Innovation Adoption and Decision Difficulty in High Technology Products: a Study With Cell Phones

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The aim of this study is to analyze how the introduction of new attributed, generally considered complex, affects the adoption of high technology products by consumers. To this end, the relationships between personal characteristics and the interpersonal influences of consumers have been evaluated, considering the difficulties of decision making in the adoption of technological innovations in cellular phones. There were two stages to the field research. The first was qualitative, with in-depth interviews with consumers and professionals in the field of cellular telephones. The second was quantitative involving 303 university students aged 17 to 25 who owned a cellular phone. The results obtained show that the independent variables analyzed had a great deal of influence on the adoption of new generation telephones. The moderating variable “Decision Difficulty” had a relatively heavy influence on the adoption of innovations in cellular phones.

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The Adoption of Innovations in High Technology Products by Young People: The Case of the Cellular Phone
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ABSTRACT
The aim of this study is to analyze how the introduction of new attributes, generally considered complex, affects the adoption of high technology products by consumers. As such, the relationships between personal characteristics and the interpersonal influences of consumers have been evaluated, considering the difficulties of decision making in the adoption of technological innovations in cellular phones. There were two stages to the field research: the first was qualitative, with in-depth interviews with consumers and professionals in the field of cellular telephones; the second was quantitative, involving 303 university students aged 17 to 25 who owned a cellular phone. The results obtained show that the independent variables analyzed had a great deal of influence on the adoption of new generation telephones. The moderating variable “Difficulty to Decide” had a relatively heavy influence on the adoption of innovations in cellular phones.

INTRODUCTION
Nowadays, technological innovations are happening at an impressive rate. It is often the case that when a person finally learns how to use a product, it becomes obsolete and is superseded by a more advanced version. In some cases, the speed of the launching of novelties is faster than their diffusion and familiarization. Moreover, gadgets that once had few functions and only a few buttons to press have become much more complex with the introduction of new features. A certain amount of effort is directed in learning how to use the gadget before all these new functions can be properly used.

In this sense, the introduction of new or even completely unknown attributes in gadgets, which make them complicated to use, may lead the consumer to perceive a dichotomy concerning the novelty, and this can be positive or negative. This perception, together with the personal and emotional characteristics of the consumer, can affect whether the product will be adopted: the consumer may believe that the innovation is too complex and that it would take a great deal of effort to learn how to use it and that the product is not worth buying; or; he may also be in doubt as to whether he should postpone the purchase and find out more about it or wait for a friend to buy the product and reduce his uncertainty.

The main aim of this study is to analyze how far personal characteristics, perceived characteristics and interpersonal influences and difficulty to decide affect the adoption of technological cell phone innovations by young people, according to the diffusion paradigm of innovation adoption by consumers of Gatignon and Robertson (1991).

DIFFUSION PARADIGM OF INNOVATIONS AMONG CONSUMERS
There are several definitions of innovation in the diffusion literature. Rogers (2003, p. 12) defines innovation as “an idea, practice or object that is perceived as new by an individual or other unit of adoption”. He also states that it matters little whether an idea is objectively new or not; what really matters is the reaction of an individual, i.e., if the idea is new to him, then it is an innovation.

To overcome the gap found in studies about diffusion among consumers, Gatignon and Robertson (1985) introduced a new theoretical proposal to advance in these studies and developed a model of the diffusion process. To formulate their model, Gatignon and Robertson (1991) used Rogers’ fundamental concepts of the diffusion theory as a basis. Therefore, the main elements of the diffusion paradigm are: innovation and its characteristics; the social system within which the innovation is diffused; the diffusion process that occurs; the adoption process by the individual consumer; the interpersonal influence that is transmitted; personal characteristics of the innovators and other adopters; the marketing strategy for the innovation and competitive activities within the product category. According to the authors, the model is not exhaustive and more interactions may take place. Each construct may also be prepared in a more complete way.

In this study, we analyze personal characteristics (familiarity, expertise, prior knowledge and the tendency to innovate), perceived characteristics and interpersonal influences. To the paradigm, we have added another element: Difficulty to Decide. This is a measuring variable. The rationale behind including this variable is to verify how the affective aspects of Difficulty to Decide influence the decision-making process. According to Souza (2002), there are few academic studies that investigate the role of emotions in behavior when it comes to the adoption of technology.

