Temporal Discounting and Marketing Variables: Effects of Product Prices and Brand Informational Reinforcement

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Abstract By integrating the temporal discounting perspective, according to which the value of rewards is progressively discounted as a function of delay, and the Behavioral Perspective Model (BPM), according to which the purchase of products can produce utilitarian (directly obtained from use) and informational (social, mediated by others) reinforcing and punitive consequences, the present research investigated: 1) if temporal discounting would be better described by an exponential or a hyperbolic function; 2) if differently priced products would differ with respect to temporal discounting rates; and 3) if brands offering different levels of informational reinforcement would differ with respect to temporal discounting rates. In a first phase of the research, 73 undergraduate students evaluated brands of cell phone, tablet and TV set, in order to rank each brand according to the informational reinforcement level they offered. In a second phase, during an online purchasing simulation of these products, 51 students were asked to state how much they were willing to pay in order to anticipate product delivery, which was free after 21 days. Results indicated that the hyperbolic function fitted the data significantly better than the exponential function for two of the products, that products with higher prices showed lower temporal discounting rates than products with lower prices, and that brands associated with higher informational reinforcement showed higher temporal discounting rates. These findings suggest that there are complex interactive patterns of temporal discounting within- and between-products and that temporal discounting framework has great potential to inform research in consumer behavior and marketing.

Keywords Informational reinforcement · Temporal discounting · Behavioral perspective model · Brand differentiation · Product price

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Choices are relatively predictable when the alternatives only differ with respect to one dimension: people tend to prefer the alternative with the largest magnitude of reinforcement, the most immediate one or the most probable one. When the available options differ with respect to more than one dimension, choices are less predictable and more variable. The research line related to subjective discounting precisely assesses this choice variability when there are two alternatives available that differ with respect to two or more dimensions. One of the themes covered by this research line consists of temporal discounting, which deals with choices between two alternatives that vary in magnitude and delay (Green & Myerson, 2004).

Temporal Discounting

According to Green and Myerson (2004), in the case of reinforcing consequences, the reward value is progressively discounted (namely, reduced) as the acquisition delay (time elapsed between the response and the presentation of the reinforcer) increases. Thus, delayed rewards have a subjective value – current value of a delayed reinforcer – established by the delay. Empirical studies have demonstrated that people give more value to an immediate reward than to the same reward available with delay; and, when instructed to choose between two equivalent delayed rewards, they tend to choose the reward which is closer to the present time once this option has a larger subjective value than the one with more delay.

When a second dimension is added to the choice situation, such as magnitude, people have to choose between a reinforcer of larger magnitude available later (LL – *larger later*) and another of smaller magnitude available sooner (SS – *smaller sooner*), for example, choosing between receiving US\$ 350 in 30 days or US\$ 200 in 20 days. One important characteristic of choice patterns in this type of situation is the occurrence of preference reversal, which has important theoretical implications. Preference reversal would occur if people initially (in Time 1, e.g., 20 days before SS) choosing LL (US\$ 350) were to change their preference to SS (US\$ 200), as the time for having SS available approaches (in Time 2, e.g., 2 days before SS). This result would demonstrate that subjective values may alter depending on the moment in which reinforcers are assessed. After the decrease of an equal amount of time for both reinforcers (in Time 2), SS subjective value would have increased more than LL subjective value, culminating in preference reversal. This would indicate that temporal discounting rates differ for SS and LL as a function of time. This phenomenon would violate the utility model of classical economic theory, which predicts that the value of all kinds of future rewards would be discounted by constant rates, which implies that there would be no preference reversal (Green & Myerson, 2004).

In order to test this type of theoretical prediction, the typical psychophysical procedure adopted in human studies – developed by Rachlin, Raineri and Cross (1991) – to empirically assess the subjective delayed reinforcement value consists of a series of choices between two stimuli presented simultaneously: one of smaller magnitude available sooner (e.g., to receive US\$ 150 now) and another of larger magnitude available later (e.g., to receive US\$ 1000 in 6 months from now). During the procedure, one of the stimuli remains constant and the other is adjusted – the reward value of SS is systematically increased, or the reward value of LL is systematically

decreased –, until both alternatives are considered equivalent by the participant (e.g., when the participant considers receiving US\$ 800 now as equivalent to receiving US\$ 1000 in 6 months from now). At that moment, characterized by a switch in preference between SS and LL, or vice-versa, the first indifference point (IP) is obtained (e.g., US\$ 800). In other words, it is possible to say that when the participant considers the alternatives equivalent, he or she is indifferent in relation to the alternatives.

With the purpose of controlling for possible order effects, immediately after obtaining an indifference point the procedure is restarted so that the same formerly altered stimulus is decreasingly adjusted if it had been increased, or increasingly adjusted if it had been reduced (e.g., to maintain constant the alternative of US\$ 1000 in 6 months from now and to offer decreasing values of smaller rewards available sooner [US\$ 950, US\$ 900, US\$ 850, US\$ 800, US\$ 750...] until the participant chooses again the larger value available later, which would represent the second IP). The mean of the two IPs is then considered as a measure of the subjective value of the delayed reward, that is, the value of the immediate reward which is, according to the participant, equivalent to the value of the delayed reward. Different delays are manipulated to obtain a function of subjective values (e.g., US\$ 1000 in one month, 6 months, 1 year, 5 years, 10 years, 25 years and 50 years from now) (Green & Myerson, 2004).

