❍	❍	❍	❍	❍	❍	❍
The way the information about time was presented was easy to understand.	❍	❍	❍	❍	❍	❍	❍
I feel that I was adequately informed by the railway company.	❍	❍	❍	❍	❍	❍	❍

Q7 Please indicate what you think about the train platform in the video. What do you think about this platform as waiting environment?

	Totally disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Totally agree
I think that the platform was attractive.	❍	❍	❍	❍	❍	❍	❍
I think that the train platform looked nice.	❍	❍	❍	❍	❍	❍	❍
I think that the platform was busy.	❍	❍	❍	❍	❍	❍	❍
I think that the platform was quiet.	❍	❍	❍	❍	❍	❍	❍
I think that the platform was empty.	❍	❍	❍	❍	❍	❍	❍
I think the platform was exciting.	❍	❍	❍	❍	❍	❍	❍
I think that the platform was clean.	❍	❍	❍	❍	❍	❍	❍
I think that the platform was spacious.	❍	❍	❍	❍	❍	❍	❍
I think that the platform had a nice atmosphere.	❍	❍	❍	❍	❍	❍	❍
I disliked the platform.	❍	❍	❍	❍	❍	❍	❍

Lastly, please answer a few demographic questions.

Q8 Please indicate your gender. Tick one option.

❍ Female
❍ Male
❍ Other

Q9 How old are you?

Q10 What is the highest educational degree you have obtained? Tick one option.

- ❍ Preparatory middle-level applied education (VMBO)
- ❍ Preparatory scholarly education (VWO)
- ❍ Senior General Secondary Education (HAVO)
- ❍ Middle-level applied education (MBO)
- ❍ Scientific education (WO)
- ❍ High School (Abitur)
- ❍ Higher professional education (HBO)
- ❍ Bachelor's Degree (University)
- ❍ Master's Degree
- ❍ PhD / Doctorate
- ❍ Other: ……..

Q11 What is your country of origin?

Appendix III – Demographical distribution of the sample

Table 8: Demographical data of the sample

Demographics		n	%
Age			
	18 thru 23 years	198	86,9
	24 thru 29 years	27	11,8
	30 thru 35 years	2	0,9
	Older than 35 years	1	0,4
	Total	228	100,0
Gender			
	Female	160	70,2
	Male	68	29,8
	Total	228	100,0%
Education			
	High school level	187	82,0
	Undergraduate level	33	14,5
	(Post-) Graduate level	8	3,5
	Total	228	100,0
Country of origin			
	The Netherlands	64	28,1
	Germany	145	63,6
	Other in Europe	13	5,7
	Other outside Europe	6	2,6
	Total	228	100,0

Appendix IV – Screenshots of all three types of progress bars

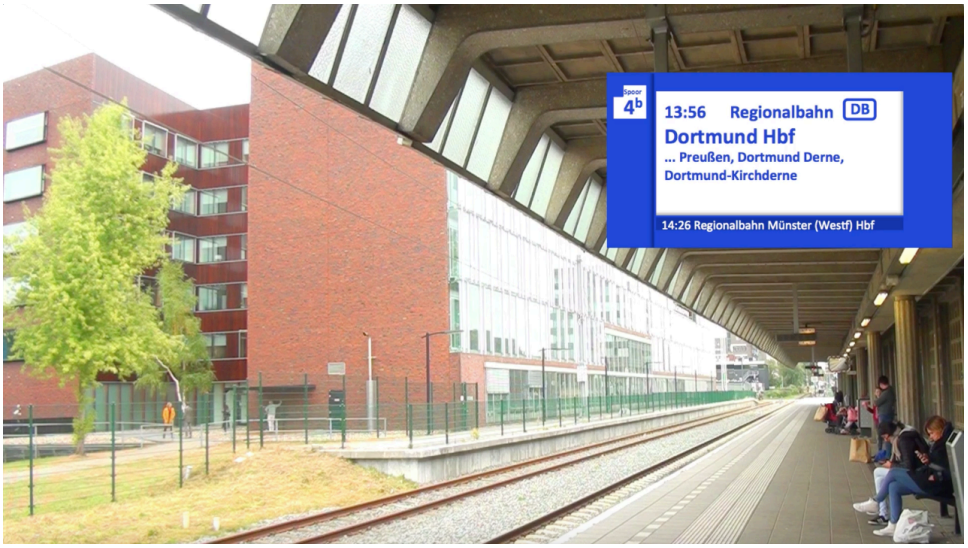

Figure 4: Screenshot of the 3 minutes no bar condition at 1:29 minutes.

