

# EURASIAN JOURNAL OF BUSINESS AND MANAGEMENT

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## TEMPORAL AND SPATIAL PERCEPTION IN PURCHASE CHOICE

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Received: March 10, 2021

Accepted: May 18, 2021

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### Abstract

Time and space are thoroughly interlinked, not only in human perception, but in everyday life. While it may still be unclear where the time and distance perception originates and what function can be assigned to their relationship, the behavioral point of view demonstrates enough evidence of similar patterns. The aim of this research is to make another step in the direction of connecting those constructs and offer a research example with application. The objective of this research is to examine time and distance preferences in purchase situations where additional unit of time or distance saves respondent's money, and to offer a research example with application in consumer choice. Two sets of survey data of responses to hypothetical situations enable response examination. Descriptive statistical analysis is followed with the cluster analysis, multidimensional scaling and unfolding, and nonparametric tests. The results are discussed in terms of possible extension of the intertemporal choice terminology and findings to the spatio-temporal context. The findings indicate dominant susceptibility to discount amount, but also reveal similarity in responses involving the time and space distances at the similar construal level. Practical implications indicate possibility for application of space and time interchangeably in discount management, which might enable higher flexibility in the supply and decrease the customer clustering on the discount days.

**Keywords:** Time-Distance, Space-Distance, Decision-Making, Spatio-Temporal Choice, Consumer Choice

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### 1. Introduction

Given the relevance of the decision-making at individual, micro and macroeconomic level, it is not surprising that huge research interest arose about defining decision-making processes, outcomes, and errors. While a part of the research deals with regularities in decision-making, there is also a part that investigates regularities in mistakes (deviations from optimal outcome) in decision-making process. The practical implications find their impact mainly in personal and business economics, as well as health, but represent guidelines for individual behavior in many aspects of life.

A specific topic in the field of behavioral aspects of decision-making represents the intertemporal choice. The aim for most of the intertemporal choice research is to examine how individuals perceive value, decisions and consequences over time and what processes does that

kind of judgment and choices include. According to Berns *et al.* (2007), intertemporal choice is decision with consequences that play over time. Decisions that involve time usually carry intuition of time sensitivity, which denotes the variations of value given the variations of time (Ebert and Prelec, 2007). While making intertemporal choices, people tend to demonstrate time inconsistencies, which Loewenstein (1987) explains as a phenomenon that occurs when individuals plan for the future, but systematically depart from that plan. Huge part of the research is devoted to determining the influences and effects on decision-making in choices that influence time, where some of them refer to external influences and applied methodologies, while other describe the internal decision-making processes. Those findings describe actual behavior related to intertemporal choice better than classical theories and utility function representation, and some of the findings extend to other areas of decision-making. One of such areas is the space (as a distance).

Time and space are thoroughly interlinked, not only in human perception, but in everyday life. It is possible for time to pass while a person remains on one location, but it is not possible to cross a spatial distance without the time laps (at least, not yet). Tuan (1979) defines distance as a spatio-temporal intuition that implies both *here* and *now*, and *there* and *then* and argues that distant places are remote both in space and in time and could be perceived as remote in the past or in the future.

The previous research connecting the spatial and temporal sensitivity mostly refers to psychological and neurological approach and its goal is to determine the relation and its origin, as Bonato *et al.* (2012) demonstrate in their extensive overview. Trope and Liberman (2003) explain construal level theory as theory that allows unified approach to psychological distances, and Trope and Liberman (2010) find that various distances are cognitively related to each other and interchangeable to some extent. Based on three conducted experiments, Robinson *et al.* (2019) find the relation of the space and time, where spatial perception depends on the temporal information, while time can be evaluated independently. The overall research of the topic is scarce in comparison to intertemporal choice. The applied research mostly treats temporal and spatial distances separately, while applied research involving examination of spatio-temporal approach is still rare. While it may still be unclear where the time and distance perception and duration perception originates and what function can be assigned to their relationship, the behavioral point of view (response analysis) demonstrates indication of similar patterns.

The purpose of this research is to make another step in the direction of connecting those constructs and offer a research example. The objective of this research is to explore time and distance preferences in purchase situations where additional unit of time or distance saves respondent's money. That is achieved using the survey data of responses regarding hypothetical situations from two studies. The first survey was conducted in 2017 on the first-year students. The second survey was conducted in 2019 on convenience sample of broader population. The analysis objective is response examination. Descriptive analysis is followed with the cluster analysis, multidimensional scaling, and nonparametric tests. Given that intertemporal choice has stronger theoretical base, the results are discussed in terms of possible extension of the intertemporal choice terminology and findings to the spatial and spatio-temporal context. The findings indicate dominant susceptibility to discount amount, but also reveal similarity in responses involving the time and space distances at the similar construal level.

The article is organized as follows: Section 2 presents literature review that offers conceptual framework based on overview of intertemporal choice, space distances and spatio-temporal distances and choices. After conceptual framework, Section 3 proceeds to methods. Section 4 presents the results and discussion and finally, Section 5 concludes the paper by summarizing the findings with limitations and suggestions for future research.

## 2. Literature review

The most used framework for representation of choice and outcome preferences are indifference curves and utility function, but a growing area of research finds inconsistencies in that framework when it is applied to real-life situations. While classical framework implies individuals' rationality, behavioral framework strives to determine actual reasons for individuals' decisions and behavior.

To determine those reasons, an interdisciplinary approach is necessary with an emphasis on psychological insights.

## 2.1. Time distances and choices

Intertemporal choice regards to how people make decisions in situations where time plays a role. Such research deals with the problems of immediate vs. delayed consumption, often regarding the problem of amounts assessment and discount rates; the problem of perception of the time and time-sensitivity; consistency of preferences and choices over time; consistency of discount rates over time; self-control; and behavioral regularities and deviations from optimal choice that enable explanation for people's behavior. Such research sheds light on the effects on intertemporal choices, where some derive from the applied methodology and others reveal psychological traits that condition the outcomes.

Most noted effects induced by the methodology are framing effect and multi-attribute choice representation. Roelofsma and Read (2000) distinguish alternative based and attribute based multi-attribute choice. Lempert and Phelps (2016) distinct framing effects as the way that elicit intertemporal preferences influences intertemporal choice. That means that diverting or allocating attention to a certain reference point or attributes influences the individual's choices. The extension of the framing effects refers to attention to attributes where a positive or negative word (attribute) might influence the choice. Attributes may indicate reward magnitude that may lead to default validation of the choices according to Ebert and Prelec (2007). Chabris *et al.* (2010) provide an overview of possible confounds for measurement of discount rates in laboratory studies, where unreliability of future rewards, transaction costs, hypothetical rewards, investment versus consumption, consumption versus receipt, curvature of utility function and demand characteristics may play a role in individuals' assessments. According to Ebert and Prelec (2007) people usually underweight duration of the event, which enables context influence on the time sensitivity involving decisions.

The aim of the other part of the intertemporal choice research is to examine how individuals perceive value, decisions and consequences over time and what processes does that kind of judgment and choice include. Read (2003) examines preference reversal in intertemporal choice and finds that the preference reversal occurs in a point of time, causing a change in the choices before and after occurrence. Zauberman and Kim (2011) find that individuals perceive time in a non-linear way. There is evidence that individuals' value discounting over time follows hyperbolic, quasi-hyperbolic or (rarely) exponential function (Ainslie and Haslam, 1992; Chabris *et al.* 2010; Cohen *et al.* 2016; Laibson, 1997; Ericson and Fuster, 2011; Harris and Laibson, 2001; Read, 2001; Thaler, 1981). Rubinstein (2000) uses decision-making procedure based on similarity relations, and Takahashi and Han (2012) propose tempospect theory as the alternative. All the stated approaches deal with the long-run optimization and short-term temptation (Fudenberg and Levine, 2006; Benhabib and Bisin, 2005; Ericson and Laibson, 2018). As opposed to quantitative approximations of peoples' calculations, assessments, and choices, O'Curry (1999) refers to it as mental accounting. Ebert and Prelec (2007, p. 1424) sum up the previous research and conclude that "people commonly underweight or even ignore the duration of an event in their evaluation of its total utility (...) where evaluations are made either in retrospect or in prospect".

Laibson *et al.* (2004) estimate time preferences of consumption choices and find that the long-term discount rate is much smaller (4.3%) than short-term discount rate (39.5%), which explains excess sensitivity to consumption and levels of borrowing. Loewenstein and Thaler (1989) find that people are sensitive to relative differences in money amounts, but according to Loewenstein and Prelec (1989) also to absolute differences over the time.

