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Consumers' associations to Nanotechnology products

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Abstract

Previous research has shown that product category cues and message framing are responsible for the generation of specific associations. Moreover, past study demonstrated that the associations produced can be a contributor to the attitude formation. The present study verifies that by the use of certain product category cues and message framing there can be specific associations generated for nanotechnology. The research also determined the effect of associations in attitude formation; associations can act as an indicator of the attitudes up to a certain level.

A total of 235 students were randomly assigned to fill in a questionnaire in order to provide their associations and attitudes for the comparative technology (GMOs, mobile phones) as well as for nanotechnology. There were six different versions of the questionnaire, referring to the six conditions in which GMOs and Mobile Phones were measured in three levels (similar, dissimilar, no frame). The four conditions of message framing included a comparison of GMOs and mobile phones with nanotechnology as similar or dissimilar. In the last two conditions frame was not used and the comparative cues were the only influential factor.

The results of the study showed that the associations produced for GMOs were the same as for nanotechnology in similar and dissimilar condition and in the “no frame” condition more positive for nanotechnology. On the other hand, the associations for mobile phones were more positive than for Nanotechnology in similar condition and almost the same in dissimilar and “no frame” condition. Further results, showed that associations can explain explicit attitudes since there is balance in respondents’ attitudes and associations for nanotechnology in each condition.

Product category cues and framing can lead to diverse results when two different technologies are used in comparison with nanotechnology. Under certain conditions, the two comparative technologies can be used also in future researches to generate specific associations for nanotechnology. In general, this research may contribute to the literature of societal response towards nanotechnology and imply certain approaches to create more positive attitudes.

Keywords: associations; explicit attitudes; nanotechnology; GMOs; Mobile phones; Message framing; product category cues.

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1. Introduction

Nanotechnology is an application of science that is moving into the centre of world-wide public attention since it includes a wide range of applications which affects the scientific community as well as the commercial marketplace (Mu & Sprando, 2010). This technological discipline is used to manipulate, study and exploit very small structures and systems (Reisch et al.2011) and nowadays is increasingly employed in the areas of food production such as packaging, cosmetic products and medicine (Mu & Sprando, 2010 & Siegrist et al. 2009). It is claimed that the use of nanotechnology is based on the opportunity that it offers to introduce new properties to materials which could lead to immense benefits. (Siegrist et al 2008).

Consumers' acceptance of nanotechnology products seem to be higher in the United States than in Europe (Roco, 2003) although the acceptance level is slowly increasing in European countries according to recent research (Rollin, 2011). Taking into account the current situation, only a few studies have been conducted concerning the risks and benefits of nanotechnology products. The results illustrated that the public is highly influenced by the way potential risks and benefits are illustrated especially by the level of salience (Siegrist et al 2007).

The issue of consumers' knowledge concerning nanotechnology products has triggered the attention of the scientific community since the choices made by consumers are based on limited information around this new technology. This lack of information might lead to a more critical attitude towards nanotechnology and raise the general public concern (Reisch,,2011). What should be taken into consideration is that there is a low level of knowledge about nanotechnology in Europe (Siegrist .et al 2008) and it is still unknown in which ways people who are willing to make a judgment base their choices on. It is also not indentified yet, which are the factors that may influence their attitude formation towards these products and thus their preference.

Associations seem to play an important role in consumers' product evaluations and choices (van Osselaer & Janiszewski, 2001) since there is a link between a product and a environmental cue (such as an attribute) which suggest an association in the mind of the consumer (Krishman, 1996). Product category cues can activate non-conscious goals in memory and influence consumers to connect the product with these cues and in order to arrive to their choice. (Chartrand, et al, 2008).The connection of a nanotechnology product with an environmental cue makes consumers' able to form an attitude towards these products even when their knowledge is limited. So, consumers with less knowledge are able to make their choices based on these associations. This research can contribute to the literature on consumers' response to nanotechnology products and provide suggestions on how to strengthen the positive associations for this technology. In many studies nanotechnology is associated to specific scientific disciplines as genetically modified organisms (Ronteltap et al. 2011). However, in this research there will be studied the associations for two different technologies compared to nanotechnology and whether the use of message framing may have an impact in respondents' evaluations.

The aim of the paper is to examine how these associations in less informed consumers can contribute in the evaluation process of nanotechnology products.

2. Problem Statement

Despite the fact that nanotechnology is an innovative domain that is used in multiple everyday applications, consumers' knowledge appears to be quite limited. The classical attitude formation model assumes knowledgeable comparison of attributes but at the moment that there is not enough knowledge no comparison can be made. Since consumers are likely to make choices attitude has to be formed differently. Attitude formation based on associations contributes to make consumers able to evaluate products. The use of some product category cues could be responsible for activating these kinds of associations. However, these associations are not identified or understood as well as the cues that contribute to their formation. In this case, any prediction of consumers' evaluative judgement cannot be made since currently the associations made for nanotechnology products remain unknown.

Research Question:
Which associations about nanotechnology products are triggered in less informed consumers?

Sub questions: There also should be a particular emphasis in the following issues:

RQ1: How can product category cues activate specific associations to nanotechnology products?

RQ2: How can associations influence evaluation?

3. Literature Review

The aim of this study is to discover how associations can contribute to the evaluation process of nanotechnology products. The theoretical framework of this study (figure 1) represents the interaction between environmental cues, associations and evaluations of a product. This research will separate this model in order to make a more salient and clear representation of these theories. At the first place evaluation and attitudes are discussed; this part includes the description of the evaluation process, the attitude formation and how attitudes and evaluation are interconnected.