Considering that the psychophysical procedure developed by Rachlin et al. (1991) and the variations of this procedure can be long and exhaustive for participants – especially when many delays are assessed, a condition that generally requires more than 100 answers per participant per session –, more direct methods were developed later. Among them, there is the Fill-In-The-Blank (FITB) method, which consists on the presentation of reward scenarios with varying delays, in the presence of which for each delay the participant must directly inform which is the present value that he or she judges to be equivalent to the delayed reward (e.g., to receive US\$ _____ now is equivalent to receiving US\$ 1000 in 6 months from now) (Chapman, 1996; Hardisty, Thompson, Krantz, & Weber, 2013). The FITB method has been shown to be valid for temporal discounting assessment (Weatherly, Derenne, & Terrell, 2011) and it can be adopted both in investigations that make use of electronic platforms and in those that use only paper and pen (Smith & Hantula, 2008).

In most temporal discounting studies, the decrease of subjective value (i.e., indifference points) of a reinforcement as a function of increases in delay to receive it has been quantitatively described by two types of functions, each one of which based on different assumptions concerning the phenomenon. The exponential function, which assumes that subjective values decrease at constant percentage rate with increased delays, adopts the following mathematical form:

$$V = Ae^{-bD} \quad (1)$$

where V is the subjective value (i.e., present discounted value) of a delayed reinforcement, A is the nominal value (i.e., non-discounted value) of the reinforcement, D is the delay to receive the reinforcement, and b is an empirically obtained parameter that measures the temporal discounting rate. The exponential function does not predict preference reversal between LL and SS alternatives as delay decreases (i.e., as time to receive the SS reinforcement becomes shorter). (Green & Myerson, 2004).

The other commonly adopted function is a hyperbolic function, which estimates that subjective values decrease at non-constant rates, that is, it predicts the occurrence of preference reversal, characterized by a change in preference from LL alternative to the SS alternative, as delay to the SS reinforcement decreases. This function has the following mathematical form:

$$V = \frac{A}{(1 + kD)} \quad (2)$$

where V , A and D represent the same variables as in Eq. 1, and k is an empirical obtained parameter that represents the rate of temporal discounting – that is, it indicates the degree to which the reward value is discounted due to the delay. (Green & Myerson, 2004)

In temporal discounting experiments, when the data significantly adjust themselves to the exponential and/or the hyperbola functions, parameters b and k , which represent discounting rate, have been used as dependent variables for discounting. In both cases, the higher the parameter value, the more steeply participants discount the value of a reinforcement due to the delay for receiving it (Smith & Hantula, 2008). Variables that can influence temporal discounting rate have been extensively studied in both humans and non-humans (e.g., Kagel, Bataglio, & Green, 1995). In the case of humans, experiments have found that greater discounting rates were associated to addiction to smoking (Baker, Johnson, & Bickel, 2003; Reynolds, Richards, Horn, & Karraker, 2004), addiction to opioids (Bickel & Marsch, 2001; Kirby, Petry, & Bickel, 1999; Madden, Petry, Badger, & Bickel, 1997), obesity (Epstein, Salvy, Carr, Dearing, & Bickel, 2010; Weller, Cook, Avsar, & Cox, 2008), inflation (Ostaszewski, Green, & Myerson, 1998) and some types of reward (e.g., money, health and vacation) (Chapman & Elstein, 1995).

The magnitude of reinforcement has also been found to influence discounting rates: larger discounting has been observed for smaller reinforcements, and smaller discounting for larger reinforcements. Thaler (1981), for example, found that participants who were indifferent when choosing between US\$ 15 to be received immediately or US\$ 60 available after one year, were also indifferent between getting US\$ 3000 immediately or US\$ 4000 in one year. In the first case, with smaller magnitude values (US\$ 15 vs. US\$ 60), the annual discounting rate was equal to 300%, whereas in the second case, with larger magnitude values (US\$ 3000 vs. US\$ 4000), the annual discounting rate was equal to 33% (e.g., Chapman & Winquist, 1998; Mitchell & Wilson, 2010; Thaler, 1981). This ratio, termed magnitude effect, has also occurred regardless of the kind of reinforcement being assessed, such as money, medical treatment, vacation trips or job choices (Chapman, 1996; Green & Myerson, 2004). The present study investigates if a magnitude effect occurs in the context of purchasing differently priced electronic equipments and more or less differentiated brands of such products.

Several temporal discounting experiments have also shown that results stemming from procedures with hypothetical reinforcements have not differed from results obtained in experiments that used real reinforcements (cf. Green & Myerson, 2004; Johnson & Bickel, 2002; Locey, Jones, & Rachlin, 2011). Some authors have even defended that procedures adopting hypothetical reinforcement show some advantages over procedures that use real reinforcement, such as money (cf. Rachlin, 2016).

