

"How long is forever?"
"Sometimes, just one second."

"Can time be adequately represented by space? - What are we answering: yes, if it is the time elapsed; no, if you talk about time flowing." [Bergson, 2001]

THE EXPERIENCE OF TIME : MAPPING A ROUTE BASED ON DURATION PERCEPTION

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ABSTRACT

Time is intangible, perceivable phenomenon which penetrates every perceptual event. The experience of time is an issue to understand how people perceive time. One of the main issues on time perception is duration. Although measuring duration is possible, perceived duration cannot be measurable with timekeeper or some other tools. Perception is affected by exogenous and endogenous stimulations, so perceived duration cannot be understood without calculating stimulant effects. The aim of this study is understanding how perceived duration is affected by the stimuli (variable). Therefore, an experiment was conducted to execute this aim with measuring the immeasurable. A route which is travelled on minibus as daily routine was chosen to travel, the subject recorded the real time with timer and perceptual time with text. The landmarks which were defined by Kevin Lynch were identified based on perceptual thresholds which are triggered by the exogenous and endogenous variables. The subject collected the measured duration and perceptual data, then mapping these data by using visualization methodologies such as distortion. Analyses were revealed that duration perception can be understandable by using partial effects of the variables.

KEYWORDS: Experience of time, Duration Perception, Route Mapping.

INTRODUCTION

Time is abstract but perceivable notion. Time perception is differentiated from other sensorial experiences. While senses are stimulated by defined sources such as an object, when it comes to time, there are no tangible stimulants, just variables such as attention, arousals, personal conditions which affect the time perception. Pöppel stated that duration estimation which is a fundamental time experience means that using conventional time units (as seconds, minutes, hours) to define elapsed time between two events (Pöppel, 1978). Duration (la'

duration) is a term defined by Henri Bergson, who rejects the definitions of time by mathematics and sciences (Bergson, 2001). He also explained that measure a moment is impossible because, 'it would be gone: one measures an immobile, complete line, whereas time is mobile and incomplete' (Bergson, 2001). According to Wittman & Wassenhove, there is no 'duration object' which can be pointed at as a source, but time can be experienced with its pervasive existence, so the duration is estimated based on a neural clock (may not depend on that) which is influenced by cognitive and emotional factors (Wittmann & Wassenhove, 2009).

The researches on time experience included misconception because the duration cannot be perceived in the way that apple perceived (Pöppel, 1978). Wittmann and Wassenhove explained that '... there exists no sense organ for time perception and, as such, all sensory modalities are possible entries at the interface of physical time with perceptual time.' (Wittmann & Wassenhove, 2009). Bergson's explanations refer to the relativity of the time, he told that time can speed up or slow down, but scientific approaches do not accept that, so he produced his own duration notion as neither a unity nor a quantitative multiplicity (Bergson, 2001). Experienced time which happens in our experiential reality is differentiated from real time which happens in physical reality, measuring this differentiation is one of the main problems. Clark conducted a study by using the psychological theory Stevens' Law which examines perception of stimulus which is affected from the actual stimulus, then he analyzed the traveler's time perception which is compared with the measured travel times (Clark, 1982). Even his methodology can explain the differences between perceived and real time, other variables such as external and internal sources that affects perception cannot included to the model.

'A route' includes both the geographical line and the timeline, so the duration (refers to Bergson's definition) and the perception is an elementary thing when a route is a matter. In this study, time experience of a route was analyzed to understand duration perception with the internal and external variables' interference by using mapping methodology for visualizing the real travel time and perceived time. Experienced time of a route had been measured based on the variables created by sensorial thresholds which affect the chosen landmarks. Duration perception was measured with an experiment that the subject's daily observations by recording the route, on herself. The subject used a timekeeper to record the real time, and also recorded the perceived time with her personal note charts. She chose some landmarks based on sensorial thresholds, so she can compare the differences between the variables by their duration perception. Then these data are used for creating the multi-layered mapping visualization to understand how perception has affected by the variable changes.