Familiarity is an important characteristic in the adoption of innovations. Alba and Hutchinson (1987) define this concept as “the number of experiences with related products that have been accumulated by the consumer” (p. 411).

Johnson and Russo (1984) studied the impact of consumers’ familiarity on their capacity to seek and learn new information. When consumers evaluate every alternative they have, familiarity facilitates learning. However, when consumers are instructed to choose an alternative, a higher degree of familiarity results in a limited search and less learning of new information. This is also confirmed in the study of Anderson and Jolson (1980).

Consumer knowledge is an important construct, being utilized to understand the behavior of those seeking information (Brucks, 1985; Rao & Sieben, 1992) and processing consumer information (Alba & Hutchinson, 1987; Bettman & Park, 1980; Johnson & Russo, 1984, Rao & Monroe, 1988). Park, Mothersbaugh and Feick (1994) analyzed the evaluation of consumer knowledge, which may be relative to information concerning the product or some previous experience with it. According to these authors, knowledge can be objective or subjective. Objective knowledge is “accurate information about a class of products stored in the memory in the long term” (p. 71). Self-assessed or subjective knowledge is “people’s perception of what or how much they know about a class of products” (p. 71). This separation of knowledge into two constructs was also done by Brucks (1985), Park and Lessig (1981) and recognized by Wood and Lynch (2002).

The results of the study by Park, Mothersbaugh and Feick (1994) demonstrate that evaluation of knowledge is based more on memory of experience with a product (through a search for information about the product, use of the product and/or ownership of the product) than on memory of information about the product.
According to Bettman, Johnson and Payne (1991), the differences in skill and prior knowledge of each individual can affect the way information is processed, absorbed and memorized, and these differences can also influence decision making.

According to Rogers (2003, p. 22), \textit{innovativeness} is “the degree at which an individual or other adoption unit adopts new ideas relatively earlier than other members of a system”. According to Midgley and Dowling (1978), the most commonly used techniques to measure innovativeness are the ownership of new products and the cross sectional, both variations of the method of adoption time. The first technique defines as innovators those individuals who buy a product in the first weeks or months after its launch or as a certain percentage of people who are the first to acquire a product in a given market. The second technique consists of determining how many new products from a given list an individual has bought up to the time of the research.

Thus, we assume a relationship between the variables outlined above and the adoption of an innovation as:

\begin{align*}
\text{H1:} & \quad \text{The higher the level of (a) familiarity, (b) prior knowledge and (c) innovativeness, the higher the adoption of innovations by the consumer.} \\
\text{Interpersonal influences} & \quad \text{play a major role in the decision making of the consumer. Individuals are often influenced by the opinion of others in the choice and use of products and services. This is due to a desire to be accepted by others (Solomon, 2002). This desire for acceptance by a group may be one of the reasons that justify the conformity that is found through a favorable response to influence. This conformity, in its turn, is defined as changes that take place in evaluations, intentions to purchase or behavior when purchasing that result from the consumer having been exposed to the evaluations, intentions or behavior of other people (Lascu & Zinkhan, 1999; Burnkrant & Cousineau, 1975).} \\
\text{Reference groups influence consumers in three ways: information, utility and expressions of value. With informative influence, the individual seeks information from people who work with the product professionally, and these people will influence the individuals choice of brands. With utilitarian influence, the decision of an individual to buy a certain brand is influenced by the preferences of the group and the people that the individual interacts with socially. With influence that is expressive of value, the individual believes that the purchase or use of a certain brand will help him to improve his public image (Park & Lessig, 1977; Solomon, 2002).} \\
\text{Therefore, the relationship of this independent variable with the adoption of innovation may be given thus:} \\
\text{H2:} & \quad \text{The higher the level of interpersonal influences, the higher the adoption level of innovation by the consumer.} \\
\text{Difficulty to Decide} & \quad \text{Mick and Fournier (1998) analyzed the purchase and ownership of technological products from the viewpoint of the paradox of technology, emphasizing how emotions acts on consumers and which strategies are used for the purchase of these products. Technology is a paradox: the same technology that creates feelings of intelligence and efficacy may also create feelings of stupidity and ineptitude, what brings people together can also isolate them.} \\
\text{These paradoxes often bring on negative emotions such as frustration, envy and defeat, which in turn lead to a number of defiant behavior strategies. In this way, consumers play a more active role in the adoption of technology. The adoption time for technology is more related to the motivation of the consumer to deal with the paradoxes of technology and the emotions he has experienced than with his degree of innovativeness or technical competence (Mick & Fournier, 1998; Fournier & Mick, 1999; SOUZA, 2002).} \\
\text{Luce, Payne and Bettman (1999) demonstrated that trade-offs by consumers can be qualitatively different from one another and that these differences have a significant impact on choice patterns.} \\
\text{In this study, difficulty to decide will be evaluated by emotional trade-off difficulty which, according to Luce, Payne and Bettman (1999, p. 144), may be defined as “the level of subjective threat that a decision maker associates when making an explicit trade-off between two attributes".} \\
\text{According to Luce (1998), the difficulty of trade-offs leads to increased negative emotion when there is no option of decision avoidance, as in keeping the status quo. The choice of avoidance (keeping the status quo or doing nothing) may be satisfactory as it means achieving success through minimization of explicitly confronting the consequences of potentially negative difficult trade-offs. In other words, the greater the difficulty to decide, the greater the level of decision avoidance.} \\
\text{In a situation involving a decision, the main determiners of a primary evaluation are the identity attributes (e.g. highly emotional attributes such as state of health), value attributes (e.g. when the focus is on potential loss or gain) and the social context of the decision. In a secondary evaluation, the main determiner in a situation involving decision is the cognitive context of the choice. The attributes may vary along with multiple dimensions, including moral factors, importance and the cognitive facility to process the information concerning the attributes. The main result of this decision situation is an evaluation of the trade-off difficulty. The trade-off difficulty, in its turn, leads to a negative emotional experience during the choice and also to a behavior of managing difficulties to achieve success. The strategies used to deal with emotional trade-off difficulties will influence the quantity and the pattern of the decision making process (Luce, Bettman & Payne, 2001).} \\
\text{The evaluation of trade off difficulty and the second evaluation are affected by the availability of avoidance options and by the cognitive aspects of the context. The absence of an avoidance option and the choice of a low quality option lead to greater trade-off difficulty, i.e., high rates of negative experiences (Luce, Bettman & Payne, 2001). Furthermore, according to these authors, the final emotional reaction concerning a choice is a function both of the trade-off difficulty and the availability and efficacy of strategies to deal with these difficulties.} \\
\text{Therefore, the relationship between difficulty to decide and the other variables of the model may be expressed thus:} \\
\text{H3:} & \quad \text{The greater the difficulty to decide, the weaker the relationship between (a) familiarity, (b) prior knowledge, (c) the tendency to innovate and (d) interpersonal influence in the adoption of innovations by the consumer.} \\
\text{Proposed Model} & \quad \text{For the general aim of this study, and based on the outlined theoretical approach, a research model is proposed in Figure 1.} \\
\text{METHODOLOGY} & \quad \text{To achieve our objectives, descriptive research was carried out, with a single transversal study. This study was carried out in two stages. The first was the preparatory qualitative stage, or an exploratory nature, with ten in-depth interviews with users of cell phones and three interviews with professionals in the field of telephones in order to obtain the necessary information in order to}
develop the questionnaire. The methodological recommendations of Babbie (1999) and Creswell (2003) were followed in order to make the interviewee comfortable to speak freely in an informal setting and so that the answers would be as reliable as possible. All the interviews were recorded, transcribed and analyzed.

The second stage was carried out by quantitative research, using the survey method through the application of structured questionnaires. These were collected in November, 2004 at higher learning institutions in a city in the south of Brazil.