Although this research is focused on temporal discounting in gaining situations, it is worth highlighting that, while for reinforcing consequences the fact that equivalent delayed rewards are gradually discounted turns the most immediate consequence into the preferred one, the opposite occurs for aversive consequences. Equivalent delayed aversive stimuli are progressively discounted which turns the most immediate consequence into the avoided one. Therefore, if the delay is the only dimension in which both alternatives differ, people tend to prefer the more delayed aversive consequence (Odum, Madden, & Bickel, 2002). Preference reversal also occurs with aversive alternatives, that is, when the alternatives differ in magnitude, most people initially (in Time 1) choose SS (e.g., to pay a smaller fee sooner), but as the moment to SS approaches (in Time 2), most people tend to change their preference to LL (e.g., to pay a larger fee later); which is the opposite of what occurs when reinforcing alternatives differ in terms of delay and magnitude (Holt, Green, Myerson, & Estle, 2008). Regarding the magnitude effect, although in some experiments with aversive alternatives the discounting rate for smaller magnitudes are higher, generally these results have not been statistically significant. Moreover, when magnitude effects are compared, the ones for losses are smaller than those for gains (Chapman, 1996; Estle, Green, Myerson, & Holt, 2006; Holt et al., 2008; Mitchell & Wilson, 2010).

The hyperbola function – or the functions derived from it, such as the hyperbola-like discounting function – has fitted more precisely data stemming from temporal discounting studies than the exponential function, both for gain (Green & Myerson, 2004; Green, Myerson, & McFadden, 1997; Rachlin et al., 1991) and loss scenarios (Estle et al., 2006; Ostaszewski & Karzel, 2002). One of the purposes of the present research is to examine which of the two functions provide better description of temporal discounting in the context of choosing among brands of electronic products.

Considering that the influence of several of these investigated variables upon temporal discounting has also been demonstrated in experiments with non-human animals (e.g., Kagel et al., 1995), this general intertemporal choice framework can approximate interpretations of shopping behavior of humans to foraging behavior of non-human animals, assuming that there is biological and behavioral continuity across species, derived from evolutionary selection (cf. Rajala & Hantula, 2000). Following this line of enquiry, the present paper investigates temporal discounting related to product categories and to products that differ with respect to brand differentiation level. In order to do so, brand differentiation is interpreted in the context of the Behavioral Perspective Model, which constitutes the most systematic behaviorally-oriented approach to consumer choice.

The Behavioral Perspective Model (BPM)

This model was elaborated by Foxall in the 1980s, which integrates principles of behavior analysis, behavioral economics and marketing science (Foxall, 1990, 1998, 2010). The BPM represents an alternative to cognitive approaches that prevail in the field of consumer research, which has presented lack of consistency between attitudes and behaviors and has neglected the influence of situational variables upon behavior (Foxall, Oliveira-Castro, James, & Schrezenmaier 2006b; Oliveira-Castro, 2013).

As shown in Fig. 1, according to the BPM, consumer behavior produces utilitarian and informational consequences in the environment, which can be reinforcing or punishing. Utilitarian consequences, both reinforcing or punishing, derive directly from the ownership and use of products and services, and are related to the functional and practical results associated to the purchase or use of a given product or service (e.g., the use of available resources of a cell phone device, door-to-door transportation obtained from using a car). On the other hand, informational consequences, both reinforcing or punishing, are social, they derive from actions and reactions of other people, and can consist of feedback related to the adequacy of the individual's performance as a consumer (e.g., the prestige of owning a certain cell phone device, the status obtained from driving an expensive and luxurious car brand). The model assumes that products and services offer different levels of utilitarian and informational reinforcement, which have been programmed by manufacturers or marketing managers. Effective reinforcing value might vary for individual consumers, considering that product or service reinforcing characteristics are planned to influence most consumers or an average consumer, although higher levels of planned utilitarian and informational reinforcement are usually reflected in their higher prices in the market. Previous research has shown that this difference among utilitarian and informational reinforcement level can be measured in different ways (e.g., Foxall, Oliveira-Castro, & Schrezenmaier, 2004; Oliveira-Castro, Foxall, James, Pohl, Dias, & Chang, 2008a; Pohl & Oliveira-Castro, 2008).

According to the BPM, the immediate antecedents to consumer behavior are the consumer's learning history, which is comprised of past experiences with certain products/services or similars, and the consumer behavior setting, which comprises aspects of the temporal, physical, social and regulatory aspects of the environment where the behavior occurs. Therefore, the context in which the consumer is located, for example, a supermarket aisle, includes events that signal, or are associated to, certain consequences. For instance, a given product brand might have become associated, in past consumption occasions, to an enjoyable flavor, a low price and compliments from family members. This brand on the supermarket shelf functions as a discriminative stimulus by signaling that the response of buying it will be followed by such reinforcing consequences. According to the BPM, the behavior setting may vary from being relatively open (i.e., many choice alternatives, no punishment, for example, a rock-and-roll show) to relatively closed (i.e., few choice alternatives, programmed punishment, for example, an opera presentation) (cf. Foxall 1998, 2010).