In the second part the role of the associations is analysed as well as the way associations are linked to the evaluative judgement.

In the third part of the literature review the role of the product cues and message framing are analysed. At this stage it is discussed how cues are related to the associative process, in which ways they can activate specific associations and which is the role of the message framing .

This theoretical framework in combination with the analysis followed, consist of the theoretical basis needed which will contribute to the analysis of the results concerning consumers' associations to nanotechnology products.

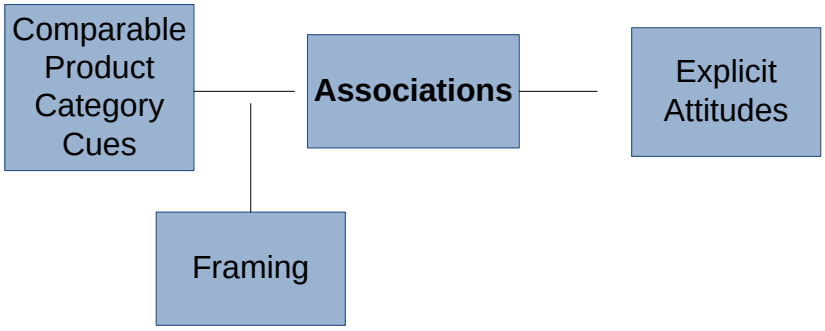

Figure 1 Theoretical framework

3.1 Evaluation and attitudes

In every situation, consumers are required to evaluate products based on what they see, the physical appearance of the object or on what they know about it, information or knowledge that it is already acquired. Judgments of products are necessary for consumers in order to reach a decision whether a product should be purchased or not (Posavac et al,2004).This assessment determines consumers

decisions about a product or even a brand and make them able to compare any alternative options (Posavac et al,2004).Consumers, in pre-consumption process are judging the products in order to estimate their utility; they have based these judgements on their perceptions and their product knowledge (Posavac et al,2004).However the utility of a product cannot be the only aspect of judgment by consumers. Products in post-consumption experience are evaluated based on their instrumental and utilitarian performance (Mano & Oliver,1993).The instrumental performance of a product can be evaluated based on the utility of the product and whether it is performing a useful function or not. Alternatively the aesthetic performance of a product is evaluated in relation to the pleasing properties that it contains (Mano & Oliver,1993). In instrumental and hedonic view, affect and satisfaction operate as influential factors in consumers' evaluations (Mano & Oliver,1993). On the other hand, the level of involvement of a consumer with a product motivate him for higher cognitive elaborations towards this product nevertheless any satisfaction judgments are not influenced by the level of involvement in this product (Mano & Oliver, 1993).

In order to examine the relation between evaluation and attitudes, it should be taken into account the explanation of the attitude and its distinctions.

According to Fishbein and Ajzen (1975) a definition of attitude is that it consists of "a function of salient beliefs at a given point in time" (Mitchell & Olson, 1981).These salient beliefs are interpreted as subjective associations between two discriminable concepts (Mitchell.& Olson, 1981). According to Fishbein's attitude theory, beliefs are those which cause attitudes especially the beliefs about attributes of a product or brand. The model Fishbein suggested has been used to estimate the belief-attitude relationship so it refers to the relationship between salient beliefs of a concept which could be a product or brand and the overall evaluation or attitude towards this concept (Mitchell & Olson, 1981). This theory focuses on attitudes in relation to a specific behavior; these attitudes can influence the behavioral intentions and urge consumers to buy a specific product (Mitchell & Olson, 1981). It comes as natural that, beliefs, attitudes and intentions is a sequential mechanism in which the one factor successively influences the other.

A different perspective about the stability of attitudes has been examined is in the research of van Harreveld and van der Pligt (2004). According to van Harreveld and van der Pligt the context of attributes (level of importance) and the chronic accessibility play a major role in the evaluative judgment. Furthermore, the likelihood of direct retrieval of memory of an attitudinal judgment is more likely to happen when the attitude towards an object is at the first place weak and the beliefs are not stable enough(van Harreveld and van der Pligt, 2004). These arguments follow the same line with Fazio (Fazio, 1993) and who argue that evaluative judgments are stored in memory and there is only a need for retrieval (van Harreveld and van der Pligt ,2004).

Whether attributes (beliefs) or memory retrieval of attitudes play a major role in the evaluative process will be examined and discussed in a later stage.

It is necessary at this point to make the distinction between implicit and explicit attitudes since they will reveal how associations are related to the evaluation and thus to attitudes.

Attitudes are divided in two different types, the implicit and explicit attitudes (Friese et.al, 2008). The implicit attitudes are activated automatically and referred as automatic evaluative reactions and predict less controlled than impulsive behavior. On the other hand explicit attitudes need more effort to be retrieved and are deliberate evaluative judgments characterized by controlled behavior (Friese et.al, 2008). Both explicit and implicit attitudes may uniquely influence one's preference for a product or brand (Douglas,2008).