The target population was made up of undergraduate students aged 17-25 who owned cell phones. These people were chosen because young people have the highest potential to consume and their behavior is constantly evolving (Ferreira, 2003). The cell phone was chosen as it was a relatively new product on the Brazilian market and was showing high growth in the rate of sales and adoption. Under-twenty-five-year-olds exchange their telephone once a year, while older people tend to change them once every two years. Furthermore, in one year, young Brazilians spend ten billion reais on cell phones (Veja, 2003). Undergraduate students were chosen because they have greater access to sources of information and are more likely to be well informed about innovations in high technology products than the rest of the population. Nonetheless, the sample’s age definition is justified by the attempt to use a homogeneous sample, eliminating possible biases in the empirical analysis, deriving from the different consumer profiles.

The sampling technique employed was non-probabilistic for convenience. A total of 360 questionnaires were completed. Forty-four of these were not considered valid because the respondents were over the age of twenty-five. A further thirteen were excluded because they were incomplete or incorrectly answered.

**Measurements**

**Familiarity:** These variables were measured on a five-point intensity scale (from very little to very large) of the usage frequency (familiarity) of some cell phone functions. A factor analysis applying principal components with Varimax rotation was used to group the items of the scale of this variable. In the previous qualitative study, three levels of ability were identified. Therefore, an a priori three factor determination was utilized. As a final result, factor 1 (Explained variance=19.00%; Cronbach’s Alpha=0.845) represents the advanced functions group, with items such as cameras, games/image/video downloads, e-mail, etc. Factor 2 (Explained variance=14.46%; Cronbach’s Alpha=0.818) represents the basic functions group, with items such as make/receive calls, send/receive SMS. Factor 3 (Explained variance=13.00%; Cronbach’s Alpha=0.688) represents the intermediate functions group, with items such as games, ring tone downloads, alarms, etc. Measured Kaiser-Meyer-Olkin (KMO)=0.847.

**Prior Knowledge:** In order to measure the subjective Prior Knowledge, a five-point intensity scale was applied, ranging from very poor to very good knowledge of cell phones, with items such as the respondent’s knowledge about his cell phone, about cell phones in general and recent innovations in cell phones. The Cronbach’s Alpha=0.782 indicates an appropriate internal consistency. Amongst the respondents, 35% declared to have high subjective Prior Knowledge of cell phones. Objective Prior Knowledge was measured by the number of correct answers about cell phones, with multiple choice questions about GSM, MMS, WAP, polyphonic tunes, roaming, etc. From a total of seven questions, less than 25% of the respondents scored more than five.

**Innovativeness:** This variable was measured in two parts. The first one approached some consumption habits of general products, by means of a seven-point Likert scale with statements like these: "I usually try new brands rather than usual brands"; "I search for more information when I hear about a new product or service for the first time". A factor analysis applying principal components with Varimax rotation was used to group the items of the scale of this variable. As a final result, factor 1 (Explained variance=23.31%; Cronbach’s Alpha=0.820) represents the pioneer people, because they are the first one to buy some new product. Factor 2 (Explained variance=15.65%; Cronbach’s Alpha=0.732) represents the people who seek novelties. Factor 3 (Explained variance=12.73%; Cronbach’s Alpha=0.683) represents the people who usually try novelties. Measured Kaiser-Meyer-Olkin (KMO)=0.813.

The second part was evaluated according to the ownership of some innovative products, such as digital cameras, DVD recorders, plasma monitors, etc. The purpose was to generate a more objective innovativeness score. This question was evaluated by multiple correspondence analysis. The input for multiple correspondence analysis, also known as homogeneity analysis (HOMALS), is the usual rectangular data matrix, where the rows represent objects, and the columns represent variables (Marchetti, Prado & Pires, 1998; SPSS, 1998). It was noted that the points that represent product ownership come near to a parabola, indicating the presence of the Guttman Effect. Therefore, the horseshoe-shaped curve may be used to indicate the products with more or less adoption rate by the respondents (Marchetti, Prado & Pires, 1998). The final outcome is a score table, according to the ownership of the appraised products.
ranging from -1.71 to 2.75, with mean=0.00 and Standard Deviation=1.00.