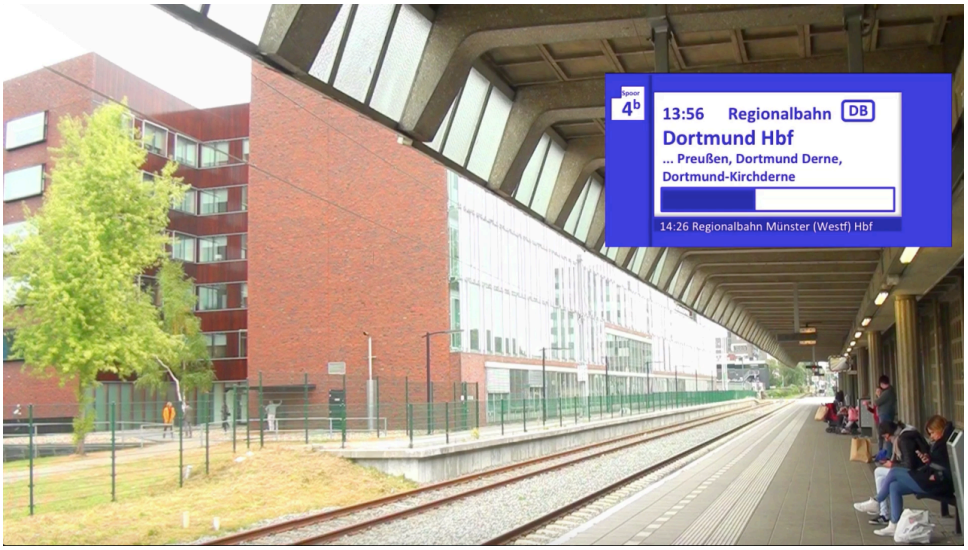

Figure 5: Screenshot of the 3 minutes interval bar condition at 1.29 minutes.

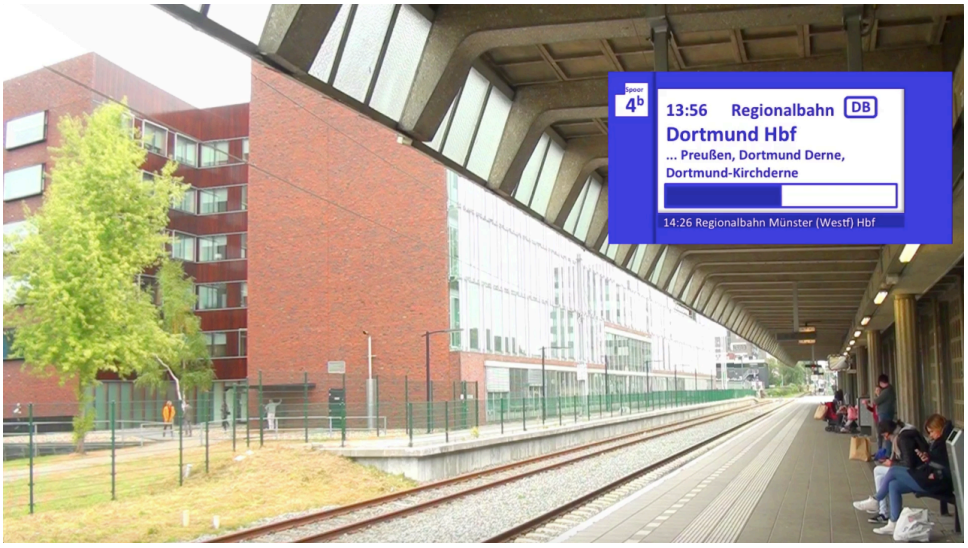

Figure 6: Screenshot of the 3 minutes constant bar condition at 1.29 minutes.

Appendix V – Principal Components Analysis

Items that are blot out were deleted after the Principal Component Analysis..

Table 9: Component 1, affective appraisal of the wait_entertainment (alpha = .83)

RQ3_1_wait_boring
Q3_2_experiencing_wait_as_enjoyable
Q3_4_experiencing_wait_as_interesting
Q3_5_experiencing_wait_as_exciting
~~Q3_7_wait_was_fair~~ (deleted)
~~RQ3_8_wait_was_annoying~~ (deleted)
Q3_9_experiencing_wait_as_pleasant
~~Q3_10_wait_went_by_fast~~ (deleted)

Table 10: Component 2, affective appraisal of the wait_disturbance

RQ3_3_wait_was_stressful
RQ3_6_wait_was_irritating

Table 11: Component 3, perceived uncertainty (alpha = .83)

RQ4_1_unable_to_predict_arrival
Q4_2_control_confidence_predict_train_arrival
Q4_3_control_estimate_time_leave_and_return
~~Q4_4_ability_to_anticipate_wait_made_feel_in_control~~ (deleted)
Q4_5_provided_information_helped_estimate_wait

Table 12: Component 4, appraisal of the provided information_cognitive (alpha = .85)

~~Q6_1_way_info_presented_pleasant~~ (deleted)
Q6_2_way_info_presented_useful
RQ6_3_info_presented_annoying
RQ6_7_info_diff_understand
Q6_8_way_info_presented_precise
Q6_9_way_info_presented_correct
Q6_10_way_info_presented_easy_to_understand
Q6_11_adequately_informed_byRailwayCompany