Evaluative judgment is often characterized as attitude towards an object. Attitude is considered as evaluations of the self, individuals, groups and other objects (Rydell et al, 2006) when people have to decide whether an attitude object is good or bad (Wilson et al, 2000). Rydell & McConnell, examined how the two different kinds of attitude -implicit and explicit- change in relation to different levels of information. In their study evaluations consist of two different systems. There is a slow learning system which "operates by gradually accruing attitude object-evaluation associations" and a fast system based on high cognitive processes to operate. These systems are referring to implicit and explicit attitudes and this research has shown that slow learning evaluation system can change implicit attitudes as well as fast learning system can change explicit attitudes (Rydell & McConnell 2007). The position of Rydell &McConnell to the issue of evaluation and attitudes addresses to the model of dual attitudes, (implicit and explicit) which are defined as different evaluations of the same object (Wilson et al, 2000).Research has shown that implicit attitudes change slower than explicit and under certain circumstances can be overridden be the explicit ones (Wilson et al, 2000). This approach of evaluation and attitudes shows they are highly interconnected but still there is not any clear explanation of how evaluations can be substituted by attitudes. Wilson, gives a plausible answer to this question; when people are confronted by an attitude object their stored evaluation about this object comes in mind automatically. In case there is not any previous attitude, then the evaluations that come in mind are based on the current thoughts about the object. When attitude is very strong then the stored evaluation is the only source of evaluation (Wilson et al, 2000). In contrast to these two extreme situations there is still the possibility that someone can weight both the stored evaluations and his current thoughts (Wilson et al, 2000). Wilsons' perspective clarifies the dependency between attitudes and evaluations which seem to serve the same purpose of assessing and judging people or objects.

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3.2 Associative Processes

The introduction of Associative processing is determinant to understand how these processes are generated by environmental cues as well as their function in the evaluative process.

Associations or Human Associative Memory (HAM) theory is defined by van Osselaer & Janiszewski , (2001), as a "declarative knowledge that is represented as a network of concept nodes connected by links that are strengthened each time two events co-occur". That means that when a technological

product repeatedly co-occurs with a positive or negative cue, there is a strong link between that product and that cue (van Osselaer & Janiszewski, 2001).

HAM theory as a model based on associations held in consumer memory demands retrieval from memory of a particular knowledge which is used to create links between various concepts (Krishnan, 1996).This argument suggests that the knowledge demanded is not necessarily knowledge of the product itself but of the cue which is used to describe or promote the product. Even in circumstances that consumers' knowledge about a new technology is limited, memory connections are responsible to link the information provided by cues to the main product. It should be underlined here, that the relation of memory and environmental cues determine a fit between preexisting structure of associations in memory and a specific set of external stimuli (Gawronski &Bodenhausen, 2006).This aspect of associative process is known as Pattern Activation and indicated that in different situations different concepts will be activated according to the environmental stimulus (Gawronski &Bodenhausen, 2006). When consumers are required to make a choice and their judgment is based on associations their attitude is formed but without making any specific attribute evaluation of the product (since they don't have the necessary knowledge). This explains why associative evaluations are characterized as automatic affective reactions which do not require any cognitive capacity (or an intention) to evaluate an object (Gawronski &Bodenhausen, 2006).

This network of associations is a fuzzy structure and can take many forms based on the nature of the cues used to access it (Krishnan, 1996).In this way salient cues can generate different associations to a category of products. Most of the consumer behavior literature focuses on the associative process in relation to brands and in which ways consumers associate brands with some cues that they receive from their environment. For example when consumers think of shoes, a particular set of associations is be activated whereas the name of a specific brand (eg.Nike) can activate different, more specific associations (Krishnan, 1996). Based on this theory, the name of the brand is a cue of information about product performance and affects its evaluation (van Osselaer &Janiszewski, 2001). Many associations are based on brand's attributes and benefits and others can be based on the past experiences with the brand (Krishnan, 1996). Brand familiarity can be a determining factor for the selection of a nanotechnology product from the moments consumers are not informed about the applications of this technological domain. However, many associations on consumers' mind can create a more complex structure which might increase their accessibility in memory or even lead to a lowered memory for the brand due to inference of these associations (Krishnan, 1996). When associations need to be quantified their complexity has to be in low levels for the sake of the research. That means that the cues used have to be very specific in order to not make the retrieval easy for the consumer and extract a number of associations which
can bring more clear results.

3.3 Implicit and explicit attitudes

3.3.1 Implicit attitudes

Taking into account that attitudes assume knowledge, especially when we refer to explicit attitudes which need more cognitive capacity, it comes as natural that associations play a vital role in the evaluation process since it is the basis for what many researchers call implicit attitudes (Gawronski &Bodenhausen, 2006). On the other hand, explicit attitudes are the basis of propositional processes known as evaluative judgments based on syllogistic inferences and derived from any propositional information (Gawronski &Bodenhausen, 2006).

Implicit attitudes cannot be consciously accessed neither their activation can be controlled (Rydell et al,2007).Their activation may arise from different sources such as past experience, positive or negative effect, cultural bias or need for cognitive consistency(Douglas et al,2008). Implicit attitudes, form and change through the use of slow learning and associative reasoning (Rydell,et al, 2006). That means that associations play a primary role in implicit attitude change considering also that a change in the associative structure or a temporal increase in the activation of pre-existing patterns will result to an implicit attitude change (Gawronski &Bodenhausen , 2006) or in other words a change in the implicit evaluation. It should also be underlined here that in order to influence implicit attitude the use of a stimuli is a determining factor for activating specific associations.
Past research on prejudice has assessed automatic prejudicial responses with implicit measures like affective priming or the IAT (Implicit Association Test) and revealed that implicit measures have less controlled processing (Conrey et al 2005). Implicit and explicit measures are considered the first as automatic and the second as more controlled cognitive processes (Conrey et al 2005).Implicit measures are influenced by associations' activation, the ability of giving a "correct" response, the success at overcoming automatically activated associations as well as the influence of bias which can influence responses when there are not any other available guides (Conrey et al 2005). Although their cognitive nature, implicit and explicit measures are based on implicit and explicit attitudes according to the study of Conrey et al implicit measures can be influenced by associations as it happens with implicit attitudes.