**Personal Influences:** This variable was measured by a five-point intensity scale, ranging from never consulted to frequently consulted. A factorial analysis was performed to determine the existence of consulted source groups. The method used was factor analysis, with Varimax rotation. Theoretically, two groups were expected: strong reference source (personal) and weak reference source (impersonal) (Pires & Marchetti, 2000). Therefore, an *a priori* two-factor determination was used. As a final result, Factor 1 (Explained variance=26.30%; Cronbach’s Alpha=0.737) represents the weak reference source group, with items such as the internet, magazines, cell phone experts, etc. Factor 2 (Explained variance=22.99%; Cronbach’s Alpha=0.772) represents the strong reference source group, with items such as friends and colleagues. Measured Kaiser-Meyer-Olkin (KMO)=0.715. If the scale is considered as a whole (all nine items together), the measured Cronbach’s Alpha=0.740.

### PRESENTATION OF THE RESULTS

Everyone in the sample was aged between 17 and 25. 48.8% belong to the upper classes (A1 and A2) and 41.2% were middle class (B1 and B2). 90.3% have their own income, including an allowance. Furthermore, 52% stated that their personal income was over 800 reais.

A logistic regression analysis model was utilized (SPSS, 1999). The results of this regression can be seen in Table 1.

Hypothesis H1b: “the greater the prior knowledge, the higher the adoption rate” had a significant and positive result for the score of prior objective knowledge and adoption (B=0.203; W=4.073; p=0.044). This means that the respondents who answered a higher number of questions concerning cell phone equipment correctly, thereby showing greater objective prior knowledge, tend to purchase cell phones with more advanced innovative functions.

However, subjective prior knowledge had no significant relationship with adoption. Therefore, hypothesis H1c was partially corroborated. Luce, Payne and Bettman (1999) argue that subjective knowledge would have more influence on adoption than objective knowledge, which was not the case in this study. One reason for this may lie in the adoption process, i.e., people who have greater technical knowledge tend to adopt an innovation more quickly because they need to seek more information, unlike other consumers, who tend to find out more before deciding to purchase.

We can see that there is a positive relationship between Innovativeness/Pioneer and adoption (B=0.418; W=8.432; p=0.004). This means that people who normally acquire novelties are more likely to adopt a new cell phone. The definition of tendency to innovate in the view of Rogers (2003) theoretically means adoption. On the other hand, people who normally seek new things had a negative relationship with adoption (B=-0.350; W=7.176; p=0.007). Therefore, hypothesis H1c was corroborated for the relationship between adoption and Innovativeness/Pioneer.

### TABLE 1

Logistic Regression between All Variables and Adoption–Total Sample

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>B</th>
<th>Wald</th>
<th>p</th>
<th>Exp(B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovativeness– Pioneer</td>
<td>0.418</td>
<td>8.432</td>
<td>0.004*</td>
<td>1.519</td>
</tr>
<tr>
<td>Innovativeness– Seek Novelties</td>
<td>-0.350</td>
<td>7.176</td>
<td>0.007*</td>
<td>0.705</td>
</tr>
<tr>
<td>Innovativeness– Try Novelties</td>
<td>0.008</td>
<td>0.009</td>
<td>0.926</td>
<td>1.008</td>
</tr>
<tr>
<td>Innovativeness– Homals</td>
<td>-0.231</td>
<td>2.447</td>
<td>0.118</td>
<td>0.793</td>
</tr>
<tr>
<td>Subjective Prior Knowledge</td>
<td>-0.071</td>
<td>0.137</td>
<td>0.711</td>
<td>0.932</td>
</tr>
<tr>
<td>Objective Prior Knowledge</td>
<td>0.203</td>
<td>4.073</td>
<td>0.044*</td>
<td>1.225</td>
</tr>
<tr>
<td>Familiarity– Basic</td>
<td>-0.405</td>
<td>6.564</td>
<td>0.010*</td>
<td>0.667</td>
</tr>
<tr>
<td>Familiarity– Intermediate</td>
<td>0.788</td>
<td>16.280</td>
<td>0.000*</td>
<td>2.198</td>
</tr>
<tr>
<td>Familiarity– Advanced</td>
<td>0.607</td>
<td>4.748</td>
<td>0.029*</td>
<td>1.835</td>
</tr>
<tr>
<td>Personal Influence– Total</td>
<td>-0.419</td>
<td>3.979</td>
<td>0.046*</td>
<td>0.658</td>
</tr>
</tbody>
</table>

SOURCE: Research Data

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0.419; W=3.979; p=0.046). This means that the more important personal influence is (from strong and weak sources), the lower the adoption rate of innovations in cell phones with more advanced functions. Thus, hypothesis H2 was not corroborated.