Fig. 1 Schematic representation of the behavioral perspective model (BPM), adapted from (Foxall, Oliveira-Castro, James, Yani-de-Soriano, & Sigurdsson 2006a)

Brand differentiation has been interpreted, in this framework, as differences in the level of informational reinforcement offered by each brand (cf. Oliveira-Castro et al., 2008a). One way of measuring the level of informational reinforcement associated to brands is to probe the programmed social contingencies related to buying different brands. This has been done with the use of a simple questionnaire, which measures what people say about the quality and familiarity of different brands. The assumption is that if most people state that a given brand is well known and of high quality, there is a higher probability that buying such a brand will be followed by social reinforcement than if the brand is little known and evaluated as having low quality. Oliveira-Castro et al. (2008a) and Oliveira-Castro, Foxall and James (2008b) used a questionnaire containing two to be answered according to four-point Likert-type scales: “How well is the brand known?” (0 – Unknown; 1 – Little known; 2 – Fairly known; and 3 – Very well known) and “What is the quality level of the brand?” (0 – Unknown/No opinion; 1 – Low quality; 2 – Medium quality; and 3 – High quality). The average, across respondents, of these mean values of knowledge level (K) and quality level (Q) – named MKQ – of the studied brands indicates if they produce consequences with high or low informational level (Oliveira-Castro et al., 2008a, b; Oliveira-Castro, Foxall, & Wells, 2010; Oliveira-Castro, Foxall, Yan, & Wells, 2011; Pohl & Oliveira-Castro, 2008). Previous studies have shown that this kind of measure of brand informational reinforcement produces similar results when applied both to small groups (around 20) and to large groups (more than 120) of respondents (Oliveira-Castro et al., 2008b).

The main purpose of the present research was to investigate temporal discounting in the context of choices involving electronic products and brands of such products. One of the objectives is to examine possible effects of the level of informational reinforcement offered by brands upon the rate of temporal discounting. For this reason, the study was divided into two phases. The first phase consisted of measuring the level of informational reinforcement offered by brands of cell phone, tablet and TV set. In the second phase, a temporal discounting task was used, in which participants had to state the delivery fee they were willing to pay (cf. Hantula & Bryant, 2005) in order to receive, with various delays, different brands of each of the products. Moreover, considering that the type of temporal discounting functions can be used to test basic assumptions concerning the phenomenon, such as the prediction of preference reversals, the goodness of fit of the exponential and hyperbolic functions were compared.

Method

Participants

In the first phase, 73 undergraduate Psychology students at the University of Brasília (UnB) participated in the research. The socio-demographic data of this sample were not collected. In the second phase, 51 students (34 females) enrolled in Introduction to Psychology classes at UnB collaborated with the research. In this second sample, 50 participants provided socio-demographic information, among whom: 48 owned cell phones; 27 had daily access to a tablet; 49 had daily access to a TV set; 41 had already made an online purchase involving delivery fees; 20 earned their own income which varied from R\$ 200.00 to R\$ 1500.00 per month; 42 provided information on family

income whose amounts varied from R\$ 500.00 to R\$ 35,000.00 monthly. Sample selection of course classes was non-random for it depended upon the availability of students and teachers to participate in the research. No variable related to students and professors was identified that could restrain the analyses of the results.

Materials and Procedures

In the first phase of the research, students were asked to fill in Questionnaire 1 in the classroom at the end of the class. The purpose of this two-page questionnaire was to measure, among UnB students, the level of informational reinforcement associated to owning and using brands of three electronic products – cell phone, tablet and TV set. The brands to be evaluated were those sold at three popular e-commerce websites. These products were chosen for being desired by both genders and for being commonly sold online. The questionnaire had a brief description about the objective of this research phase (“We would like to have information on how different brands of electronic products are known by consumers, and how consumers assess the quality of those brands”), filling instructions and questions related to the products. For each product, there was an indication of their type of operating system and the names of the brands were randomly listed – no figures nor photographs were used. For 16 brands of smartphones with android operational system, 45 brands of tablet with android operational system, and for eight brands of smart TV, each participant was requested to evaluate if they were well known and to assess their level of quality through a two four-point Likert-type scales, ranging from zero to three (Oliveira-Castro et al., 2008a, b). In order to calculate the level of informational reinforcement programmed by each brand, the average of the two scores (familiarity and quality) was calculated for each participant. One advantage of averaging the two scores, over, for example, a multiplicative approach, is to distinguish brands that are somewhat known to the consumer but its quality level is considered to be equal to zero from those that the consumer does not know at all, which would both receive a score of zero in a multiplicative combination. Then, the MKQ was calculated, across respondents, for each brand of each product. Thus, for each product, it was possible to find the brand with the highest MKQ (equivalent to the brand that produces the highest level of informational value – brand A) and the brand with the lowest MKQ (equivalent to the brand that produces the lowest level of informational value – brand B). Based upon this information, Questionnaire 2 was elaborated.