While a part of the research assumes stable tendencies toward being impulsive or patient, Lempert and Phelps (2016) provide an overview that shows malleability of intertemporal choice. They refer to smaller and sooner rewards as to impulsivity, and the delay of the reward (larger and later) is referred as a patience. Carvalho *et al.* (2016) refer to the delay of the reward as a willingness to delay gratification, where waiting time is inversely proportional to impatience waiting

time. According to Prelec and Loewenstein (1991), immediacy effect occurs when people delay consumption that would otherwise be immediate and consequently, over-discounting occurs.

According to Prelec and Loewenstein (1998), pain of paying denotes negative emotions that people experience when they must pay a certain amount. They find it to be a proxy for a consideration of opportunity costs, and it is expected to be bigger as the amount rises. Lempert and Phelps (2016) distinguish spendthrift and tightwad types in decision making regarding the spending. First type will spend due to their hedonistic urges, while the second ones' approach is utilitarian way to money spending. They found that the diminishing pain of paying reduces the differences between the types, causing the tightwads to behave more like spendthrifts. Ericson and Laibson (2018) refer to impatience as a present-focused preference. They also propose the idea that shifting individual's perception to future events can lead to more patience if those future events are framed to appear more concrete or easier to imagine.

Practical implications of the intertemporal choice relate to applications in personal and business economics, especially in financial decision-making, management, and consumer behavior. Griffith *et al.* (2009) research consumer shopping behavior in a situation where consumer decides based on several alternatives. They argue that the choices depend on preferences and costs, such as special price differences and transport costs, and quantities and storage costs. Alreck and Settle (2002) examined the time saving perceptions for the use of catalogue and online purchase and found that those kinds of purchase are perceived as a time saving. Nevertheless, the respondents only rarely reported those methods of purchase to save time. That creates the inconsistency between reported time-saving preference and self-reported behavior that needs to be additionally explored.

## **2.2. Space distances and choices**

Tversky (2003) provides an overview of perceived space regarding the mental representations that people form, which differ from external representations (maps, geography, etc.). The author divides the space as a space of the body, space around the body, the space of navigation and space of the graphics. The author found that the perception of navigational space is perceived in two – dimensional way, and that people make systematic mistakes in judgement of remembered spaces. Those mistakes are rotation and alignment, which show that individuals create their own representations (cognitive collage) based on the reference frame and perspective. Tversky (2005) offers an overview of possible misrepresentations of space and distances. Plumert and Spencer (2007) provide an overview that shows that spatial assessment and recollection vary over time. Dopkins and Gayler (2018, p. 130) examine ability to determine distance, and ask subjects to observe distance between two points of two objects and find that “the horizontal distance between the test circles was imperfectly extracted from the overall distance between them”, which means that the classification is made based on overall distance.

Some practical applications of spatial distances are applied to tourism, trade, investment, and consumer behavior. Lewicka (2008, p. 211) examines memory of places, using the terms place attachment and place identity and examines the place, as “the core concept in environmental psychology”. Moreover, for VanHorn (2020), temporal distance can also be observed from evolutionary perspective. VanHorn (2020) combines spatial and temporal dimension in created scenarios of travelling or going to places, with survival issue, high and low effort and find evidence for survival perceived temporal distance effect. Maguire and Klinkenberg (2018) found notable differences of place attachment between groups given the spatial distribution of place. Rangan and Lawrence (1999) examine home bias effects, as an extension of familiarity bias, and find that the firms will be more likely to choose familiar business partner. Hidalgo and Hernandez (2001) measured place attachment within house, neighborhood, and city spatial dimension, as well as physical and social dimensions and found that the neighborhood attachment is the weakest, and the social attachment is higher than physical attachment.

Nicolau and Mas (2006, p. 990) find that spatial dimension has important role in the choice of tourist destination, and that “motivations moderate the effects of distance and prices in the choice of tourist destinations”.

Hegde and Suresh (2017) analyzed consumer behavior and found that customer's resident location is relevant and that customers usually travel 1- 5 km to perform the purchase of frequent item sets. Bordalo *et al.* (2017) examined customers' sensitivity to price at different locations and find location to be a relevant context factor, but it does not change the predictions only with the time factor. They distinguish situation-specific adaptation (history should influence reference price equally at all locations) and adaptive reference point (price-sensitivity should be same at any location). They learn that after repetitive behavior, a choice behavior becomes stable in each location.

### **2.3. Spatio-temporal distances and choices**

Tuan (1979) defines distance as a spatio-temporal intuition, that implies both *here* and *now*, and *there* and *then* and argues that distant places are remote both in space and time and could be perceived as remote in the past or in the future. According to Tuan (1979, p. 399), "the analysis of spatial experience seems to require the usage of time categories. This is because our awareness of the spatial relations of objects is never limited to the perception of the objects themselves". Trope (2004) offers Construal level theory that the same information is construed at a higher level when the information pertains to distant-future events than when it pertains to near-future events, which means that the distant event is perceived in more abstract way. That leads to conclusion that the value perceived in distant-future will be enhanced with the temporal distance, while the value associated with near-future events diminishes with temporal distance (meaning, that people will evaluate events differently at their occurrence and in retrospective). Fujita *et al.* (2006) propose that spatial distance is a dimension of psychological distance with similar effects on the representation of social objects and events. They connect the Construal level theory to spatial dimensions and find that spatially distant events are associated with abstract presentation, just as distant-future events. They argue that spatial distance can be conceptualized as psychological distance. Trope and Liberman (2010) examine psychological distance from various aspects and its applications. They also review some aspects of intertemporal choice from a perspective of construal level theory and conclude that the outcome is more attractive in the near future if it is more positive than its high-level value, thus showing the augmentation. They also compare spatial distance research to decision-making research. Trope and Liberman (2010) find that various distances are cognitively related to each other; the various distances influence and are influenced by level of mental construal; and that the various distances are, to some extent, interchangeable in their effects on prediction, preference, and self-control. According to Maglio (2020, p. 2), basic construal level theory consensus is "that people see and act on things in a systematically different way depending on whether those things are or simply seem psychologically close or far". Maglio (2020) suggests that psychological distances can be observed independently from construal level theory, and that there are overlaps and interplay between spatial, temporal, probabilistic and social distance.

Bonato *et al.* (2012) provide extensive overview of the time and space interconnection. They examine and compare evidence for main approaches to the topic: Mental Time Line, Spatial Numerical Association of Response Code (Dehaene *et al.* 1993) and A Theory of Magnitude (Walsh, 2003). A Mental Time Line (MTL) refers to the idea of spatial representation of the time flow (such as in timeline graphical representations, where "short temporal durations (are) associated with left space and long temporal durations associated with right space", Bonato *et al.* 2012, p. 2259). Spatial Numerical Association of Response Code (SNARC) involves numerical representation, and its index refers to "faster responses to relatively small numbers with the effector that operates on the left side of space and faster responses to relatively large numbers with the operator that operates in the right side of space" (Bonato *et al.* 2012, p. 2260). A Theory of Magnitude (ATOM) combines time-space-number processing and represents a common system for magnitude processing (Bonato *et al.* 2012). However, a context issue rises regarding the framing the situations, where authors discuss the linguistic properties (as tenses), cultural influences and units. Their overview points out that "number-time interaction was shown to be influenced by framing the numerical magnitudes in specific context, as for instance a measure of weight" (Bonato *et al.* 2012, p. 2267). While linguistic properties may cause the shift in spatial

attention, the cultural influence was discarded by some previous research of infants and animals. They find that if a temporal task involves a spatial aspect, time-space interactions emerge. Those interactions can manifest "in the form of lateralized response keys or in the form of a spatial lateralization of the target" (Bonato *et al.* 2012, p. 2261). The authors also point out that a due attention must be dedicated to the distinction between process and response examination, as well as differences between *small vs long* durations or *past vs future* temporal positioning.

According to Robinson *et al.* (2019, p. 3), "the perception of space is dependent on temporal information, but the perception of time can be evaluated without spatial information". Robinson *et al.* (2019) conduct three experiments in virtual reality, examining respondents' choices of reward regarding the distance and variations in speed. They also noted the effects of delay and effort, where spatial distances involve cognitive and physical effort. Their motivation is to disentangle spatial from temporal discounting and they removed the influence of physical effort to achieve their goal. They learned that "subjects were more heavily influenced by the time to reach a reward than the distance" and the "influence of these two dimensions was negatively correlated between the subjects, such that a high influence of one dimension led to lower influence of the other" (Robinson *et al.* 2019, p. 219). As they revealed strong individual differences, they offer an explanation that those differences may arise from personality traits.