This result can be compared with some other studies (Lascu & Zinkhan, 1999; Bettman, Luce & Payne, 1998, Burnkrant & Cousineau, 1975), which claim that individual desire to obtain acceptance within the group may be one of the reasons for this conformity that we see in a favorable response to influence. This conformity, in its turn, is defined as a change that takes place in evaluations, intentions to purchase or behavior resulting from exposure of the consumer to the evaluations, intentions and behavior of other individuals.

In this context, the lower rate of adoption may stem from the influence of other people, which is also in keeping with the result for the relationship with prior objective knowledge, since consumers with more technical acumen tend to be less influenced by the group. These consumers have less need to justify their decisions to the other members of the group and obtain their approval because they have more objective knowledge that allows them to make this choice by themselves.

**Adoption Considering Difficulty to Decide**

In order to examine the moderating variable Difficulty to Decide, the database was initially divided into groups based on perception of the level of importance of different attributes of cell phones and the level of perceived stress in the case of a wrong decision. This composition followed the results suggested by Luce, Payne and Bettman (1999), in which the difficulty should be verified not only in its cognitive dimensions but also concerning the affective aspects involved.

An exploratory Latent Class analysis was carried out to separate the groups in which one variable with latent k-classes is utilized to define the association between the groups formed with the observed variables. Each latent class and each cluster groups similar cases together (Prado, 2004). The results displayed two clusters: “less difficulty to decide” and “greater difficulty to decide”.

Therefore, the prior evaluation for the whole group was repeated again for each cluster. The effects of “greater difficulty to decide” and “less difficulty to decide” were given a logistic regression analysis.

Beginning the analysis with the cluster with greater difficulty to decide, familiarity with basic functions changed their relationship with adoption and was not significant when moderated by difficulty to decide. This result may be accounted for by the low complexity of these functions, which are found in almost every cell phone and which, despite being important, are not decisive attributes during the purchasing process.

When familiarity with intermediate and advanced functions and its relationship with adoption are analyzed, the results indicate that difficulty to decide does not affect the results, with the relationship being statistically significant and positive. However, familiarity with intermediate functions and the effect on adoption becomes weaker, although it does remain significant (B=0.674; W=8.765; p=0.003) and the relationship of familiarity with advanced functions becomes even more significant when moderated by Difficulty to Decide. This result corroborates some studies (Park & Lessing, 1981; Gatignon & Robertson, 1991), which show that the experience of the consumer tends to accelerate the adoption process.

Furthermore, objective prior knowledge is significant and positive for adoption by the group with greater difficulty to decide (B=0.231; W=3.367; p=0.066), but this relationship is weaker when the moderating effect of Difficulty to Decide comes into play (see Table 1).

This result suggests that prior knowledge tends to help consumers who feel that it is more difficult to decide which cell phone to buy. Bettman, Luce and Payne (1998) claim that personal characteristics such as expertise, familiarity with the product and prior knowledge tend to facilitate the process of choosing and

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Greater Difficulty to Decide Cluster</th>
<th>Less Difficulty to Decide Cluster</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Wald</td>
</tr>
<tr>
<td>Innovativeness – Pioneer</td>
<td>0.417</td>
<td>6.031</td>
</tr>
<tr>
<td>Innovativeness – Seek Novelties</td>
<td>-0.474</td>
<td>6.874</td>
</tr>
<tr>
<td>Innovativeness – Try Novelties</td>
<td>0.032</td>
<td>0.089</td>
</tr>
<tr>
<td>Innovativeness – Homals</td>
<td>-0.155</td>
<td>0.744</td>
</tr>
<tr>
<td>Subjective Prior Knowledge</td>
<td>-0.164</td>
<td>0.462</td>
</tr>
<tr>
<td>Objective Prior Knowledge</td>
<td>0.231</td>
<td>3.367</td>
</tr>
<tr>
<td>Familiarity – Basic</td>
<td>-0.272</td>
<td>1.745</td>
</tr>
<tr>
<td>Familiarity – Intermediate</td>
<td>0.674</td>
<td>8.765</td>
</tr>
<tr>
<td>Familiarity – Advanced</td>
<td>0.694</td>
<td>5.102</td>
</tr>
<tr>
<td>Personal Influence – Total</td>
<td>-0.380</td>
<td>2.249</td>
</tr>
</tbody>
</table>