In the second phase of the research, the students were asked to fill in Questionnaire 2 in the classroom at the end of the class. The purpose of this eight-page questionnaire was to assess how would brands A and B of each of the three products be temporally discounted. This questionnaire did not make explicit the objectives of the research to avoid any influence that this information might have had on participants’ responses. Instructions asked participants to imagine that they were navigating on a reliable website to buy electronic products of different brands, but with equivalent features, functions and prices. For each hypothetical purchase, they should fill in the values that they would be willing to pay for the delivery of the product as if the situation were real. They should also fill in only one page at a time without going back to the pages that they had already filled, and without consulting the next pages. Right after the instructions, on the same page, there was a field reserved for an individual answering training,

where the student could ask questions to the experimenter until he or she felt ready to start answering the questionnaire alone. The six following pages of the questionnaire had six online purchase simulations involving choices of delivery fees: smartphone with android operational system of the A and B brands; tablet with android operational system of the A and B brands; and smart TV set of the A and B brands. In all simulations, the participant was informed that the delivery time of 21 consecutive days would be free, and that he or she should fill in the value that he or she would be willing to pay for faster delivery, according to the following delays: 14 consecutive days, 7 consecutive days, 5 consecutive days, 3 consecutive days and 1 day. Aiming at reducing an eventual device's upgrade effect, the participant was instructed to imagine, in all purchase simulations of this research, that he or she did not have access to the type of product that hypothetically he or she was purchasing (e.g., "Imagine that you don't have access to a tablet and that you are purchasing an android tablet from the brand **Samsung** in a reliable website. The delivery time of 21 consecutive days is free. Please fill in the values that you would be willing to pay for delivery according to the delays indicated below."). Once more, no figures nor photographs were used in the questionnaire.

To minimize possible effects of the order of presentation, two versions of the questionnaire were randomly distributed to the students: AB order, where A brands were presented before B brands; and BA order, where this was reversed. In both versions, the presentation order of the products remained the same: cell phone before tablet, and tablet before TV set. The last page of the questionnaire consisted of questions related to socio-demographic information: gender, age, family income, own income, own cell phone, possible access to a tablet or a TV set, the brands of these three products, experience with online purchasing that involved delivery fees, name of the undergraduate major at UnB and the corresponding academic semester. Right after filling in Questionnaire 2, a text was presented which explained to participants the objective of the research.

The idea of using delivery fees to measure temporal discounting, the values of delivery delays and the alternative of presenting a free delivery were based on the already mentioned study on temporal discounting conducted by Hantula and Bryant (2005). Aiming at optimizing data collection time, the FITB method was chosen. Thus, participants were asked to directly inform the value they would be willing to pay as delivery fee related to each delay. The experimental situation is interpreted as temporal discounting of reinforcing consequences, that is, temporal discounting in a context of gains. The reason for this is that, although participants are hypothetically losing money to pay for delivery fees, they do so to obtain the purchased products quicker than the 21-day free delivery. This feature differs from typical experiments of temporal discounting of aversive consequences, since in such experiments participants only loose rewards without gaining anything to compensate the loss. In addition, it is worth mentioning that the informational value levels (A and B) and the delays in consecutive days (21, 14, 7, 5, 3 and 1) correspond to the independent variables (IV) of the experiment. On the other hand, delivery fees informed by participants correspond to the dependent variable (DV), which are interpreted as equivalent to temporal discounting indifference points.

Considering that delivery fees decrease as delay increases and reach the value of zero, for the 21-day delay, and that this would generate calculation difficulties (for this

value of zero would have to be eliminated from the analyses), the average market price of each selected product was added to the values of delivery fees provided by the participants in all other delays. Therefore, constant amounts of R\$ 340.00, R\$ 485.00 and R\$ 1700.00 were added to the delivery fees for cell phone, tablet and TV set, respectively. These average market prices were calculated from price research in three popular e-commerce websites. It is considered that the students would be willing to pay for these amounts to get the purchased products as these are the products' average market prices. With this, each temporal discounting indifferent point (IP) was obtained by the sum of the product's market price (P) and the delivery fee (F) informed by the participant. From now on, the value of this sum will be referred to as PF.

Finally, it is worth mentioning that, in order to calculate equation parameters, PF value for 1-day delay (the closest delay to the present) was adopted as the present value of each product (the non-discounted value of a future reward, i.e., the A parameter in both equations). Consequently, the A parameter was not equal to all participants, as each one of them was willing to pay a different fee for this shortest delay.¹ Considering, moreover, that the obtained data were not normally distributed and could not be normalized without adjustments on the scores correction that would jeopardize individual analyses, non-parametric tests were used to analyze research data.