Jafarpour and Spiers (2017) examine the nature of mental representation of time and space using sketch-maps and learn that "estimates for sketched space were expanded with familiarity, estimates of the time to travel through the space were contracted with familiarity" (p. 12). It seems as if the respondents zoom-in the familiar space, while the travel through familiar space seems faster. As familiarity forms through experience, the revealed relationship involves memory and recollection. Isaacs (2001, p. 120) examined the relation between the time and distance in urban places and assumes that there is a relation between the subjective time and subjective distance and the research reveals that "spatial features in the urban environment influence individuals' perceptions of time".

The previous research connecting the spatial and temporal sensitivity mostly refers to psychological and neurological approach and its goal is to determine the relation and its origin. The overall research of the topic is scarce (especially compared to intertemporal choice), applied research mostly treats temporal and spatial distances separately, while applied research involving direct examination of spatio-temporal approach is rare. However, the possible similar pattern is assumed or, as Maglio (2020) summarizes the underlying thought on distances, every distance facilitates distancing from *here* and *now*.

### 3. Methods

#### 3.1. Prerequisites for Spatio-temporal Examination

While it may still be unclear where the time and distance perception originates, the behavioral point of view demonstrates enough evidence of similar patterns, especially regarding the responses. Therefore, it can be assumed that the commodity choices will demonstrate similar underlying perception of time and space.

As the literature overview points out, it is necessary to define time concept (past vs future), time duration (brief vs long; concrete vs abstract), spatial concept (close vs far), as well as the time and space relation. It can be noticed that there are different approaches in defining the time-space relation: time can be evaluated without the space, space can be evaluated as time (temporal representation of space), and time can be evaluated as space (spatial representation of time).

The relation between the time, space and numbers, allows for assumption that numerical representation is appropriate. Contextual framing of the numerical magnitude can be done by usual measurement units.

Given the presented task, the respondents may experience cognitive and physical effort, where first denotes judgement process and the later energetic effort of crossing the distance, and/or waiting or return. Those efforts should be either accounted for in the research or discussed in the findings.

As the overview of the intertemporal choice reveals, the task can be framed as an earning (reward), a savings or losing (usually when examining risk preferences) issue, while the discounts can be fixed or relative. While current research in spatial sensitivity does not point out to high influence of the framing effect (besides the measurement units), the temporal sensitivity to framing is well documented. As both temporal and spatial sensitivity is involved, the task should be carefully designed to minimize the framing effect. Relying on the existing evidence for the relation of the temporal and spatial discounting, it can be assumed that the respondents would exhibit similar choices regarding the concreteness and abstractness of the choices, where the similarity would occur between *closer* and *sooner* options, as well as between *farther* and *later*. If such relation occurs, it can be additionally examined if the documented heuristics and biases from intertemporal choice extend to the spatio-temporal choices.

Based on the conceptual framework, it is expected that the analysis will reveal:

- similar choice patterns regarding the discount sensitivity,
- similar choice patterns regarding the concreteness and abstractness of spatio-temporal dimension,
- groups of respondents based on their discount sensitivity and spatio-temporal preferences.

### 3.2. The questionnaire compilation

The goal is to examine time and distance preferences and their patterns in purchase situations where additional unit of time or distance saves respondent's money, thereby a set of hypothetical situations/ questions with unimodal choices (same object of choice now or later) were created and offered to respondents for assessment.

Haghani and Sarvi (2018) examined hypothetical and realistic settings influence on results analysis. They found that "choice elicitation outcomes are reasonably consistent between the hypothetical and realistic settings" (p. 361). They found that models performed very similar in respect to predictions and prediction errors. According to Chabris *et al.* (2008), hypothetical rewards might influence measurement of discounting rates, because respondents might not reveal their true preferences when asked about hypothetical situations. Authors also refer to Johnson and Bickel (2002) and Madden *et al.* (2003) comparison of hypothetical to real choices, and their findings that the difference does not arise in practice. Given that relatively small difference is found in responses and estimators for hypothetical versus realistic setting, a questionnaire of hypothetical questions is chosen for this research. For an exploratory analysis such as this one, a hypothetical setting is an appropriate choice.

As Ericson and Laibson (2018) argue, the concreteness of the future event would diminish impatience, and their conclusion may reasonably be extended to tangibility of the objects. To avoid further abstraction and its possible inference with the spatio-temporal abstraction, the concreteness will be achieved by introducing the three commonly used commodities with different price range (T-shirt, TV, and mobile phone).

While the research aims to examine time and distance preferences, the elicitation and calculation of the discount rate is not in research focus. The preferences are examined in pairwise comparison, with options: immediate or delayed. The analysis objective is response examination.

The time concept is set in the future. Examined time possibilities are immediate, and sooner or longer option. Beside the immediate option (on the spot), spatial concept is examined by introduction of a closer and a farther option. The approach to time and space relation refers to different usage of time and space expression: a month (time evaluated without space); 15 minutes away (space evaluated as time), and 5/ 15 km (space evaluated without the stated timeframe). The 15 minutes away option is not controlled by stating a manner of reaching the destination or the speed, allowing the respondents to assess the distance by themselves (it could be a shorter walking distance or farther driving distance). Relying on Robinson *et al.* (2019) findings, this impreciseness should not matter, as the time to reach the destination has greater influence than the distance itself.

Numerical magnitude is expressed in numbers: 1, 5, 15, 15; and numerical magnitude context is defined with: month, km, min, km. To avoid framing effect that derives from the tenses

or words as *delay* or *waiting*, the questions are constructed as simple sentences, using the infinitive. For example: You want to buy a new TV and you can choose to: buy the TV now by the price of 1000 kn; buy the TV in a month by the price of 950 kn; or You want to buy a new TV and you can choose to: buy the TV here by the price of 1000 kn; buy the TV in a 15 km distant location by the price of 950 kn.

### 3.3. The surveys

The survey and data collection were conducted using two surveys and two convenience samples. The first survey was conducted in 2017 on the 89 first-year students of economics and business economics in Pula (Croatia), and the questionnaire examined only fixed discount, along with the time evaluated without space and space evaluated as time. The second survey was conducted in 2019 on a broader population with 391 responses, and the questionnaire was extended for examination of the relative discount, as well as the options of space evaluated without the stated timeframe. Each respondent approached to the survey only once, and there are no repeated responses. Both samples are convenient and collected from respondents in Croatia with access to online services, which does not allow any conclusions generalization.

In line with the analysis objective, most of the applied methods belong to descriptive and explorative methods (cluster analysis and multidimensional scaling/unfolding), aiming for the insights in the underlying patterns.

## 4. Results and discussion

### 4.1. Study 1: Fixed discount, time evaluated without space and space evaluated as time

Three frequently used products are picked for the choice objects in the questionnaire: T-shirt, TV, and mobile phone. The prices for T-shirt, TV and Mobile phone are 100, 1000 and 5398 HRK (approx. 14, 140, 740 EUR), respectively. For the choices with additional unit of time ( $t_1$ ) and additional unit of distance expressed in time ( $dt_1$ ), the price is lower by 50 kn. The discount is held fixed to minimize the interference with the spatial and temporal sensitivity. The crossing of the distance is expressed in time (15 minutes). A 15-minute distance is chosen, because it presumably involves approximately the same effort as returning to the location after a month. The intuition related to the choice of a *month* of waiting is related to the standard salary receipt once a month and the customary purchase after the receipt of the salary. As location preferences tend to stabilize over time (Bordalo *et al.* 2017), it is assumed that the mental representation of *here* and *now* will relate to usual buying location (and return in a month by a default), whereby the presumable effort shifts from crossing a distance to waiting. That diminishes the difference in additional efforts and allows the comparison of time and distance sensitivity based on the expressed time in both choices. The effort effect for the TV choice is bigger in comparison to other choices, as it is physically the biggest product, however the effort is approximately the same within the TV choice. While accounting for the efforts, one must keep in mind that the effort is assumed rather than applied, as respondents answer the question and not exhibit the behavior.