**SOURCE:** Research Data
The Adoption of Innovations in High Technology Products by Young People: The Case of the Cellular Phone

There is a positive and statistically significant relationship between Innovativeness/Pioneerism and adoption when considering Difficulty to Decide (B=0.417; W=6.031; p=0.014). However, if these results are compared with the results obtained without considering Difficulty to Decide, the relationship becomes weaker, despite remaining significant.

For Innovation/Pioneer there is a negative relationship with adoption (B=-0.474; W=6.874; p=0.009). In this case, difficulty to decide heightened the tendency of the consumer not to adopt. A possible explanation for this may be that these results constitute a so-called “paradox of technology” as propounded by Mick and Fournier (1998), which assumes that emotions act on consumers and influence the strategies they use for choosing technological products.

Adoption time for technology by these consumers may have more to do with emotional aspects such as a need to acquire status, to be modern and to use a hi-tech product, a tendency that is common among the young. Bettman, Johnson and Payne (1991) argue that if there is a heavy emotional influence, the consumer tends to adopt more compensatory strategies to seek out information and compare the alternatives, which may postpone adoption should he feel any difficulty to decide.

When considering the moderating effect of Difficulty to Decide, the relationship between interpersonal influences and adoption is not significant (B=-0.380; W=2.249; p=0.134).

In this context, considering the group of respondents with greater difficulty to decide, hypothesis H3a was corroborated only for familiarity with intermediate functions. Hypothesis H3b was not corroborated for subjective prior knowledge, only for objective prior knowledge. Hypothesis H3c was corroborated only for the innovativeness of pioneers and those who seek novelties. Hypothesis H3d was not corroborated.

Analyzing the cluster with less difficulty to decide, the data indicates that six variables changed their relationship with adoption: Innovativeness/Pioneerism, Innovativeness/Seek Novelties, Objective Prior Knowledge, Familiarity (Advanced) and Interpersonal Influences ceased to have any statistically significant relationship with adoption.

On the other hand, Innovativeness/Homals had a statistically significant and negative relationship with adoption considering that there was less Difficulty to Decide (B=-0.782; W=5.519; p=0.019). A possible explanation for this could be the motives for using the equipment because there are probably some consumers who are simply not interested in adopting an innovation even when they have no difficulties in dealing with the choice process. Since the innovativeness of these consumers is already lower, if they feel the slightest difficulty, their Innovativeness drops further still.

The difficulty to adopt, however small it may be, strengthened the negative relationship between familiarity with basic functions and adoption (B=-0.962; W=8.771; p=0.003). Moreover, the difficulty to decide weakened the relationship between familiarity with intermediate functions and adoption (B=1.176; W=7.237; p=0.007).

Thus, for this group with less difficulty to decide, hypothesis H3a was confirmed for familiarity with basic functions and not corroborated for familiarity with intermediate functions and familiarity with advanced functions. Hypothesis H3b was not corroborated. Hypothesis H3c was confirmed for Innovativeness/Homals and for the rest it was not corroborated. Hypothesis H3d was also not corroborated.

**FINAL CONSIDERATIONS**

The qualitative research had shown some interesting relationships between the variables analyzed in this study. Despite the motivations for buying (and the respective adoption) having varied among the interviewees, we noted that most of those who had shown familiarity, prior knowledge and greater Innovativeness had purchased equipment with the innovations mentioned. However, there were exceptions. One interviewee, who had shown little interest in technology and little prior knowledge of cell phones, was the one who had owned most cell phone equipment of all those involved in the study and her current telephone was one of the latest models. Another interviewee showed exactly opposite characteristics and yet owned an older model of telephone.