Results

For each product, the MKQ of all brands resulting from the scores of 73 participants was ranked with the objective of establishing the brands with the highest and the lowest MKQ for the elaboration of Questionnaire 2 to be used in the second phase. Among the 45 tablet brands Samsung® (2.48) had the highest MKQ, and Dazz® (0.00) was one of the brands that had zero as MKQ. They were, respectively, established as the A and B brands of tablet. On the other hand, among the eight TV set brands Sony® (2.65) and AOC® (0.42), respectively, had the highest and the lowest MKQ, and were defined as the A and B brands of TV set. Among the 16 cell phone brands, Samsung® (2.77) had the highest MKQ followed by Sony® (2.61). However, considering that these brands were already chosen as the A brands of other products, and aiming at minimizing eventual effects of brand repetition, Motorola® (2.60), the third brand with the highest MKQ, was established as the A brand of cell phone. Finally, although the Tct Mobile Telefones® had the lowest MKQ (0.08), this barely unknown brand was not considered due to its foreign name in the Brazilian context, which could cause an undesirable effect on the experiment. With this, the second brand with the lowest MKQ, MEU® (0.11), was chosen as the B brand of cell phone. From now on, they will be referred to as products A and B in each product category (e.g., cell phone A, tablet B).

To verify if participants provided different average indifference points (IP), for A and B brands, means of price plus delivery fee (PF), calculated for each participant across all delay values, of A brands were compared to the same mean PF obtained for B brands through the Wilcoxon signed-rank test. The test revealed that, in average across all delays, participants were willing to pay significantly more for the delivery of A

¹ Another procedural decision was the elimination of data from one of the 51 participants that filled in Questionnaire 2 because he or she attributed delivery fees equal to zero to all products in all delays.

brands than for the delivery of B brands for all three product categories (cell phone: $N = 50$, $Z = -3.23$, $p < 0.01$, $r = -0.32$; tablet: $N = 50$, $Z = -4.71$, $p < 0.01$, $r = -0.47$; and TV set: $N = 50$, $Z = -3.60$, $p < 0.01$, $r = -0.36$).

Figure 2 presents mean values, across participants, of product price plus delivery fee (PF) obtained for A and B brands in each delay. The figure shows that mean values of PF, calculated across participants, were higher for A brands than for B brands in all delay values for all three products.

Parameters for the exponential (Eq. 1) and hyperbolic (Eq. 2) functions were calculated with data obtained for each participant for each product and each type of brand (A and B). Both equations fitted the data well showing median R^2 values equal or higher than 0.90, with more than 75% of values above 0.80, in all six conditions (two brands of three products). With the purpose of contrasting the goodness of fit of the two equations, coefficients of determination (R^2), obtained from statistically significant functions, were compared with the use of the Wilcoxon signed-rank test. The test revealed that the hyperbola function fitted the data significantly better than the exponential function in the cases of cell phone A ($N = 47$, $Z = -3.04$, $p < 0.01$, $r = -0.31$), cell phone B ($N = 45$, $Z = -4.01$, $p < 0.01$, $r = -0.42$), tablet A ($N = 48$, $Z = -2.24$, $p < 0.05$, $r = -0.23$) and tablet B ($N = 46$, $Z = -3.22$, $p < 0.01$, $r = -0.34$). However, there was no significant difference in R^2 between the hyperbola and exponential functions in the case of TV set A ($N = 48$, $Z = -0.89$, $p > 0.05$, $r = -0.09$) and TV set B ($N = 47$, $Z = -0.21$, $p > 0.05$, $r = -0.02$), despite that fact that there were more cases of better adjustments for the hyperbola than for the exponential function.

Figure 3 shows mean values and standard deviations of residuals, calculated across participants for each product (across brands A and B), obtained from fitting the hyperbola and exponential equations to the data from each participant. As can be observed in the figure, means and standard deviations obtained with the two equations were very similar, with respect to their absolute values and to the directions of deviations, for all three products. For both equations residuals were positive for the 1-day delay and became increasingly negative as delay increased from one to seven days, returning to be positive in the two longest delays of 14 and 21 days.

Fig. 2 Mean values of product price plus delivery fee per delay obtained for a and b brands of cell phone, tablet and TV set ($N = 50$). Continuous lines represent a brands and dotted lines represent b brands

Fig. 3 Means and standard deviations of residual, calculated across participants for each product (across brands), obtained from fitting the hyperbolic and exponential discount functions to the data of each participant

Considering the significantly better adjustment of the hyperbola, based upon the values of R^2 , when compared to the exponential function and the similarity of the residuals generated by each function, the values of parameter k obtained with Eq. 2 were used to examine whether temporal discounting differed between A and B brands, using parameter values derived only from statistically significant applications of the equation. Table 1 presents medians of k and the values of k for inter-quartile ranges, calculated across participants, obtained from Eqs. 2 for each brand type of each product. As the table shows, values of k were higher for A brands than for B brands

Table 1 Medians of k and values of k for inter-quartile ranges, obtained with Eq. 2 (hyperbola), per brand type for each product