**Table 1. Frequencies of responses**

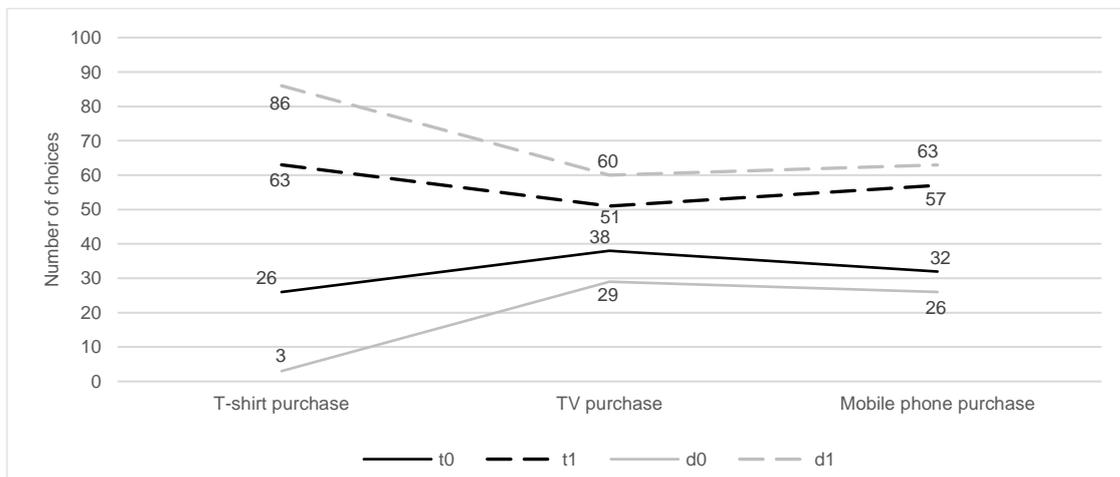
	T-shirt purchase	T-shirt purchase (%)	TV purchase	TV purchase (%)	Mobile phone purchase	Mobile phone purchase (%)	Total (%)
$t_0$	26	29.21	38	42.7	32	35.96	35.96
$t_1$	63	70.79	51	57.3	57	64.04	64.04
Total	89	100	89	100	89	100	100
$dt_0$	3	3.37	29	32.58	26	29.21	21.72
$dt_1$	86	96.62	60	67.42	63	70.79	78.28
Total	89	100	89	100	89	100	100

**Note:**  $t_0$  – purchase immediately;  $t_1$  – purchase in one month;  $d_0$  – purchase at immediate location;  $d_1$  – purchase at location 15 minutes away.

**Source:** Author's own preparation

The preliminary data is gathered from convenience sample of the 89 first-year students in 2017 in Croatia. To compensate for small convenience sample, simple bootstrapping is applied. Frequencies of the responses are presented in the Table 1.

The amount of savings between choices  $t_0$  to  $t_1$  is the same (50 kn) for all products. Therefore, for a rational subject is expected to make the same (saving) choice over offered products. The propensity to save the same amount of money diminishes with the increase of the purchase amount, meaning that individuals assess the amount of saving relative to the total amount. However, presented data points out the choices' inconsistency given the purchase amount: 70.79% of the respondents chooses cheaper option for buying a shirt (cheapest product), 57.3% for buying a TV (middle price product), and 64.04% for buying a mobile phone (most expensive product). Similar pattern can be noticed for the 15-minutes option. The amount of savings between choices  $dt_0$  to  $dt_1$  is the same (50 kn) for all products. The same as for previous situation, it is expected that same preference is chosen over offered products. Presented data points out the choices' inconsistency given the purchase amount: 96.62% of the respondents chooses cheaper option for buying a shirt (cheapest product), 67.42% for buying a TV (middle price product), and 70.79% for buying a mobile phone (most expensive product).



**Figure 1. Graphical representation of respondent's answers**  
Source: Author's representation

The frequency pattern for  $dt_0$  and  $t_0$  show similar pattern, as well as  $t_1$  and  $dt_1$  (Figure 1). The pattern similarities may indicate the similarity in perception of time and place distances. The absolute difference of the choices  $dt_0$  and  $t_0$  and the choices  $t_1$  and  $dt_1$ , amount 23, 9 and 6, for T-shirt, TV, and mobile phone, respectively. The ratios of time over distance for the commodities are 8.67, 1.31 and 1.23 for the choices  $t_0$  and  $d_0$ , and 0.73, 0.85 and 0.9 for the choices  $t_1$  and  $d_1$ . The ratios appear to converge as the overall amounts gets higher. The convergence, as the amounts get higher, may indicate smaller price sensitivity to absolute amount of the discount (Loewenstein and Thaler, 1989, Loewenstein and Prelec, 1989), immediacy effect (Prelec and Loewenstein, 1991) and the lack of *pain of paying* (Prelec and Loewenstein, 1998).

To measure the affinity (tendency) of the respondents for each commodity regarding the deviation toward the time and distance point, it seems appropriate to examine inclination, as the ratio of the differences in responses between two points and the fixed point. The ratios will provide the direction of response inclination regarding the points, and the amount of the responses' deviation regarding the fixed point. The inclinations are represented in the Table 2.

As Table 2 shows, the inclination of the T-shirt choice regarding the now-time point is negative and points out that the difference in choices will be 1.423 times bigger in favor of the opposite time. The inclination of the T-shirt choice regarding the delayed time point is positive and points out that the difference in choices will be 0.5.

**Table 2. Responses inclination for each commodity regarding the deviation from the time and distance point**

Inclination	$s_{t_0} = \frac{t_0 - t_1}{t_0}$	$s_{t_1} = \frac{t_1 - t_0}{t_1}$	$s_{d_0} = \frac{dt_0 - dt_1}{d_0}$	$s_{d_1} = \frac{dt_1 - dt_0}{d_1}$	$s_{td_0} = \frac{t_0 - dt_0}{t_0}$	$s_{td_0} = \frac{dt_0 - t_0}{d_0}$	$s_{td_1} = \frac{t_1 - dt_1}{t_1}$	$s_{td_1} = \frac{dt_1 - t_1}{d_1}$
T-shirt	-1.423	0.587	-27.66	0.965	0.88	-7.66	-0.37	0.27
TV	-0.34	0.25	-1.07	0.52	0.236	-0.31	-0.18	0.15
Mobile phone	-0.7813	0.44	-1.42	0.59	0.19	-0.23	-0.11	0.1

Source: Author's calculation

87 times the choices of delayed point in time in favor of the opposite time. If there is a negative sign, the inclination points that the choices will deviate towards the opposite point in time and/or distance. If the inclination is smaller than one, that means that the approximate differences (and choices) in favor the opposite option are smaller than the choices in favor of the observed point. It is interesting to notice that all the inclination signs are equal among the columns, indicating equally oriented preferences between two points in time and distance. The variation of the inclination amount, namely its decrease within the column, points out to regularity that might be explained with the increase in overall amounts. However, both options show same inclination direction, and the inclinations absolute values decrease within the column. At this point, it can be noticed that the choices follow the same pattern, which is indication that similar effects appear for choices involving time and distance for this sample.

The U-shaped distribution of the choices requires further examination. If respondents perceived TV price as low already, that might be an explanation of the U-shaped curve, so repeated research with corrected TV price is required to check if the deviation still occurs. Such deviation may also arise because of the small sample, the specific sample bias, or the data noise. Another explanation might be the underlying quasi-hyperbolic discounting that governs the respondents' choices. The analysis of comparison of distance measured in usual distance units (for example, km/m) is also required to reach the conclusion. It is also required to examine distance sensitivity for a different (bigger) option. Further research requires examination of consistency of results for relative amounts of discounts (holding the T-shirt example unchanged and as a reference point).

**4.2. Study 2: Fixed and relative discount, time evaluated without space, space evaluated as time, and space evaluated without the stated time frame**

Given the extensive limitations of the first study, the data collection was repeated with corrected TV prices, as well as with extended variety of options for examination of time and distance preferences. Such questionnaire was compiled and distributed online by student-pollsters in 2019 for the completion of the wider population in Croatia (with the access to online services). The method of questionnaire distribution followed stratified sample rules regarding the age and gender (Table 3). At the time, 425 questionnaires were collected, but after removing cases with missing responses and unusual cases, 391 fully completed questionnaires are used for further analysis.

The extended questionnaire contains 28 questions, and among them are additional questions with the price for the TV corrected to 2,000.00 HRK (doubled). Additional questions added to the second questionnaire refer to examination of the relative discount (50%) and examination of the distance measured in kilometers (5 and 15 km).

**Table 3. The sample demographic characteristics**

Age	Frequency (percentage)	Male (percentage)	Female (percentage)
18-24	109 (27.88%)	10.74	17.14
25-38	85 (21.74%)	10.49	11.25
39-54	89 (22.76%)	10.49	12.28
55-	108 (27.62%)	13.55	14.07

Source: Author's own preparation

Table 4 shows responses regarding the questions with fixed discount and Table 5 shows responses to questions regarding the relative discount. The T-shirt purchase choices enable comparison to both fixed and relative discount (the price is 100 kn, and the discount is 50 HRK = 50%) and are presented in both tables. It can be noticed that the response distributions do not point out to U-shaped curve in fixed discount responses, as it was the case in the first sample. There are small variations between the TV choices (original and corrected price), but they are not statistically significantly different. The responses with relative discount show the slight U-shaped curve with the decrease in immediate choices for the middle values.