This article had four parts. First, it reviewed the literature relevant to time perception. Second part is overviewed mapping methodology studies. Third, the collected data of the subject

was examined. At last, the article concluded with the discussions of methodological approaches on time experience and how can it measured with multi-layered mapping.

EXPERIENCE OF TIME

Time is experienced and perceivable notion. According to Gallagher, the experience of time is based on cognitive functions which are memory and expectation (Dyke & Bardon, 2013). Hernandez explained that Augustine who is one of the first philosophers researched on nature of time, developed two time approaches that the first one is time is subjective matter which happened in human consciousness and the second one is time exists before human consciousness (Hernandez, 2016). As Gallagher cited that Augustine created the idea of 'mental space' where storage of images, impressions or the present moment with the sign of the past and possible future projections (Augustine Conf. XI. 27) (Dyke & Bardon, 2013). The events can be perceivable when they are past because the brain process cannot catch the light and sound speed, although this cannot explain the most compelling aspect of experiencing the present that it is continually changing (Le Poidevin, 2015).

According to Pöppel, there are five elementary time experiences which are duration, non-simultaneity, order, past and present, and change (Pöppel, 1978). He explained that duration estimation (perceptual duration) which means the ability to estimation of how much time elapsed between events, is one elementary time experience (Pöppel, 1978) (Fig. 1). The real time can be measured, but perceived time means that the subject needs to estimate the duration with their mental process. Massey quoted Heidegger '...one point of time differs from the preceding one only in that it follows after it, it is possible to measure time and thereby motion. As soon as time is measured—and only as time that is measurable and to be measured does it have a meaningful function in physics—we determine a 'so many'.' (Massey, 2015). Heidegger's discourse supports the idea of time experience cannot be measured as physical time.

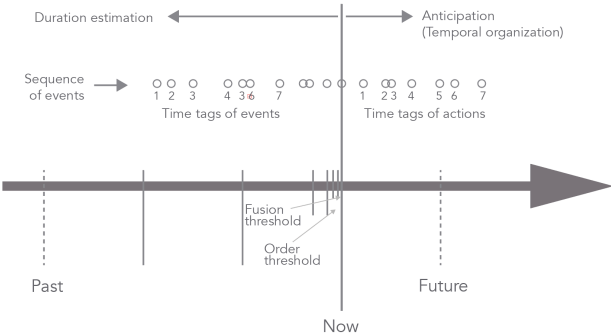


Figure 1. Duration estimation diagram (Pöppel, 1978).

Phenomenological approach proposes time-consciousness which includes perception, memory, expectation, imagination, habituation, self-awareness, and self-identity as the central point of time experience researches (Kelly, 2001). Kelly also pointed at that phenomenology does not investigate time-motion relation as Aristotle, past and future moments' psychological aspects and boundless cognitive assumption about mental construction of time as Kant (Kelly, 2001). Bergson is re-stating the problem of perception in terms of images because it seems to be an intermediate position between realism and idealism (Bergson, 1988). For Bergson, the image is less than a thing but more than a representation. The 'more' and the 'less' indicates that representation differs from the image by degree. It also indicates that perception is continuous with images of matter. Through the hypothesis of the image, Bergson is re-attaching perception to the real (Bergson, 1988).

Language can be way of representation for the expressing the perception. Heidegger explains the discourse of 'Language is the house of being (refers to *dasein* which is 'the subject' for this study)' (Heidegger, 1927). This study offers the usage of language to representation of duration perception.

MAPPING THE ROUTE

Map is defined in the dictionary as 'a representation usually on a flat surface of the whole or a part of an area' (URL-1). The dictionary also mentioned that a map is 'a diagram or other visual representation that shows the relative position of the parts of something' (URL-1). Creating maps means not only creating traces of either a reference's location at the planet but also, a notion's image in our mind or the senses' perceptual traces could be counted as one of the forms of the mapping.