Product	N^a	Median of k	k for inter-quartile range
Cell phone A	44	0.003865	0.002775 to 0.006910
Cell phone B	44	0.003675	0.002590 to 0.005924
Tablet A	46	0.003324	0.001959 to 0.005773
Tablet B	46	0.002409	0.001749 to 0.003975
TV set A	47	0.001384	0.000786 to 0.002684
TV set B	47	0.001160	0.000677 to 0.002570

^a N refers to the number of participants whose k were derived from significant hyperbola functions for both the A and B brands per product.

for all three products. In order to test whether such differences were statistically significant, a Wilcoxon signed-rank test was conducted, considering only k values for participants for whom the hyperbola function showed significant results for both A and B brands. The test revealed that k was significantly larger for A brands than B brands for cell phone ($N = 44$, $Z = -2.88$, $p < 0.01$, $r = -0.31$), tablet ($N = 46$, $Z = -4.21$, $p < 0.01$, $r = -0.44$) and TV set ($N = 47$, $Z = -3.18$, $p < 0.01$, $r = -0.33$), indicating that temporal discounting was larger for A brands than for B brands. In addition, the medians of k and the amounts of k of interquartile ranges were higher for A brands than for B brands. Still according to the mentioned test, there were more cases in which k for the A brand was higher than the k for the B brand for all the products.

Results presented in Table 1 also show that values of k were larger for cell phone than for tablet, which in turn had larger k values than TV set. Considering that average market prices were ranked in a reversed order, that is, TV sets had higher prices than tablets, and tablets had higher prices than cell phones, values of k were inversely proportional to product average prices. A Wilcoxon signed-rank test was conducted to examine if such differences, among products, were statistically significant. The test showed that parameter k was significantly larger for cell phone A than for tablet A ($N = 46$, $Z = -5.30$, $p < 0.01$, $r = -0.78$) and for TV set A ($N = 46$, $Z = -5.91$, $p < 0.01$, $r = -0.87$), for tablet A than for TV set A ($N = 47$, $Z = -5.91$, $p < 0.01$, $r = -0.86$), for cell phone B than for tablet B ($N = 41$, $Z = -2.79$, $p < 0.01$, $r = -0.44$) and for TV set B ($N = 42$, $Z = -4.38$, $p < 0.01$, $r = -0.68$), and for tablet B than for TV set B ($N = 45$, $Z = -4.93$, $p < 0.01$, $r = -0.73$).

Finally, to verify if the presentation order of the A and B brands in Questionnaire 2 had any influence upon discounting rates, values of k from the group presented to the AB order were compared to those from the group presented to BA order based upon the Mann-Whitney test. Again, only values of k obtained from statistically significant hyperbolic functions, for both brand types, were considered. The test revealed that although all the medians of k related to the BA order were higher than the medians of k related to the AB order, there was no statistically significant effect of order on values of k for any of the products.²

² All these results, concerning the values of k across products and brands, remain unchanged when Equation 1 (exponential) is used.

Discussion

The present study investigated temporal discounting in the context of choices of delivery fees when purchasing electronic products that differed in terms of brand differentiation. Results indicated that both hyperbolic and exponential functions fitted well the data, producing residuals that were similar in value and in direction, although the hyperbolic function showed statistically significant superiority in fitting the data for two of the three products. In the case of TV sets, although adjustment parameters (R^2) were higher for the hyperbola, the difference was not statistically significant, what may have been partly due to the fact that undergraduate students have less experience purchasing this type of product than they have in buying cell phones and tablets. This finding, related to a better adjustment of the hyperbola, corroborates the majority of empirical studies in the literature, suggesting that there is preference reversal in temporal discounting (Estle et al., 2006; Green & Myerson, 2004; Green et al., 1997; Ostaszewski & Karzel, 2002; Rachlin et al., 1991).

In the procedure adopted here, participants were willing to pay delivery fees in order to receive a product faster. In this case, the interpretation of preference reversal is slightly different than the usual interpretation. Typically, in temporal discounting tasks, a preference reversal refers to a switch in preference from the larger more delayed (LL) reinforcing alternative to the smaller more immediate one (SS), as the delay to receive the SS decreases. In the present case, paying for higher delivery fees to obtain the product sooner could be compared to the SS alternative, since the person would be getting the same product with higher costs. According to this interpretation, the LL alternative would then correspond to receiving the product delayed without any extra cost (i.e., free delivery in 21 days). The prediction of preference reversal, derived from a hyperbolic discounting, indicates that the decrease in the fee that participants would be willing to pay is not constant in the waiting interval, that is, participants would be willing to pay proportionately higher fees to have the product delivered sooner, the closer they are to the day of delivery. For instance, if one considers the median value of k (0.003865) and of A (R\$ 370) for cell phone A, applying Eq. 2, it is possible to estimate how much participants were willing to pay for each day of delay during the 21-day period. Such estimation indicates that participants were willing to pay R\$ 30 (R\$ 370 - R\$ 340) to reduce their wait in 20 days, at the beginning of the period (delay of one day, which is the value of A minus the product market price), which corresponds to a price of R\$ 1,50 per day of anticipation. This same calculation indicates that participants would be willing to pay R\$ 1,53, R\$ 1,62 and R\$ 1,94 per day of anticipation in order to reduce their wait in 15, 10 and 5 days, respectively, in relation to the 21-day free-delivery waiting time. Therefore, these results suggest that the subjective value of anticipating one day to receive the product decreases as the waiting period increases. This implies that there will be a time in delivery delay at which preferences between paying to anticipate delivery and waiting for a free-delivery will switch. This type of result illustrates a possible application of temporal discounting framework to marketing and might be useful to managers in planning their delivery options.