**Table 4. Frequencies of the responses to questions about purchase with fixed discount of 50 kn**

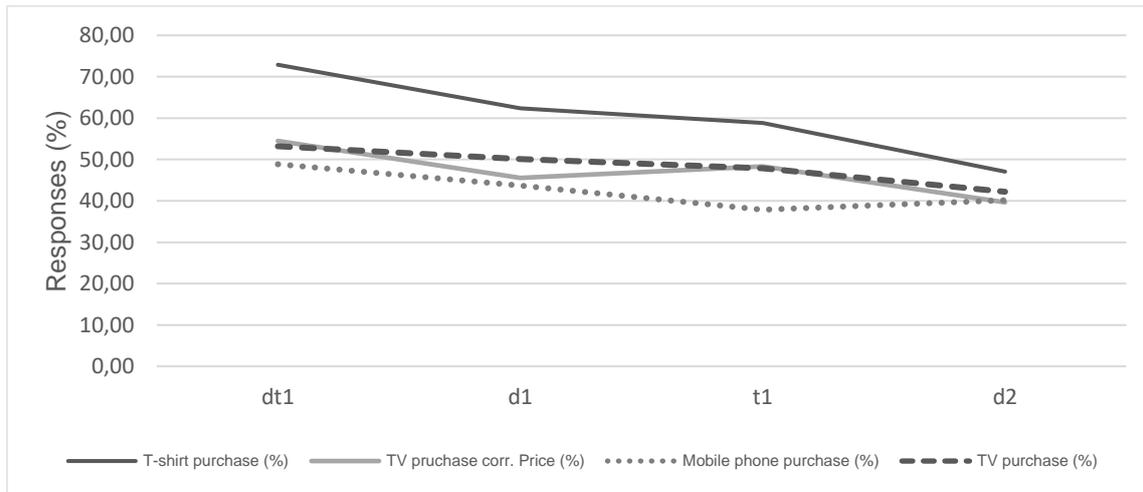
	T-shirt purchase	T-shirt purchase (%)	TV purchase	TV purchase (%)	TV purchase corr. price	TV purchase corr. price (%)	Mobile phone purchase	Mobile phone purchase (%)
$t_0$	161	41.18	204	52.17	202	51.66	243	62.15
$t_1$	230	58.82	187	47.83	189	48.34	148	37.85
Total	391	100.00	391	100.00	391	100.00	391	100.00
$dt_0$	106	27.11	183	46.80	178	45.52	200	51.15
$dt_1$	285	72.89	208	53.20	213	54.48	191	48.85
Total	391	100.00	391	100.00	391	100.00	391	100.00
$d_0$	147	37.60	195	49.87	213	54.48	220	56.27
$d_1$	244	62.40	196	50.13	178	45.52	171	43.73
Total	391	100.00	391	100.00	391	100.00	391	100.00
$d_o$	207	52.94	226	57.80	236	60.36	234	59.85
$d_2$	184	47.06	165	42.20	155	39.64	157	40.15
Total	391	100.00	391	100.00	391	100.00	391	100.00

**Note:**  $t_0$  – purchase immediately;  $t_1$  – purchase in one month;  $dt_0$  – purchase at immediate location;  $dt_1$  – purchase at location 15 minutes away;  $d_0$  - purchase at the location;  $d_1$  - purchase at 5 km distant location;  $d_2$  - purchase at 15 km distant location.

**Source:** Author’s own preparation

The data from Table 4 shows the increase of the immediate choices as the purchase value rises, and respective decrease of the delayed options. Higher percentages of the respondents chose closer ( $d_1$ ) and sooner ( $dt_1$ ) options of delayed purchase (+1), pointing out to effects of delayed gratification, patience, and future-focus. That is in accordance with the findings of Carvalho *et al.* (2016), Laibson *et al.* (2004), and Loewenstein and Prelec (1989). The presumable physical effort may also play a role. The highest presumable physical effort exists for the  $d_2$  options and are highest for the TV (as a physically large product). The distinction between the choices of *closer* and *sooner vs farther* and *later* options point out to possible classification of the options as the concrete vs abstract as in Construal Level Theory and Mental Time Line (Trope and Liberman, 2003; Bonato *et al.* 2012).

Most of delayed responses with fixed discount follow the choice pattern with diminishing choices for more delayed options, from highest to lowest:  $dt_1 \rightarrow d_1 \rightarrow t_1 \rightarrow d_2$ . It is not surprising to notice that there are more choices for a month's delay than the 15 km distance. One of the possible explanations for this occurrence might be the perception of the increased physical effort, while the other refers to number magnitude (one vs 15). The only exception to that pattern is  $dt_1 \rightarrow d_1 \rightarrow d_2 \rightarrow t_1$  for the mobile phone purchase (most expensive option), indicating impatience over the effort elicitation. If we assume that spatio-temporal discounting (hyperbolic or quasi-hyperbolic) holds for this example, the stated lineup would be the representation of the respondents Mental Time Line (Figure 2). That means that the number of choices of the delayed option are expected to decrease as that option becomes more abstract (farther and later, on the right space of the MTL).



**Figure 2. Respondents Mental Time Line based on the delayed responses for the fixed discount**

Source: Author's own preparation

The comparison of the responses from Table 4 and Table 5 reveals the distinction in the choices produced by the discount difference. All the delayed purchase options show higher number of choices with relative discount, meaning that relative discount is stronger motivator for the delayed purchase. According to Loewenstein and Thaler (1989), higher sensitivity to relative discount is to be expected. That is also in line with Griffith *et al.* (2009) about the special price differences.

**Table 5. Frequencies of the responses to questions about purchase with relative discount of 50%**

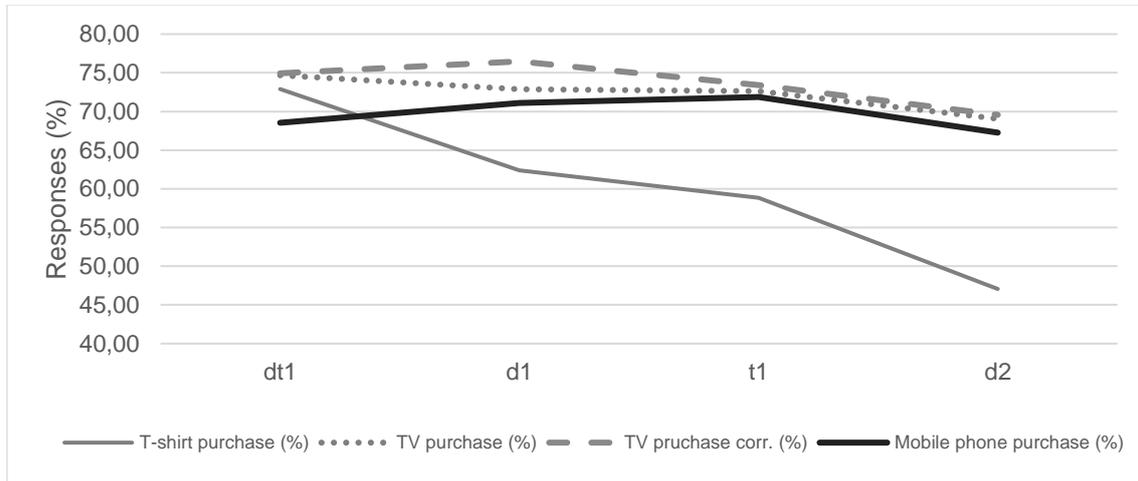
	T-shirt purchase	T-shirt purchase (%)	TV purchase	TV purchase (%)	TV purchase corr. price	TV purchase corr. price (%)	Mobile phone purchase	Mobile phone purchase (%)
$t_0$	161	41.18	107	27.37	104	26.60	110	28.13
$t_1$	230	58.82	284	72.63	287	73.40	281	71.87
Total	391	100.00	391	100.00	391	100.00	391	100.00
$dt_0$	106	27.11	99	25.32	98	25.06	123	31.46
$dt_1$	285	72.89	292	74.68	293	74.94	268	68.54
Total	391	100.00	391	100.00	391	100.00	391	100.00
$d_0$	147	37.60	106	27.11	92	23.53	113	28.90
$d_1$	244	62.40	285	72.89	299	76.47	278	71.10
Total	391	100.00	391	100.00	391	100.00	391	100.00
$d_o$	207	52.94	121	30.95	119	30.43	128	32.74
$d_2$	184	47.06	270	69.05	272	69.57	263	67.26
Total	391	100.00	391	100.00	391	100.00	391	100.00

**Note:**  $t_0$  – purchase immediately;  $t_1$  – purchase in one month;  $dt_0$  – purchase at immediate location;  $dt_1$  – purchase at location 15 minutes away;  $d_0$  - purchase at the location;  $d_1$ - purchase at 5 km distant location;  $d_2$ -purchase at 15 km distant location.