3.3.2 Explicit Attitudes

Each attitude, explicit or implicit can predict different kinds of behavior (Rydell & McConnell, 2006).
Explicit attitudes differ from implicit attitudes since they depend on judgments of the validity of "syllogistic inferences" and they are consciously controllable (Douglas et al 2008). Propositional processes are the source that they derive from and they can emerge and change based on true judgments about an attitude object (Douglas et al 2008). That means that consumers' explicit

attitudes are based on more cognitive processes and their expression signifies highly elaborative judgments. The available information from the environment plays an important role in the formation of explicit attitudes from the moment that consumers elaborate more (Rydell & McConnell, 2006). In this case the behavior that can be predicted from explicit attitudes is more deliberative and does not illustrate any spontaneous reactions for an attitude object (Dempsey & Mitchell, 2010).

It has been argued that explicit attitudes can change more easily than implicit when new information is presented and are consistent with a quick-learning, rule-based system of reasoning (Rydell & McConnell, 2006). This reveals that the stability of explicit attitudes is much higher than this of the implicit attitudes. Any external information can influence consumers' judgments and thus form a different attitude towards an object.

Explicit attitudes are tested and measured by many scientists usually when they are searching for associations in brand categories. Nevertheless it has been argued that associations are mostly related to implicit attitudes however there is an explanation by Gawronski on how associations can be linked also to explicit attitudes. While consumers cannot be aware of the processes underlying implicit attitudes they sometimes can be aware of the product of processing or in other words the automatic reaction (Gawronski, *et al*. 2007). In this case the automatic reaction can be transferred into a propositional format and if it is considered as valid by the consumers they form explicit evaluations by relying their intuition on implicit attitudes (Grumm, *et al*., 2009). This explanation makes obvious that explicit attitudes can be related to associative processing and enlightens for which reasons research conducted in brand associations is based on explicit attitudes.

Past research in brand associations was mostly based on comparing brands within product categories in order to gain knowledge on consumers' associations for each brand' object or the brand itself and thus observe consumers' attitudes towards it. There is also enormous research of consumers' attitudes on brand equity, which refers to the incremental utility or value added to a product by its brand name (Yoo & Donthu, 2001). According to Aaker (1991, 1996) and Keller (1993) brand equity consists of four dimentions: brand loyalty, brand awareness, perceived quality of the brand and brand associations (Yoo & Donthu, 2001).According to Keller and Lehmann in many cases brand attitudes can affect perceptions of brand associations. Consumers thoughts and feelings about a brand is mainly controlled by the extrarnal environment and the information that can influence their thoughts and expectations (Lehmann& Keller, 2006). .

Moreover, judgments about the selection of the brand which are used in research are mostly based on the familiarity with the brand the past experience of consumers with it as well as the functional aspects of the brand which can trigger more explicit associations. By focusing on these aspects, associations can be triggered easier since consumers are more involved with the attitude object. In terms of uninformed consumers which are not familiar with the brand, the attitudes triggered can be based on environmental factors (eg. minimum amount of information taken from the environment randomly in the past), or by the use of cues which can stimulate him to give a certain response.

Explicit attitudes should be measured in this research in order to gain knowledge and compare them with the associations made. These attitudes are important in order to comprehend the way consumers

evaluate nanotechnology products in relation to product cues of different technological fields. The degree of influence by product cues will not only exemplify the way uninformed consumers can arrive to an attitude formation but also how this attitude formation can be manipulated by the use of cues.

Returning to the theory about memory retrieval of attitudes of van Harreveld and van der Pligt ,since preexisting memory associations is the key point the research is based on, the attitude formation will be based on memory retrieval of attitudes as well. The stored evaluations will come in mind automatically without the use of salient beliefs about this object. Under these conditions, the theory of Fishbein about beliefs and attitude formation can be rejected from the moment memory plays a substantial role in attitude formation.

3.4 Product cues and Associative processes

In triggering associations the existence of a Product Cue is necessary in order to generate associations between two different concepts. Cues can be seen as features of the everyday environment that may influence evaluation and choice (Fitzsimons & Berger, 2008). They work as information of products' benefits and make consumers' able to draw inferences (Beverland & Farrelly ,2010, Bertini et al, 2009). A fundamental position to many literatures which are studying cues and associations is that consumers use product attributes or brand names as retrieval cues for information about a product's performance; those attributes of brand names work as links to diagnostic information about a product (van Osselaer & Janiszewski, 2001).

Product cues have an "associative strength" (Keller,1991,) which updates and evolves as cues interact (van Osselaer & Janiszewski, 2001).Associations in memory can be activated and also become more easily accessible by the use of these cues (Fitzsimons & Berger, 2008). Additionally, more salient cues increase the probability of retrieval of a brand relative to other category brands when they are presented in short term memory (Lindsey & Krishnan, 2007).