Route is defined in the dictionary as 'a traveled way' (URL-2). People do not think or imagine the routes as only maps, locations or traveled ways. They create personal experiences with the routes, but in our world, GIS (Geographic Information Systems) and navigation technologies are developed only with the 3-dimensional aspects. These systems do not allow the user to activate their imaginations. As Barthes explained that in Japan there are no addresses only postal values which a postman knows where the location is (Barthes, 1989). He mentioned that they draw sketches to express the location, then 'one can figure out the address by a (written or printed) schema of orientation, a kind of geographical summary which situates the domicile starting from a known landmark, a train station, for instance' (Barthes, 1989). Therefore, a map is not just a geographical information, it is also the image of personal experiences. 'A route' includes both the geographical line and the timeline, so the duration and the perception is a fundamental thing when a route is a matter.

Claudel, Nigel, and Latti cited Robinson that 'flow map' defined as "an established cartographic method to depict movements over time and space" (Claudel, Nagel, & Latti, 2016). They produced their own flow map with the geospatial infographic which is different from traditional cartography by its information layers that creates substantial possibilities (Claudel, Nagel, & Latti, 2016). Kloeckl, Senn, and Ratti collected data from the taxis in Singapore, then they visualize the map based on the traffic with a distortion method (Kloeckl, Senn, & Ratti, 2012). The map of Singapore (island) has been distorted by the traffic, so "If traffic is slow and travel time is long, the island grows larger while with fast traffic and shorter travel time, the island shrinks. Different areas distort differently reflecting the specific travel time to these destinations at a given time" (Kloeckl, Senn, & Ratti, 2012). This methodology is applied to the study while visualizing the perceptual duration dataset.

DATA COLLECTION

The experiment was conducted on the subject which Heidegger defined as '*dasein*' (German word means 'being there') which is described as the self-consciousness of the being (Heidegger, 1927). As Bolt cited Heidegger explained that 'our world-in-our-day-experience' should be our starting point (Bolt, 2013). The experiment was to measure the subject's duration perception of the route which was taken on minibus from Çeliktepe to Sütlüce (Fig. 1). The route was experienced as a daily routine for the subject starting from the home ended at the workplace. This was a daily journey which included its own fantastical features such as police chasing, following non-route paths and not obeying the traffic rules, carrying overload count of passenger. These features had effects on the duration perception of this route.

In the mind of the subject, the reality of the route was matched and layered with not only its' navigational/geographical imaging but also sensorial stimulations during travel which is caused by external and internal sources. Personal experiences were generated based on the variables which are triggered with sensorial thresholds. Variables which affected the duration perception were diverged into exogenous variables and endogenous variables. Exogenous variables are result from external sources which are traffic jam, weather, road conditions, traffic lights, crowd at minibus, smell inside minibus, being seated or not seated. Endogenous variables are arose from internal sources the subject's psychological condition (mood), packs, and being late. This study was defined the 'Threshold' notion as the moment person creates the awareness of the variables that stimulate the senses.

As Lynch explained that 'the landmarks' are chosen by the observer as the point references which are external to the observer as basic environmental components (Lynch, 1990). The duration perception of the route measured based on the landmarks which are located through the sensorial threshold points. The subject chose the landmarks based on perceptual

thresholds. These landmarks are 'the first turn' which is the point of first right turn (1st Landmark), 'the crossroad' the point that connects with main arterial road (2nd Landmark), 'the gas station' after long traffic jam which also is a turning point (3rd Landmark), the 4th Landmark where 'metro construction' ended, 'elevated highway' (5th Landmark), 'underground way' (6th Landmark) (Fig. 2). The experiment showed that 'the turning' was a moment the subject being aware of the locational information.