Source: Author's own preparation

It is specific for the responses in Table 5 that the percentage of the delayed options rise as the purchase value rise, which can be explained with the increase in the absolute value of the discount. The delayed responses for the first two commodities with relative discount follow the choice pattern with diminishing responses for more delayed options:  $dt_1 \rightarrow d_1 \rightarrow t_1 \rightarrow d_2$  (the same as most responses for fixed discount). The lineup of the highest percentages of delayed option for the TV with corrected price is:  $d_1 \rightarrow dt_1 \rightarrow t_1 \rightarrow d_2$  (as for the purchase of mobile phone

with fixed discount). The lineup of responses for the mobile phone purchase is:  $t_1 \rightarrow d_1 \rightarrow dt_1 \rightarrow d_2$ . If we observe the lineups as the MTL (Figure 3), it can be noticed that subjective temporal and spatial perception are not only related to each other, but also susceptible to other influences, such as relative discount and respective increase in the absolute value for more expensive products in this example.



**Figure 3. Mental Time Line (MTL) based on the delayed responses for the relative discount**

Source: Author's own preparation

While the first and second lineup reveal the diminishing choices as the delayed options become more abstract (farther and later), the latter two lineups of the responses (TV with corrected price and mobile phone purchase) reveal some kind of a reversal point where increase in the amount affects the spatio-temporal preferences (or vice versa; however, given that such effect does not occur for the choices with fixed discount, it is safe to assume that the change in choices before and after specific point in the spatio-temporal construct is affected by the value - both the product and respective discount). For the TV with the corrected price, choices of the delay options reveal the change in the order of closer and sooner options, while the mobile phone choices reveal the shift of the monthly delay to first place, leaving the rest of the choices ordered as for the TV choice. As the spatio-temporal abstraction level rises, the choices for the middle and most expensive product appear to converge.

Another interesting and practical observation can be made: for most of the observed situations, there is higher percentage of the choices of 15 minutes distant location over 5 km distant location. As there can be some situations where 15 minutes can refer to the 5 km distance (with the use of transportation), it appears that 15 minutes distant option is more alluring than the 5 km distant option. In relation to Hedge and Suresh (2017), where respondents frequently buy within the 1-5 km distance, it seems that this finding could be used in promotional purposes (i.e., instead of 2 km away, advertisement can state the minutes necessary to reach the location).

Even though some patterns can be revealed from the frequency distributions, further analysis is necessary to reveal the underlying principles of the choices. Given the data properties and the research goal, cluster analysis and the multidimensional scaling (PROXSCAL algorithm) will be applied to the data.

**Table 6. Cluster analysis results**

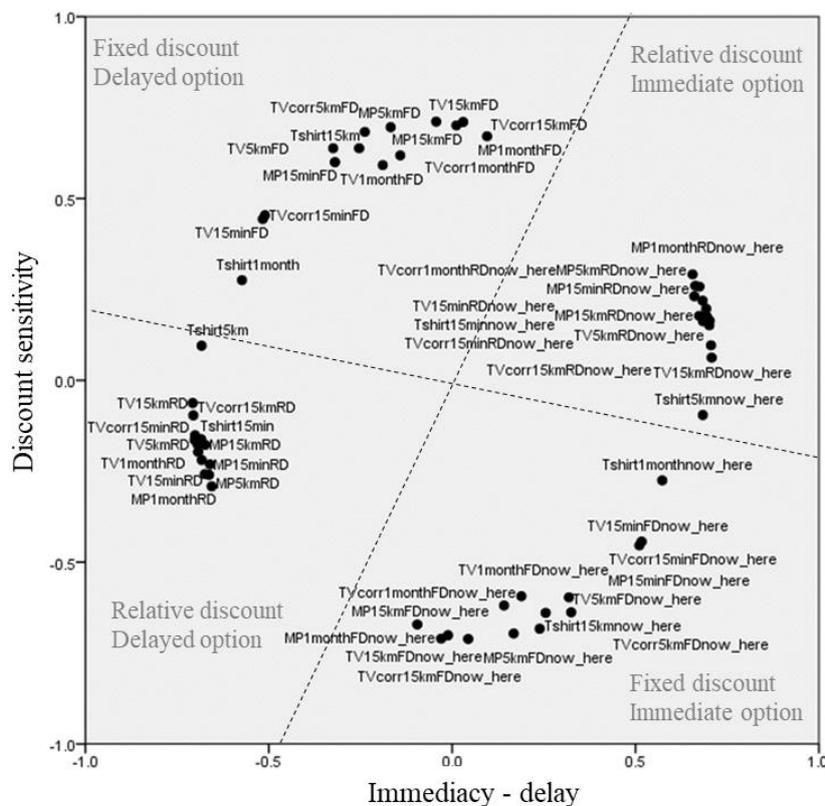
Cluster	1	2	3	4
Number of cases	94 (24.04 %)	120 (30.69 %)	129 (32.99 %)	48 (12.28 %)
Sum of cluster centers	52.51	43.99	42.98	34.63
Sum of cluster centers with fixed discount options	21.94	14.26	18.28	14.98
Sum of cluster centers with relative discount options	23.03	23.38	18.49	14.77
Sum of cluster centers for here/now options	7.54	6.36	6.21	4.88
Sum of cluster centers for close/soon options	26.79	22.98	21.36	17.58
Sum of cluster centers for farther/later options	25.72	21.02	21.62	17.05
Possible properties	Tightwads Future-focused Savings behavior Utilitarian	Convenience oriented Discount sensitive Moderately utilitarian	Convenience oriented Discount insensitive	Spendthrifts Present-focused Spending behavior Hedonistic

**Source:** Author's calculation using SPSS

The cluster analysis reveals four statistically significantly different clusters, which are distinct enough to capture the differences in responses and group the respondents (the statistical differences are confirmed by ANOVA test with  $p=0$ , while further increase of the number of clusters would lead to redundancy regarding the possible properties). Table 6 reports the sum of the cluster centers, which reveals that respondents in the first cluster tend to choose delayed options, and respondents in the fourth cluster tend to choose immediate options. According to the intertemporal choice terminology, first group can be related to tightwads, patient (Lempert and Phelps, 2016), future-oriented individuals (Ericson and Laibson, 2018) that exhibit savings behavior. The fourth group can be related to spendthrifts, impatient (Lempert and Phelps, 2016), who are present-focused (Ericson and Laibson, 2018) and demonstrate spending behavior. The respondents in the second and third clusters (63.68% of the respondents) choose both immediate and delayed options, which possibly makes them a most susceptible group to the influences of the price increase, discount amount and spatio-temporal differences, as well as to the framing and bracketing effects. Given the lack of the standardized terminology for medial groups, the second and third group will be examined given the response properties. For the third cluster, approximately half of the responses relate to the immediate and the other half to delayed purchase and there is no difference regarding the fixed/ relative discount. Such responses indicate convenience-oriented respondents, insensitive to discount. For the second cluster, most of the respondents' immediate choices occur for the fixed discount, while most of the respondents' delayed choices occur along the relative discount. Those respondents reveal convenience-oriented and moderately utilitarian choices with sensitivity to the discount amount.

The cluster analysis points out to the groups of the respondents given their choices of immediate or delayed purchase, but it does not reveal the underlying principles that govern their choices based on the differences in spatial and temporal choices. However, the lack of such evidence is indication that spatial and temporal sensitivity follows the same pattern and is similarly susceptible to the discount and purchase delay. The patterns might be revealed with the multidimensional scaling and unfolding analysis.

Multidimensional scaling analysis reveals the underlying perceptions that shape the respondent choices and can be expressed as dimensions. For this analysis, unimodal (pairwise) choices were recoded into separate binary variables, where a certain choice occurred or not. The analysis is performed using PROXSCAL algorithm, without restrictions, proximities are created from the data using Euclidean distances, with simplex initial configuration, ordinal proximity transformation, criteria is set for two dimensions, with standard stress settings. A model is derived, with following measures of fit: normalized raw stress is 0.0073, Stress-I is 0.0856, Stress-II is 0.1896, S-Stress is 0.0088, dispersion accounted for is 0.9927 and Tucker's Coefficient of Congruence is 0.9963. The model shows acceptable measures of fit, but non-zero stress values require special attention with interpretation. The model, presented in Figure 4, is a visual representation of the least squares of the similarities and distances pattern of the examined variables/ objects.