Moreover, there are external cues such as price or irrelevant attributes which can make in a later stage quality judgments more accurate especially when they are considered as initially biasing cues (Vanhouche & van Osselaer, 2009).Changing the physical appearance of a product and leaving the quality in the same levels can help consumers to retrieve the quality of the consumption experience more accurately compared to situations that biasing cues do not exist (Vanhouche & van Osselaer, 2009). Research has show that add-on features in products which enhance existing capabilities, may affect the evaluation of products negatively by consumers; contrary add-ons that introduce new features may have a more favorable evaluation (Bertini et al., 2009). In any case, cues are responsible for driving consumers attitudes in a more positive or negative evaluation of the product.In the same line of thinking, while there is a comparison which takes place with use of product cues there can also be a comparison with *product category cues*. The comparison which may influence evaluation and choice of a nanotechnology product can be with previous technologies well-known to

consumers which can work as cues. Many researches for brand categories have been conducted to measure brand strength trend, support and facilitate marketing managers to strengthen a weaker brand by activating more associations (Krishnan, 1996).Following the theory the intercategory effect can be activated by the context of previous choices then brand categories of products may influence consumers' choice (Shocker et al. 2004). Past experience, information and possible satisfaction with another technology can influence consumers' choice about a new technology (Shocker et al. 2004). Associations triggered by this comparison of similarities or dissimilarities of other technological products will demonstrate that there is a link between familiar technologies and others unfamiliar by the consumers like nanotechnology.

Using a category of products as cues to manipulate consumers' judgments is because the familiarity with other technologies can be more influential than just a product cue used to a nanotechnology product. According to the theory of Gawronski and Bodenhausen (2006), pre-existing associations which are formed in memory may coincide to the stimulus provided by cues. In essence, the product category cues will be in this case a catalytic factor of generating associations.

The associations generated by consumers between the product and its benefits will illustrate the degree on which consumers can be influenced by the cues and arrive to a positive attitude towards a nanotechnology product. Thereby, any information and characteristics about other technological disciplines used as cues may determine the associations made and thus consumers' evaluations.

In this research the comparison products used as cues should belong to two different technological disciplines in order to gain an idea on how different may be the associations produced for nanotechnology. Respondents' familiarity with the alternative technologies used a as cues it is necessary, as well as having the basic knowledge of its functions and utility (i.e.GMOs and mobile phones). This choice will bring clearer results since the comparison will be between a well known technology and a new one as nanotechnology for which they are uninformed.

3.5 The choice of Product Category Cues

In the present study, mobile phones and GMOs will be the comparison products to nanotechnology. The choice of those products is based on the fact that participants have a considerable familiarity with mobile phones considering of their age and lifestyle. In addition, GMOs will be the second comparison product since participants' education have provided them with at least the basic knowledge GMOs about their characteristics and their public acceptance.

The difference in the cues is apparent judging from the fact the one product is technological and the second one is food related. This choice has its bases on the similarities that these two areas of production share. In the last two decades there has been a highly increased production of GMOs and mobile phones. The manufacturing of both technologies started at the middle of the '80s and though the rapid research a systematic production started progressing in many countries. The concentration on the fast adoption of GMOs in agricultural exporting countries coincided with the production and

promotion of mobile phones to many markets by the technical industry (Sheldon, 2002 & Ziefle, 2010).

Not only do they share the same roots in the market industry as they appeared the same time, but they also share the same novelty that makes them innovative to consumers. Whereas being very up to date technologies, it is believed that they meet all requirements for using them as comparative products to nanotechnology.

3.6 Framing

One of the ways that a cue can be used in order to create certain associations and ameliorate product's evaluation is message framing. The use of framing is oftenly used in consumer behavior literature and it is connected with product cues. This research refers to the result of the product consumption and it might describes the gains for the consumer after product's consumption of the looses in case of not consuming it (Ganzach & Karsahi, 1995). The way that information given is framed can influence consumers' decision through the perceived risk of received benefits that can gain of the product. The use of framing as a communication tool is based on the "Prospect Theory" in which people try to avoid risks and increase gains (Ganzach & Karsahi, 1995); the risk aversion increases consumers' tendency for the consumption of the benefits and thus raises the preference for a product.

The persuasiveness of the message is determined by the valence of the arguments used not only whether they will be negative or positive (gain or risk frame) but also in which level arguments are clearly stated or not. Information given clearly to consumers motivate them to scrutinize more the message and lead to a greater persuasion (Dardis & Shen, 2008). The more effective arguments will lead to more direct results thought the systematic elaboration of consumers. In addition message framing used as comparative framing, as similar or dissimilar between two products, implies the negative (looses) or positive (gains) consequences resulting after the consumption of the promoted product.

Framing message which is commonly used in advertising suggests as a communication tool to provide positive information about the sponsor and negative information about the compared product; under this circumstances message framing is used in a positive or negative fashion (Roggeveen et al 2006). In many cases different brands are compared in order to influence through framing, consumers' perceptions about different products.

Negative comparisons can lower consumers 'attitudes for advertised brands (Jain & Posavac, 2004). Based on this_argument, if the attitude towards the comparison product will be lower than the advertised brand then there is a chance that the advertised will be more favorable evaluated and thus be chosen by more consumers (Jain et al 2006).

Furthermore in the analysis of Roggeveen et al. (2006), consumers scrutinize more positive framed message cues than negative framed. The comparison product was the main force that directed consumers' evaluations in situations that negative framing was used and the message did not require

more cognitive analysis from consumers so they accept the information as it is (Roggeveen et al 2006). According to this perspective, the “negativity effect” explains that when different products are compared negative information can be more diagnostic, and consequential than positive information (Dardis & Shen,2008). While positive information from cues provided via a framing massage results to a thorough analysis between the different products compared the negative information will result to a faster acceptance of the message without much elaboration by consumers.