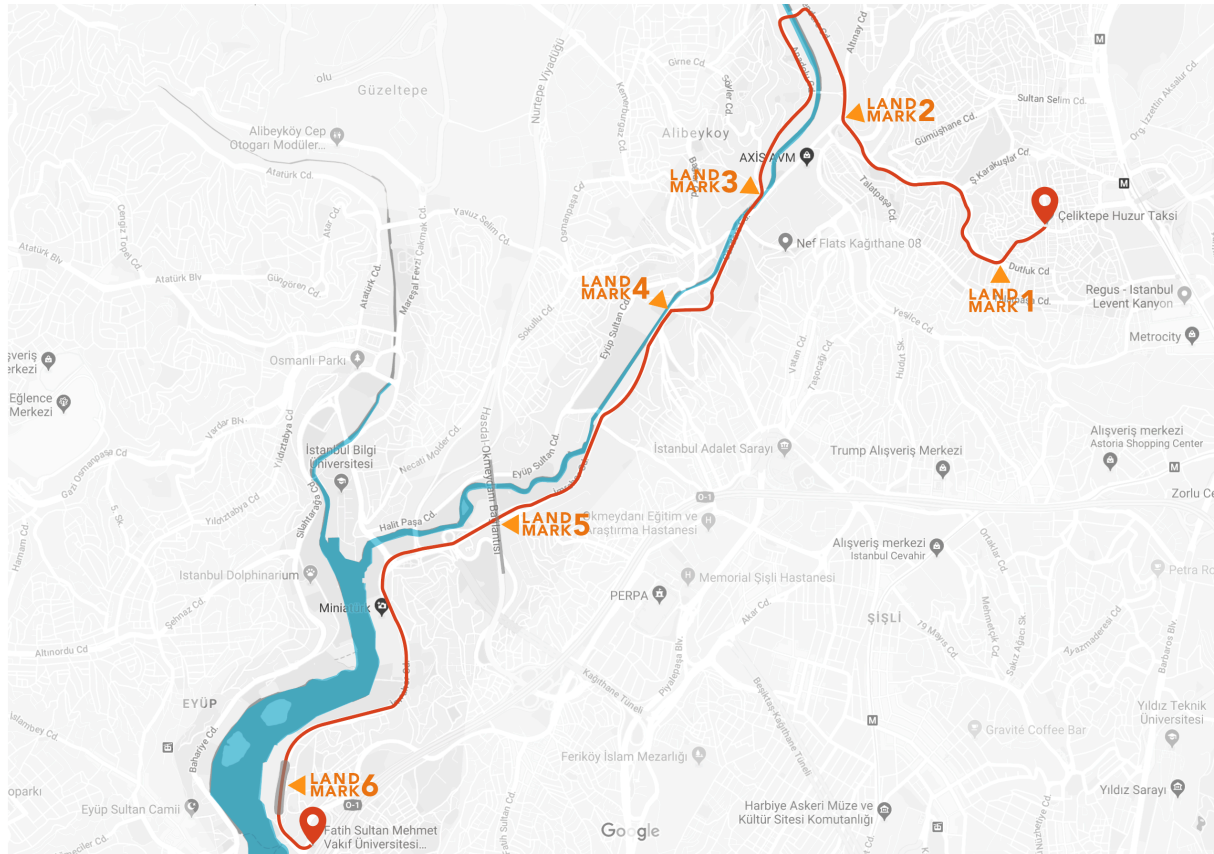


Figure 2. The experienced route with the landmarks on the map.

The dataset was collected for ten days with different circumstances such as different times that allows the various variables included the perception. The subject measured the real time while travelling and noted perceived time which is defined as an adjective of the sense. Measured time and perceived time were visualized with the variable effects. While measured times were ranged between twenty to thirty-five minutes at total route, perceived time was described as USUAL, LONG, EXTREME LONG, FAST, SLOW, DIFFERENT. Language which is a tool for Heidegger's being (dasein) who needs for defining emotions and situations, that creates awareness of subjective and instant experiences. The moment (i.e. the instant experience) is embodied with the use of language. The subject was defined the duration perception with words to embody the experience.

Data visualization was used for explaining the perception clearly. Therefore, representations of perceptual map included visual hierarchy based on importance of data and the variables

are showed as multipliers based on their contribution at that day (Fig. 3). These multiplier contributions are calculated as positive and negative influence on the duration perception. If the variable affects the duration to the long direction, the multiplier of the variable has positive value with higher number (between 1-5). However if the variable created the duration perception to the fast direction, the multiplier value becomes negative number between (-1/-5). When the variable had no effect on the duration perception, it counted as multiplier '1'.