Table 13: Component 5, appraisal of the provided information_affective (alpha = .72)

Q6_4_info_presented_interesting
RQ6_5_info_presented_boring
Q6_6_info_presented_exciting

Table 14: Component 6, appraisal of the environment_attitude (alpha = .85)

Q7_1_platform_attractive
Q7_2_platform_looked_nice
~~Q7_6_platform_exciting~~ (deleted)
Q7_7_platform_clean
~~Q7_8_platform_spacious~~ (deleted)
Q7_9_platform_nice_atmosphere
RQ7_10_disliked_platform

Table 15: Component 7, appraisal of the environment_crowdedness (alpha = .60)

RQ7_3_platform_busy
Q7_4_platform_quiet
Q7_5_platform_empty

Appendix VI – Analyses of the secondary dependent variables

Table 16: Results of the Kruskal-Wallis ANOVAs testing the effects of progress bar type and waiting time condition on the two components of the affective appraisal of the wait.

Dependent variable	Independent variable	H*	N	df	p-value	η^2	Cohen's f
Affective appraisal of the wait_entertainment	Progress bar type	.69	228	2	.71	.003	.05
	Waiting time condition	13.70	228	2	.001	.06	.25
Affective appraisal of the wait_disturbance	Progress bar type	5.06	228	2	.08	.02	.15
	Waiting time condition	5.44	228	2	.07	.02	.16

*Corrected for ties.
df = Degrees of freedom
η^2 = Partial eta-squared

Table 17: Results of the Mann-Whitney U tests following the Kruskal-Wallis ANOVA testing Affective appraisal of the wait_entertainment*waiting time condition.

Dependent Variable	Waiting time condition	U	z-score*	p-value**
Affective appraisal of the wait_entertainment	3 minutes*6 minutes	2709.00	-.66	.51
	6 minutes*12 minutes	2104.50	-3.01	.003
	12 minutes*3 minutes	1958.00	-3.33	.001

*Corrected for ties.
** Two-tailed.

Table 18: Results of the factorial between groups ANOVAs testing the effects of progress bar type and waiting time condition on the two components of the appraisal of the information.

Dependent variable	Independent variable	n	df	F	p-value*	η^2
Cognitive appraisal of the information	Progress bar type	217	2	8.85	< .001	.07
	Waiting time condition	217	2	3.34	.04	.03
	Progress bar type*waiting time condition	217	4	.57	.68	.01
Affective appraisal of the information	Progress bar type	217	2	6.31	.002	.05
	Waiting time condition	217	2	3.06	.049	.03
	Progress bar type*waiting time condition	217	4	.19	.94	.004

df = Degrees of freedom
η^2 = Partial eta-squared

Table 19: Results of the Post-Hoc analyses using Tukey's HSD for testing which progress bar type and/or waiting time condition differed significantly from each other within the two components of the appraisal of the information.

Dependent variable	Independent variable		p-value of Tukey's HSD
Cognitive appraisal of the information	*Progress bar type*	No bar*interval bar	.97
		Interval bar*constant bar	.001
		Constant bar*no bar	.001
	Waiting time condition	3 minutes*6 minutes	.87
		6 minutes*12 minutes	.04
		12 minutes*3 minutes	.14
Affective appraisal of the information	*Progress bar type*	No bar*interval bar	.06
		Interval bar*constant bar	.44
		Constant bar*no bar	.002
	Waiting time condition	3 minutes*6 minutes	.48
		6minutes*12 minutes	.04
		12 minutes*3 minutes	.42

Table 20: Results of the factorial between groups ANOVAs testing the effects of progress bar type and waiting time condition on the two components of the appraisal of the environment.

Dependent variable	Independent variable	n	df	F	p-value	η^2
Attitude towards the environment	Progress bar type	216	2	1.35	.26	.01
	Waiting time condition	216	2	2.63	.07	.02
	Progress bar type*waiting time condition	216	4	1.27	.28	.02
Crowdedness of the environment	Progress bar type	218	2	4.03	.02	.04
	Waiting time condition	218	2	11.77	< .001	.10
	Progress bar type*waiting time condition	218	4	.72	.58	.01

df = Degrees of freedom
η^2 = Partial eta-squared

Table 21: Results of the Post-Hoc analyses using Tukey's HSD for testing which progress bar type and/or waiting time condition differed significantly from each other concerning the crowdedness of the environment.

Dependent variable	Independent variable		p-value of Tukey's HSD
Crowdedness of the environment	Progress bar type	No bar*interval bar	.14
		Interval bar*constant bar	.68
		Constant bar*no bar	.02
	Waiting time condition	3 minutes*6 minutes	< .001
		6minutes*12 minutes	.996
		12 minutes*3 minutes	< .001

Appendix VII – List of abbreviations

AGT = Attentional Gate Theory

ANOVA = Analysis of Variance

OWT = Objective Waiting Time

PCA = Principal Component Analysis

PI = Progress Indicator

PWT = Perceived Waiting Time