Tormala and Petty (2007), argued that the context of the message is a determining factor in creating more favorable attitudes towards the target stimulus. When respondents were exposed to two messages with similar context they perceived the less information the first message contained the more information respondents perceived the target message (second message) to have and they were more persuaded. When two different messages are used, assimilation and contrast effect the source of the first message defines the persuasion level. When respondents are primed to focus on dissimilarities they were more persuaded by a low credibility source (contrast). In the same manner, when they were primed to focus on similarities then the use of a high credibility source will result to a high level of persuasion –assimilation- (Tormala & Petty, 2007).

4. Hypotheses

4.1 Framing the message

Message framing can be used in order to enhance the similarity or dissimilarity between the two product categories. When two nanotechnological products are compared, the level of similarity or dissimilarity of these two depends on how a message is framed to consumers. The degree of (dis)similarity of the products will be manipulated in a frame of gains or looses in order to gain insight on which associations can be generated in each occasion. Since comparable attitude objects are used as cues, nanotechnology can be linked as similar or dissimilar to these cues from the perspective of benefits or possible losses resulting after their production or consumption. Under these circumstances, it is expected that the associations extracted will differentiate when those products are compared. By using familiar technologies in each condition the research will point out how positively or negatively consumers can be influenced when referring to different occasions.It is expected that the general attitude towards these cues used will lead to different results. For a cue that is less public acceptable (GMOs) the associations of nanotechnology will differ compared to the case that a more favorable cue (Mobile Phone) is used. This point of view originates from the fact that there is a general low estimation for GMOs by consumers which will also influence the evaluation of nanotechnology since it consists also a new technological discipline highly interconnected with GMOs. Taking into account there will be the manipulation of message framing, consumers' responses will be even more influenced in these cases. It is expected that in these two different situations, there will be a difference in nanotechnology associations and however the same with the product category cues used.

H1: *Framing the message as similar or dissimilar will cause people to generate associations of nanotechnology products more or less as those of the comparison product.*

4.2 No framing Condition

Manipulating the message through framing is a manner to trigger associations by which it can be examined the degree on which consumers can be influenced by the way technologies are linked as similar or dissimilar. At the same time it is interesting to find out how nanotechnology is perceived without any influencing factor such as framing. According to HAM theory the memory associations triggered will represent their judgment which will be based on the cues provided (Krishnan, 1996). Since knowledge is limited, stimulus will have an impact in the evaluation which will direct consumers' perceptions about the product. By measuring consumers' associations in neutral situation (without framing), it is expected that the answers given will demonstrate that even when framing is not used,

the associations triggered about nanotechnology will be more negative when GMOs are used and more positive when Mobile Phones are mentioned. Likewise, mobile phones associations as a more favorable field of technology will induce respondents to more positive associations similar with nanotechnology products also without the use of framing.

H2: *Without framing, nanotechnology associations will be the same as in similar condition.*

4.3 Evaluation

Attitude formation or product evaluation cannot be neglected since the research is focusing on consumers with limited knowledge towards nanotechnology products. Consumers need higher elaboration and information in order to form their explicit attitudes (Rydell &McConnell, 2006). This elaborative process can be considered as the validation of the propositions based on prior attitudes (Gawronski &Bodenhausen, 2006). This specifies that validation of associations made can take place by the use of prior attitude of the associative technologies. As a result, the explicit attitudes will be formed based on the justification of the associations made. Therefore, consumers will be mainly influenced by the product category cues from the moment they are uninformed about nanotechnology products and thus form their attitudes.

H3: *Associations will explain consumers' explicit attitudes*.

5. Research Design

5.1. Participants and Design

In order to test these assumptions, 235 undergraduate or graduate Dutch students of Wageningen University between the age of 21-25 were asked through email to participate in this study. Both male and female students were included, considering that in both cases respondents are concerned about new developments of technology and they are motivated to answer the questions.
The selection of participants was a random process; they were found in Wageningen University and asked to complete a questionnaire through the internet application of Qualtrics'. In addition, For each condition there will be a comparison of nanotechnology with GMOs or Mobile phones respectively. There will be a 2x3 research design of six conditions; The two factors used will be GMOs and Mobile Phones and which will be measured in three levels (similar, dissimilar, no frame condition).
The two first conditions include GMOs framed as similar in the first one and dissimilar in the second. The next conditions 3 and 4 contain Mobile phones framed as similar in the first one and dissimilar to the other. The final to two conditions 5 and 6 do not include framing

5.2 Pilot testing

A pilot test conducted with a sample of ten Dutch students has shown that the time limits included in a part of the questionnaire and the framed text used were appropriate for the research. The level of English language was good enough and all the instructions comprehensible.

5.4 Experimental Procedure

Six different conditions were used and for each of them groups of forty participants had to give their opinion by filling in the questionnaires. Limitations of time were used in all conditions in the part where respondents had to express the associations generated for GMOs, Mobile phones and Nanotechnology products. This process is necessary to increase the validity of the research since the associations that have to be measured (according to the HAM theory) need to be based on spontaneous automatic reactions. The procedure the respondents followed in the questionnaire is described in figure 2.
In all the questionnaires, the free association task has been used in order to extract the answers from the sample. Respondents had to give five characteristics of GMOs/Mobile Phones that come in their mind in thirty seconds. In case the time available was over, then in the screen appeared the next

question, even if they haven't completed all the number of associations. Additionally, they were asked to express the degree of agreement or disagreement in a 7-point Likert scale by which their explicit attitudes will be measured for GMOs/Mobile Phones. Five statements have been used such as "I consider the presence of GMOs/Mobile Phones important for future products", "I would buy products based on GMOs/Mobile Phones", "I believe that production of GMOs/Mobile Phone products will have a negative impact on the environment.", "I believe that the production of GMO/Mobile Phone products will have a negative impact on human health.", "I consider that producing with GMOs/Mobile Phones is worthwhile.", "I feel confident about the scientific research on GMOs/Mobile Phones".