**Figure 4. Result of the multidimensional scaling**

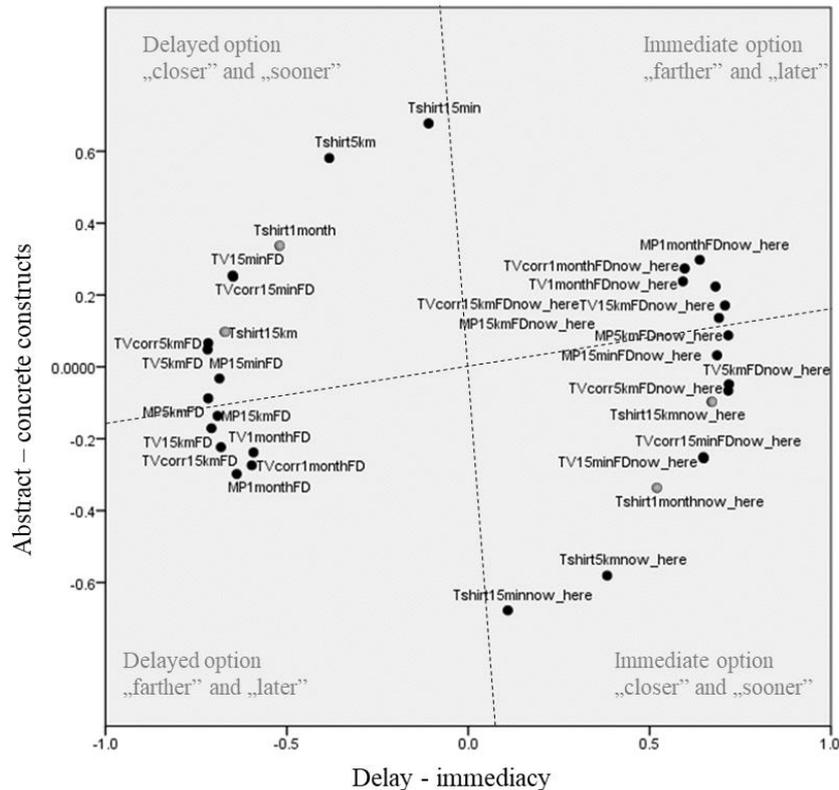
Source: Author's calculation using SPSS

The insight into object/variable position reveals that the dimensions refer to the relative and fixed discount, as well as to the immediate and delayed choices. The combinations of the dimensions reveal four areas: choices of delayed option with relative discount, choices of delayed option with fixed discount, choices of immediate option with relative discount and choices of immediate option with fixed discount.

More detail insight reveals that it is not possible to distinguish any pattern regarding the time and space choices, as they overlap in each area. That means that the discount sensitivity and the immediacy vs. delaying represent more dominant underlying principles in choices regarding the economic example of spatio-temporal task. It seems that respondents almost ignore time and space distances in this prospect evaluation, which complies with Ebert and Prelec (2007) summarization on cognitive distances. It also shows that those principles occur for both temporal and spatial choices.

Because of the revealed regularities that refer to the relative and fixed discount, the responses to questions regarding the fixed and relative discount are further analyzed separately i.e., controlled for the discount effect.

Figure 5 represents the results of the multidimensional unfolding of the responses regarding only fixed discount. Derived model has following measures of fit: normalized raw stress is 0.0101, Stress-I is 0.1006, Stress-II is 0.1976, S-Stress is 0.0117, DAF is 0.9899 and Tucker's coefficient of congruence is 0.9949.



**Figure 5. Result of the multidimensional unfolding of the responses to questions with fixed discount**

**Note:** Gray dots denote non-fitting objects.

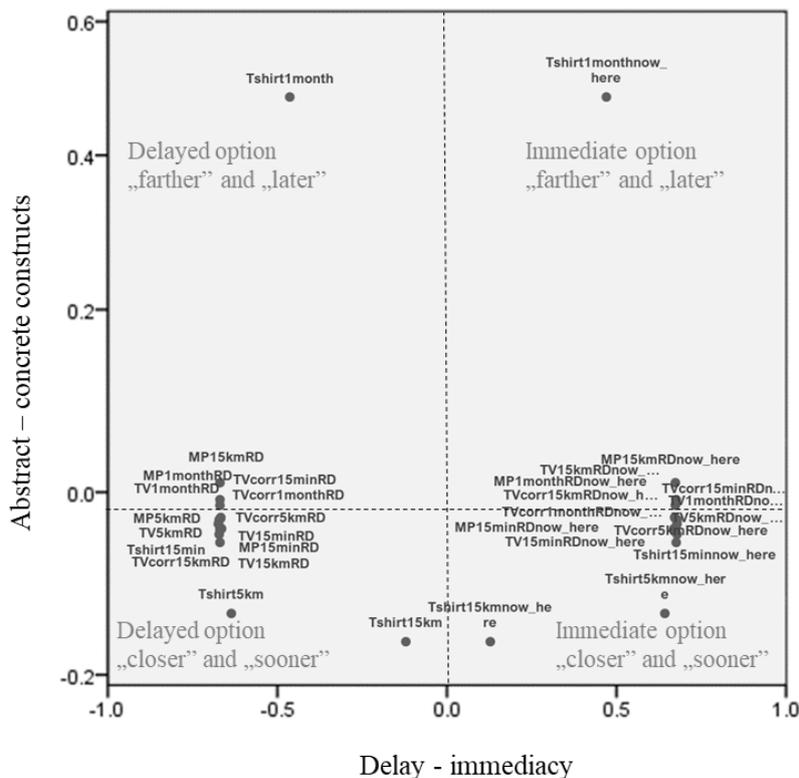
**Source:** Author's calculation using SPSS.

Separately analyzed data reveals some underlying principles regarding the spatio-temporal preferences. Given the objects distribution over Figure 5, it can be noticed that they can be divided regarding the immediacy and delay (as in previous setting), but this setting also reveals distinction of the abstraction level of the spatio-temporal constructs. This is the first indication that there is underlying principle that separates the *closer* and *sooner* choices from *farther* and *later* ones in the analyzed sample. As abstract - concrete dimension involves both temporal and spatial option at each pole, it can be assumed that the spatio-temporal sensitivity holds. In addition, it suggests the examination of the extension of the findings of the intertemporal choice. The group of responses that refers to delayed options in combination with *farther* and *later* could be related to patient, future-focused individuals, tightwads, and the delay of gratification. The group of responses that refer to immediate option in choice where other options are *closer* and *sooner* might indicate impatient, present-focused individuals and spendthrifts. Those are both extreme categories and easily identified. The remaining two combinations of immediacy-delay and abstract-concreteness refer to moderately susceptible respondents that fit somewhere in between. For example, the delayed option in combination with *closer* and *sooner* options might indicate convenience tightwads, relatively future-focused. The remaining, immediate option in

combination with alternative *farther* and *later* could indicate convenience spendthrifts, relatively present-focused.

It can also be noticed that there is asymmetry regarding the perception of the abstract-concrete constructs. While delayed options can be directly related to the *closer/sooner* dimension, the immediate choice is related to alternative option. The alternative option refers to the non-chosen option, but it reveals the underlining intuition: in comparison with *farther* and *later* alternative, the immediate option is more concrete one; as is for the *closer* and *sooner* alternative, just with the smaller contrast that might lead to higher abstraction for those respondents. However, further examination is required to validate and confirm, as well as to extend the findings to the relative discount. It is also necessary to review if the analysis of the responses with relative discount shows similar results.

Figure 6 represents the results of the multidimensional scaling of the responses regarding only relative discount. The measures of fit for the model: normalized raw stress is 0.0068, Stress-I is 0.0826, Stress-II is 0.1318, S-Stress is 0.0112, DAF is 0.9932 and Tucker's coefficient of congruence is 0.9966.



**Figure 6. Result of the multidimensional unfolding of the responses to questions with relative discount**

**Note:** gray dot denotes non-fitting object

**Source:** Author's calculation using SPSS

The first insight in Figure 6 reveals that some of the variables do not fit well in their designated quadrants. The dimensions are set according to most of the variables that fit into certain quadrant. While the dimensions are the same as in the previous model (all the combinations exist as well), the distinction occurs regarding the positions of immediate choices in combination with more concrete and more abstract options. That difference results in the lack of the asymmetry which was present in the previous model. A part of the explanation can be higher sensitivity to delay - immediacy effect in questions with the relative discount (responses are more polarized given the delay - immediacy dimension in comparison to Figure 5, while immediate options minimally deviate (with few exceptions) on the abstract-concrete constructs

dimension from zero). That reveals that in the presence of the relative discount occurs a change in the preferences, whereby abstract-concrete construct dimension becomes less relevant for the choices. The relative discount shifts a significant number of responses toward the delayed options. Most of the delayed options belong to the abstract part of the scale, but they also show higher amount of the non-fitting objects. The T-shirt choices reveal the greatest distances from the center, while TV and mobile phone choices remain grouped at delay and immediate pole of the dimension. The cause seems to be the presence of the relative discount and the underlining value perception that dominantly influence the choices. The discount sensitivity predominance conceals the spatio-temporal sensitivity. Despite the similarities to the model with fixed discounts, the model presented in Figure 6 requires thorough future examination.