Another interesting finding was that temporal discounting was larger, that is, parameter k was larger, for cell phones than for tablets and TV sets, and was also larger for tablets than for TV sets, of both types of brands. Considering that market price of cell phones was the lowest among the three products, that market price for TV

sets was the highest, and that the price of tablets was situated between the prices of the other two products, this findings corroborates the occurrence of a magnitude effect, frequently recorded in the field (e.g., Chapman, 1996; Chapman & Winquist, 1998; Green & Myerson, 2004; Mitchell & Wilson, 2010; Thaler, 1981), in a quite different choice context, in which participants estimated the amount they were willing to pay for faster delivery of such products. This adds to the robustness of the magnitude effect in temporal discounting and suggests, particularly to those interested in consumer behavior, that consumers not only may be willing to pay less for delivery of cheaper products, when compared to more expensive ones, but also that the amount they are willing to pay decreases faster with increases in delivery delay.

The adoption of the BPM to interpret consumer behavior made possible to measure brand differentiation on the basis of the level of informational reinforcement offered by different brands (e.g., Oliveira-Castro et al., 2008a, b; Oliveira-Castro et al., 2010; Oliveira-Castro et al., 2011; Pohl & Oliveira-Castro, 2008). The finding of higher rates of temporal discounting associated to brands with higher level of informational reinforcement, i.e., more differentiated A brands, could not have been predicted based on the literature, in view of the lack of marketing research using the temporal discounting framework. If one considers that A brands usually have higher prices than B brands in the market and that participants would be able to estimate this, this finding contradicts somewhat the frequently recorded magnitude effect, in the sense that more expensive items would be temporally discounted more steeply than less expensive ones. The phenomenon becomes even more interesting in face of the magnitude effect observed when product categories were compared, in which cell phones, the cheapest product, showed higher discounting rates than tablets, medium priced product, which in turn had higher discounting rates than TV sets, the most expensive product. Taken together, these results indicate that, as far as price is concerned, temporal discounting tends to go in opposite directions depending if one is conducting a between-product analysis or a within-product analysis (i.e., comparing brands). Temporal discounting would be inversely related to price between products, while it would be directly related to price between brands within a given product category. This suggests the occurrence of complex discounting interactive patterns in real life purchase situations.

This opposite effects, observed within and between product categories, resemble those reported in previous work that investigated consumer search behavior. Oliveira-Castro (2003), examining product search duration in a supermarket, found that consumers spend significantly more time searching for more expensive products than for cheaper ones, even when search periods were very short, lasting only a few seconds. When the same type of methodology was applied to the investigation of search duration of brands within a given product category, shorter search duration were associated to brands that offered higher levels of informational reinforcement (cf. Pohl & Oliveira-Castro, 2008). This suggests that, both in search duration and in temporal discounting, intra-product variables, related primarily to informational reinforcement, have different effects than typical economic variables, such as utilitarian reinforcing characteristics and punishing consequences (e.g., costs).

Moreover, considering that the level of informational reinforcement is related, conceptually, to social reinforcement, rather than to utilitarian benefits obtained from product ownership and use, it could be speculated that choice alternatives associated to higher levels of social reinforcement, in general, are temporally discounted more steeply than

alternatives associated to lower levels of informational reinforcement. The learning process related to informational consequences, mediated by others and, usually, by verbal behavior, may be at the basis of such differences. The present results do not allow for the identification and separation of these possible effects derived from consumer learning experience. The results seem to have identified a phenomenon that calls for explanation, which might be advanced if more research effort is directed to examine it.

The use of temporal discounting framework to analyze consumer behavior in relation to existing products and brands may be a promising line of investigation that tends to integrate, in a novel way, behavioral economics and marketing. It opens a wide range of possibilities of studying temporal discounting in the context of existing products and brands, which might be useful to the development of research in consumer behavior and marketing. Contrary to the typical research of temporal discounting in behavior analysis, where much focus has been given to individual and group differences in temporal discounting, from a marketing perspective, it is relevant to obtain measures of temporal discounting associated to certain products and brands or types of products and brands. In order to do so, it would be relevant to test the generality of the present findings to non-simulated situations in which participants can choose to actually pay for delivery of products that they will in fact obtain. Although temporal discounting results obtained with simulated choices have been extensively replicated with real choice situation, the use of a new procedure, using payment of delivery fees, and of novel marketing-like variables, such as existing products and brands, calls for attempts to replicate these findings in real-choice situations.

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