Afterwards, in the first four conditions that framing is used, a small text appears in the screen where GMOs or Mobile Phones and nanotechnology are compared. In the first condition GMOs are compared as similar and in the second as dissimilar. Respectively in the third condition mobile phones are compared as similar and in the fourth as dissimilar to nanotechnology.

The next step which was included in all conditions was to extract the associations generated of a Nanotechnology product and asking them to provide five characteristics in thirty seconds. Then, they also had to give their opinion for Nanotechnology by expressing the degree of agreement and disagreement of six statements. The statements used in all conditions are the following: "I consider the presence of Nanotechnology important for future products.", "I would buy products based on Nanotechnology", "I believe that production of Nanotechnology products will have a negative impact on the environment.", "I believe that the production of Nanotechnology products will have a negative impact on human health", "I consider that producing with Nanotechnology is worthwhile" , "I feel confident about the scientific research on Nanotechnology".

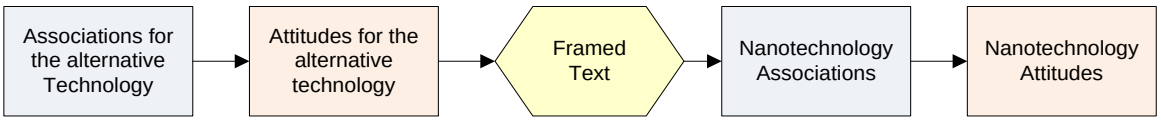


Figure 2. Questionnaires' procedure in framing condition

It is important to note here, that for the consistency of the research and the right measurement of the results, the statements used for measuring the explicit attitudes had to be the same in all conditions. That means that GMOs statements (Conditions 1 and 2) are the same with the statements used for Mobile phones (3 and 4), as in neutral framing (4 and 5) and the same as in all statements for nanotechnology. In addition the message framed is exactly the same and contains information for the same aspects (health and environmental). This method is necessary for influencing all respondents about the negative/positive factors of the cues and thus of nanotechnology through a similar stimulus.

The last two conditions are mentioned as "neutral situation", which means that there was not any message framing used. Respondents, after giving their associations and explicit attitudes for GMOs

(condition 5). What is highly important here is to trigger the associations for nanotechnology without the use of framing and by only the use of cues (GMOs –Mobile phones). Along these lines it will be very interesting to make later on a comparison of the different situations-conditions.
Condition 6, is also a condition with no framing but by using as product category cues the mobile phones. The text appeared in the screen will be the same as in condition 5. Similarly, five associations for mobile phones had to be mentioned and respondents' attitudes to be indicated by using the same statements.As in previous cases, nanotechnology associations are asked and also using the same statements which the sample had to rate.

6. Results

6.1 Sample Description

The data collected were analyzed with SPSS version 17.0.2 for Windows statistical package. The total number of responses given is 235 (N=235) with mean age category of 20-24 years old. The vast majority of participants were Bachelor or Master students from different scientific disciplines.

6.2. Preliminary analysis

As a first step, there has been an elimination of participants who did not fill in all the questions given. This small group of twelve participants (<5%), has been excluded from the research in order to avoid any problem in the analysis.
Furthermore, the variable that directed participants to 1 of 6 versions of the study was recoded into three different levels of framing (similar/dissimilar/no frame) and whether the comparison product was GMOs of mobile phones. To facilitate the analysis of the associations the given words were coded as 1=positive, 2= neutral, 3= negative. Based on this coding, the average association for each participant was calculated, for nanotechnology (Q6) and for the alternative technology (Q2).
For further analyses the difference in valence of associations between nanotechnology and the alternative technology was calculated ("AssociationDiff") by the subtraction of alternative technology's associations minus nanotechnology associations. According to this variable, a higher value indicates more positive associations for nanotechnology.

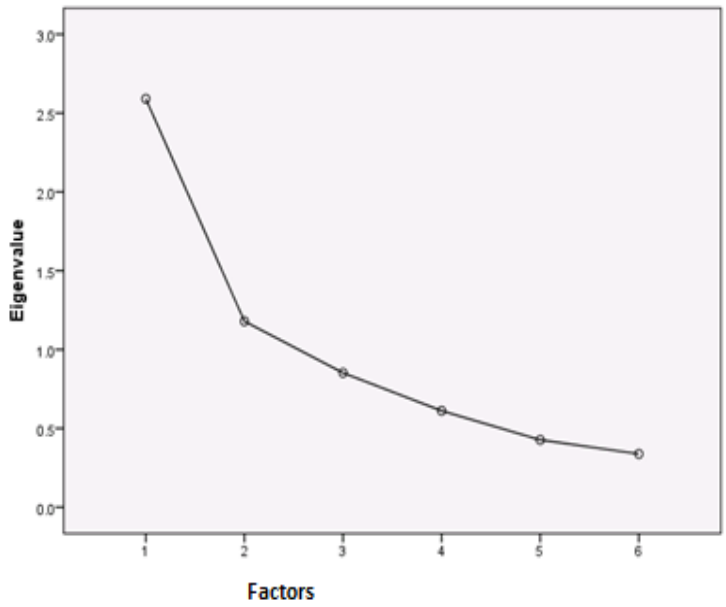
The reliability analysis of the items in the attitude scale has shown a Cronbach's α =0.709 for alternative technology and α=0.730 for nanotechnology which proves that the scale is sufficiently reliable.