To further examine similarities and differences based on the revealed regularities, it is appropriate to check if statistically significant differences occur for pairwise comparisons of *closer* and *sooner*, as well as of *farther* and *later* responses. To achieve that, McNemar test is applied to the original data. The results are presented in Table 7.

**Table 7. Results of the McNemar pairwise test**

Construct	Variable	N	Chi-Square <sup>b</sup>	Asymp. Sig.	Exact Sig. (2-tailed)	Point Prob.
closer and sooner (more concrete)	Tshirt15min & Tshirt5km	391	13.913	0.000***	0.000***	0.000
	TV15minRD & TV5kmRD	391	0.434	0.51	0.510	0.065
	TV15minFD & TV5kmFD	391	0.890	0.346	0.346	0.040
	TVcorr15minRD & TVcorr5kmRD	391	0.260	0.61	0.610	0.067
	TVcorr15minFD & TVcorr5kmFD	391	9.248	0.002***	0.002***	0.001
	MP15minRD & MP5kmRD	391	0.827	0.363	0.363	0.048
	MP15minFD & MP5kmFD	391	3.008	0.083	0.082	0.014
farther and longer (more abstract)	Tshirt15km & Tshirt1month	391	13.500	0.000***	0.000***	0.000
	TV15kmRD & TV1monthRD	391	1.482	0.223	0.223	0.032
	TV15kmFD & TV1monthFD	391	3.063	0.08	0.080	0.012
	TVcorr15kmRD & TVcorr1monthRD	391	1.798	0.18	0.180	0.027
	TVcorr15kmFD & TVcorr1monthFD	391	7.459	0.006***	0.006***	0.001
	MP15kmRD & MP1monthRD	391	2.408	0.121	0.120	0.019
	MP15kmFD & MP1monthFD	391	0.454	0.5	0.501	0.050

**Note:** Statistical significance at 1% level is denoted \*\*\*; FD and RD stand for the fixed and relative discount, respectively. MP stands for the mobile phone.

**Source:** Author's calculation using SPSS

As expected, for most pairwise comparisons (10 of 14), there are no statistically significant differences at 5% level, therefore the proportion of the choices is equal between those pairs. That finding is additional confirmation of the similar effects of the time and space perception in response examination. It can also be noticed that the respondents show no significant sensitivity to the number magnitude, while the context of number magnitude plays a role. Given the time and space relation, the pairwise comparison enables conclusion that most responses reveal no statistically significant differences in responses regarding the same level construct and relation between the space expressed as time and space evaluated without the stated timeframe, as well as between time expressed without space and space expressed without the stated timeframe. That allows the suggestion for extension of time sensitivity (the variations of value given the variations of time (Ebert and Prelec, 2007), to space sensitivity as the variations of value given the variations in space distance, and to spatio-temporal sensitivity as the variations of value given the variations in time and space distances.

However, differences occur for four pairwise comparisons. At 1% level of statistical significance, there are differences between responses for buying T-shirt and between the responses for buying TV with corrected price with fixed discount, regarding both more concrete and more abstract options. The noted differences can be explained with the perception of the value and presumable physical effort. The differences in responses for T-shirt purchase rise from the more choices in favor of the 15 minutes distant location and a purchase in a month for the more concrete and more abstract construct, respectively (Table 4). Both favored options carry presumable lower physical effort, indicating possible bracketing effect. Considering the overall value and the frequencies of the chosen options, it can be reasonably assumed that in T-shirt choice physical effort that rises from crossing a distance plays a role while respondent discounts or performs intuitive cost-benefit analysis. With a twist, the offered possible explanation can be extended to choices for buying TV with corrected price with fixed discount. The TV price is significantly higher than the price of the T-shirt (the fixed discount is relatively smaller in comparison to overall value), and the higher frequency of the responses occurs for the purchase in a month-option. A purchase in a month carries smaller presumed physical effort, which may be part of the explanation for those choices. However, no such differences occur for the option with the lower (TV purchase) and higher (mobile phone purchase) price, hence this represents a deviation. While a part of that can be explained with the presumable physical effort, the rest might occur due to the heuristics and biases in decision-making process.

## 5. Conclusion

The purpose of this research is to examine time and space distance preferences in purchase situations where additional unit of temporal or spatial distance saves respondent's money. The survey and data collection were conducted using two surveys and two samples. The first survey was conducted in 2017 on a first-year students ( $n = 89$ ) and the questionnaire examined only fixed discount, along with the time evaluated without space and space evaluated as time. The second survey was conducted in 2019 on broader population ( $n = 391$ ) with the extended questionnaire for examination of the relative discount and options of space evaluated without the stated timeframe.

The data from the first sample shows that the propensity to save the same amount of money diminishes with the increase of the purchase amount. That means that respondents assess the amount of saving relative to the total amount. Despite its limitations, the data from the first sample reveals indication that the underlying preferences regarding the time and space show similar pattern in responses.

Similarly, the second sample exhibits the increase of the immediate choices as the purchase value rises, and respective decrease of the delayed options for options with the fixed discount. On the other hand, the responses from the second sample for options with relative discount show higher frequency of choices of delayed purchase, and the percentage of the delayed options mostly rises as the purchase value rise, which can be explained with the increase in the absolute value of the discount. That means that relative discount is stronger motivator for the delayed purchase. According to Loewenstein and Thaler (1989), higher sensitivity to relative discount is to be expected for intertemporal choice. Moreover, it seems that the conclusion can be extended to spatio-temporal choice, as well. Both samples reveal distinct percentages of the respondents who choose closer and sooner options in comparison to more delayed purchase. The distinction between the choices of *closer* and *sooner* vs *farther* and *later* options point out to possible classification of the options as the concrete vs abstract as in Construal Level Theory and Mental Time Line (Trope and Liberman, 2003; Bonato *et al.* 2012). While that does not indicate anything about the judgment process (which is beyond the scope of this research), it reveals the similarities in underlying guidelines for the choices. The constructs do not show complete overlap, implying similarities in pattern and possible overlaps, which is in line with Maglio's (2020) suggestion and leaves plenty of room for further examination of distances.

The cluster analysis points out to the four groups of the respondents given their choices of immediate or delayed purchase, and the possible properties of the groups are discussed. The multidimensional scaling applied to data recoded into binary variables reveals choices grouped

in four areas by the dimensions of the relative-fixed discount and immediate-delayed options. More detail insight reveals that it is not possible to distinguish any pattern regarding the time and space choices, as they overlap in each area. That means that the discount sensitivity and the immediacy vs delaying represent more dominant underlying principles in choices regarding the economic example of spatio-temporal choice. That is also the first evidence in this analysis that there is an underlying principle that separates the *closer* and *sooner* choices from *farther* and *later* ones in the analyzed sample. As abstract - concrete dimension involves both temporal and spatial option at each pole, it can be assumed that the spatio-temporal sensitivity holds. The model with fixed discounts demonstrates more clear distinction of the spatio-temporal constructs, while the model with relative discount shows very low sensitivity regarding that dimension.

The revealed regularities are reinforced by nonparametric tests. As expected, for most pairwise comparisons (10 of 14) of responses to hypothetical situations with similar construal level of time and space, there are no statistically significant differences at 1% level, therefore the proportion of the choices is approximately equal between those pairs. That allows the suggestion for extension of time sensitivity of the respondents to space sensitivity as variations of value given the variations in space distance, thereby also extending it to spatio-temporal sensitivity as the variations of value given the variations in time and space distances. Also, it can be noticed that the respondents show no significant sensitivity to the number magnitude, while the context of number magnitude does play a role.

The limitations of the study rise from the use of the convenience sample, as well as from the chosen commodities, time, and distance options. To generalize the findings, more extensive research with expanded variety of options, conducted on representative sample is required.

Nevertheless, this response examination reveals that for the examined time and spatial distances options applied to commodity choices, the spatio-temporal perception holds. The possible practical implications of the findings indicate possibility for application of space distances among the time distance in discount management, which might enable higher flexibility in the offer and decrease the customer clustering on the discount days. Stated opens possibility of further examination of the relations between the time and distance relation and interchangeability in terms of both theoretical and applied research. Also, a variety of contextual settings remains to be explored.

If future research enables generalization of the spatio-temporal sensitivity, its application could advance to areas beyond business economics, such as health, environmental protection, and other decision-making situations that involve temporal and spatial dimensions.

**Acknowledgments:** A part of the findings was presented at the 2019 IAREP/SABE conference in Dublin, Ireland.

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