The quantitative research showed that, among the participants, the independent variables had an influence on the adoption of the latest generation of cell phones. The moderating variable Difficulty to Decide had some influence on the adoption. However, this influence was not seen for all the proposed relationships. One possible explanation for these results concerns certain characteristics of the respondents. They were a homogenous group with very similar socio-economic backgrounds. Furthermore, the product chosen in constantly evolving, every month numerous new cell phone models with new functions are launched in the market and new services are constantly being introduced by cell phone providers. This fact may have hindered the understanding of the innovation on the part of the respondents (“old generation” versus “new generation”).

When only the relationships between independent variables (familiarity, prior knowledge, Innovativeness and interpersonal influence) and adoption were tested, almost all the relationships were significant, in keeping with the theory. Nevertheless, bearing in mind the type of product analyzed and the characteristics of the group of people analyzed, there were some differences in relation to what was proposed in hypotheses H1 and H2. The negative relationship between familiarity with basic functions and adoption is an example, which may be accounted for by the nature of these functions. As they are found in almost all cell telephones, they did not have a decisive influence on the adoption of the technology.

Moreover, subjective prior knowledge had no influence on adoption, which goes against the theory (see Luce, Payne & Bettman, 1999; Gatignon & Robertson, 1991). As what was analyzed was the adoption of a hi-tech product that is constantly being updated, the heavier influence of objective knowledge on adoption may be justified in this case.

Interpersonal influence had a negative and statistically significant relationship with adoption, contrary to the theory. Once again, this difference from what is said in the literature may be accounted for by the context, since young people are highly involved with cell phones, which could be directly linked with the desire of these consumers to be accepted by their group and paying more attention to the opinions of others. This conformity may lead them to postpone the adoption of a new technology.

When considering the moderating factor of the variable Difficulty to Decide, some results are also different from the theory and many relationships were not corroborated. This may be due in part to the limitations of the study. On the other hand, it may serve as a warning that the theory of diffusion of innovations cannot be generalized for all products and types of consumers.

By adding up the results obtained in the qualitative and quantitative research, it is believable that there are still more variables that have a stronger relationship with adoption which were not considered in this study and which may help us to understand better the adoption process of innovations in hi-tech products.
Limitations and suggestions for future studies

This study has some limitations. The first concerns the sample, as the sampling technique was non-probabilistic. According to Malhotra (2001), this technique does not ensure an objectively precise evaluation of the sampled results. As it is not possible to determine the probability of choice of any element in particular for inclusion in the sample, the estimates that were collected cannot be statistically projected to the whole population.

Another limitation concerns the people chosen for the sample. The choice of the seventeen to twenty-five age group, despite representing an important segment of the market, is restricted when it comes to considering cell phone users in Brazil. The choice of university students may not be totally representative of the population because they have more access to information and most of them are nearer the top of the socio-economic pyramid.

This study may serve as a basis for other studies. For example, it could be replicated with a different sample of people in order to make comparisons with the results obtained here. Another possibility would be to use a probabilistic sampling technique, which would allow generalizations of the results obtained. This sample could include all age groups and comparisons could be made.

On the same note, the services offered by cell phone providers could be included in a later study in order to include innovations in services. Another relevant application is replication of this study using other hi-tech products such as digital cameras, DVD recorders, PDAs, mp3 and mp4 players, etc.

The variable Innovativeness could be approached as a way of establishing in which category of products or interest the respondent could be considered an innovator in order to verify the claims of Summers (1971); Midgley (1977); Gatignon and Robertson (1985) and Schifferman and Kanuk (2000), that it is not prudent to state that consumers who are innovative in one category tend to be innovative in other categories.

It would also be interesting to investigate other variables that were not used in this study. For example, the involvement of the consumer with the product under study (see Fonseca & Rossi, 1999), the risk perception and the emotional trade-off difficulty (see Luce, Payne & Bettman, 1999; Gatignon & Robertson, 1991) and his attitude towards technology (see Parasuramanam, 2002). It would also be relevant the implementation of other analysis techniques in future studies, such as conjoint analysis, aiming to better analyze the consumers perception on the product’s complexity during the choice process.

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