DAYS	MEASURED TIME	PERCEIVED TIME	EXOGENOUS VARIABLES					ENDOGENOUS VARIABLES				
			TRAFFIC	R O A D CONDITIONS	WEATHER	CROWD SEATED / NOT SEATED	SMELL	BEING L A T E	PACK	PSYCHOLOGICAL CONDITION		
										WORKLOAD	INSOMNIA	EMOTIONS
1	20' <small>TWENTY MINUTES</small>	USUAL	-2	1	1	-2 <small>SEATED</small>	1	1	1	2	1	1
2	35' <small>THIRTY-FIVE MINUTES</small>	EXTREME L O N G	5	2	3 <small>RAINY</small>	3 <small>NOT SEATED</small>	2	3	2	2	1	5 <small>UNCOMFORTABLE</small>
3	23' <small>TWENTY-THREE MINUTES</small>	USUAL	1	1	1	1 <small>SEATED</small>	1	1	1	1	1	1
4	20' <small>TWENTY MINUTES</small>	DIFFERENT	-3	1	1	2 <small>NOT SEATED</small>	1	1	1	1	1	-2 <small>COMFORTABLE</small>
5	27' <small>TWENTY-SEVEN MINUTES</small>	LONG	5	2	1	1 <small>SEATED</small>	1	3	1	3	1	1
6	28' <small>TWENTY-EIGHT MINUTES</small>	EXTREME L O N G	4	1	2 <small>RAINY</small>	1 <small>SEATED</small>	1	1	1	1	4	1
7	24' <small>TWENTY-FOUR MINUTES</small>	USUAL	1	1	1	3 <small>NOT SEATED</small>	1	2	1	1	1	1
8	23' <small>TWENTY-THREE MINUTES</small>	LONG	4	1	1	1 <small>SEATED</small>	2	1	2	1	2	1
9	21' <small>TWENTY-ONE MINUTES</small>	USUAL	-2	1	1	2 <small>NOT SEATED</small>	1	1	1	1	1	1
10	22' <small>TWENTY-TWO MINUTES</small>	FAST	-5	1	-2 <small>SUNNY</small>	2 <small>NOT SEATED</small>	1	1	1	1	1	-2 <small>COMFORTABLE</small>

Figure 3. Data chart of measured and perceived data with variables as multipliers.

For the first day, measured time was twenty minutes and perceived time was defined as USUAL. When the variables were examined, traffic and crowd affected the duration perception decreased way (Fig. 3). However the heavy workload caused slower feeling. Second day, thirty-five minutes was measured and EXTREME LONG was defined to perception. Traffic, uncomfortable feeling, rainy weather, being not seated, heavy workload and packs affected the subject negatively, then that negativity created longest travel ever (Fig. 3). The records of the third day revealed that it is ordinary day with no variable. Fourth day showed that emotional conditions as variables can affect the perception. Then the fifth day and comparing the days between each other, traffic had high ratio on the duration perception. Measurements on the sixth day indicated that insomnia and traffic enlarged the perceived duration. Seventh day revealed that being seated or not seated had minimal effect. For eighth day, even if the measured time was short, traffic, insomnia, packs and smell had major effect on the perceptual time. The data of the day nine occurred that seated-not seated

variable had importance with the traffic. On the last day, traffic, emotions and good weather created fast impression.

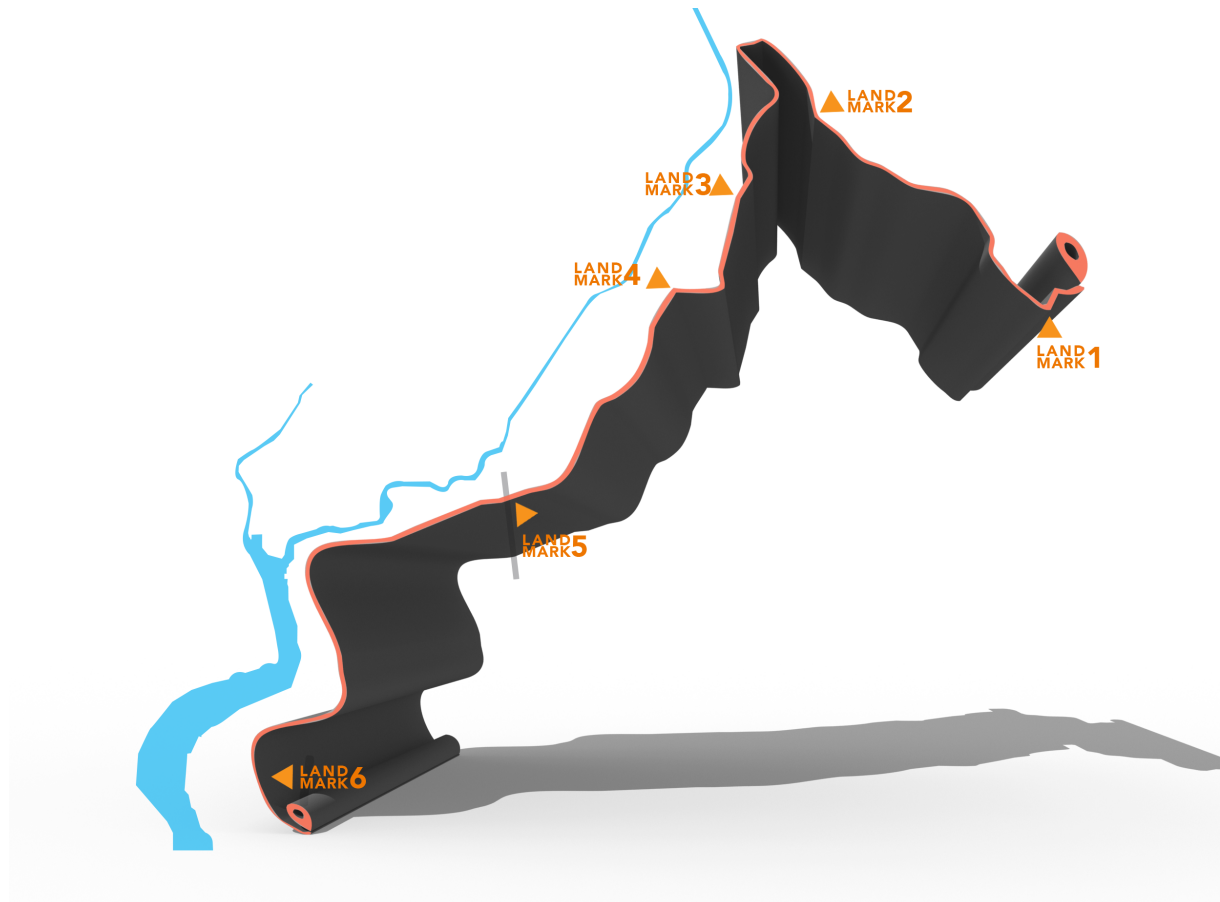


Figure 4. Distorted and extruded 3D route to represent the difference between real duration and perceptual duration.

In the end, all the dataset revealed that perceptual duration does not have to match with the measured duration. The experiment revealed that even if the duration perception cannot be measured, stretching and shortening effects which occur around the stimulations from the variables can be predictable. The route map was visualized to represent the difference between measured and perceived duration (Fig. 4). Stretched paths are the representation of longer duration perception than measured real time, so shortened paths are the expression of shorter perceived duration than reality.

CONCLUSION

Understanding duration perception of the route as experience of time was aim of this study. According to reach that goal an experiment which measured the real duration with a timer and its reflection on the subject's mind as duration perception was conducted. The data was collected for ten days on different times. While a timer was used for real time calculations,

textual definitions are recorded for perceptual duration and the variable multipliers were defined (positive or negative direction with the number). Then the datasets were analyzed. Analyzes were revealed that duration perception can be understandable by using partial effects of the variables. Therefore, firstly all the exogenous and endogenous variables are needed to specify. Then, if the negativity and positivity with the multiplier value can be determined, it can be presumable that how duration perception can be affected.

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