Nevertheless, a factor analysis carried out in order to examine the influence of constructs to the responses of measured variables.

The factorability of six items was examined for the two different scales of attitude rating (for Nanotechnology and for the alternative technology). Oblique rotation was chosen for a better estimation of the factors and correlations, with delta=0 to keep constant the rotation produced. The correlation between factors for alternative technology was 0.18. Choosing the same analysis for nanotechnology the correlation was higher reaching 0.298. For all the six items in both scales the communalities were above 0.3 , suggesting that the six items share a common variance.

Principal Component Analysis was used in order to identify the scores of the factors underlying the attitude scale. According to the initial eigenvalues the variance for the first factor explained 42.4%, 24.79 % for the second, 12.67% for the third and for the last three factors varying between 7.6% to 5.6%. At the same time the initial eigenvalues of the second factor analysis(nanotechnology) ,the first factor explained 43.18%, the second 19.66% and the third 14.20%. The last three factors were explained by 5.6% to 10.1%. The scree plots (figure 1) for the factor analysis conducted were necessary to ensure which factors should be extracted since the sample exceeds the 200 participants. Based on the scree-plot criterion the point of inflection occurs at the second factor which has eigenvalue around 1 so in this case there should be two factors extracted.

Figure 1: Scree Plot of Eigenvalue



The items of that cluster suggest that component 1 represents the four positively framed attitude components and component 2 the two negative attitude items and represent the two factors extracted.
After the extraction of factors Cronbach's α =0.779 for positive attitudes and α=0.698 for the negative attitudes of the alternative technology. For nanotechnology, α=0.739 for component 1 and there is a considerable low internal consistency for component 2 with α= 0.571. Component 2 has a limited internal consistency; however both items were included in the questionnaire without any deletion of those with an insufficient internal consistency.

Another analysis which has been done in order to measure how persuasive can be the framed text was to ask for respondents to rate the level of believability and realism of the message. Respondents indicated in different conditions for GMOs and Mobile phones the degree on which they considered the message was believable and realistic and gave very high rating for GMOs both in similar and dissimilar condition. To be more specific it was rated between 4.9 and 5.2 as realistic and between 5.2 and 5.3 as believable (see appendixes XVI,XVII). In contrast the ratings for mobile phones were lower with 4 to 4.7 and 4.4 to 5 respectively.

6.3 Hypothesis testing

1. (H1). Framing the message as similar or dissimilar will cause people to generate associations of nanotechnology products more or less as those of the comparison product.
2. (H2). In neutral condition, the associations to nanotechnology would copy previous associations (Similar) as in framing situation.

In the first hypothesis framing as similar or dissimilar was expected to influence respondents' associations about nanotechnology and generate associations similar as those of the alternative technology. In the second hypothesis, it was assumed that the no frame situation would correspond to the similar frame condition.

An ANOVA was carried out with the difference in association between nanotechnology as independent variable and alternative technology as dependent variable. Some of the results are mentioned in the analysis and the rest of them are indicated in the appendixes. The results showed that the alternative technology (GMOs/Mobile Phones) resulted in an association difference with $F(1,128)=13.7$, $P<0.01$ to the extent that the comparison of nanotechnology with GMOs showed that nanotechnology is more positively evaluated than GMOs. Alternatively, when nanotechnology is compared with mobile phones, the results showed that nanotechnology is less positively evaluated than mobile phones. Framing nanotechnology as similar or dissimilar to the alternative technology had a significant effect with $F(2,128)=5.6$; $P<0.01$. The present outcomes make clear that framing as similar resulted in less positive associations for nanotechnology, framing as dissimilar for no difference in associations between nanotechnology and alternative technology and no explicit framing, resulted in more positive association for nanotechnology compared to the alternative technology.

Moreover, the outcome of the interaction of framing conditions with the alternative technology is significant as well; $F(2,128)=3.17$ with $P<0.01$ (see table1 and figure2). In addition, the pairwise comparisons table shows that there is a higher difference in the associations for the dissimilar condition compared to the similar with $M=0.182$; $P>0.01$. This finding specifies that in the dissimilar condition the overall results occurred are more positive about nanotechnology.

In Table 1, the interaction between dependent variable and fixed factors demonstrates the fluctuation of means in different conditions for GMOs and Mobile Phones. In figure 2, the differences in associations were calculated as the difference in positivity of associations for nanotechnology and the alternative technology. A positive number in this figure means that there are more positive associations for nanotechnology compared to the alternative technology.

Nanotechnology is similarly associated as GMOs in similar condition ($M=0.108$;$P<0.05$) as well as in the dissimilar condition with $M=0.061$. To some extend the one part of hypothesis is confirmed by

these findings since in associations between the two technologies are not considerably different in similar situation.

By examining the cases where Mobile phones are used (figure 2 and table 1), it seems that the results in similar condition are not those expected since the M=-0.037; P<0.05 which shows that nanotechnology associations are negative and mobile phones are much more positively evaluated. In dissimilar condition, mobile phones seem to be about equally associated as nanotechnology (M=0.042;P>0.05) which also rejects the second part of the hypothesis.

Furthermore, the second hypothesis in which associations were expected to be the same as in neutral and similar condition, is not confirmed.

According to Table 1, GMOs in neutral condition have M=0.501 with P>0.05 which is greater than the M=0.108 in similar condition. This explains that there is a high difference between nanotechnology associations in the two conditions since in the similar condition is more positively associated than in the neutral.

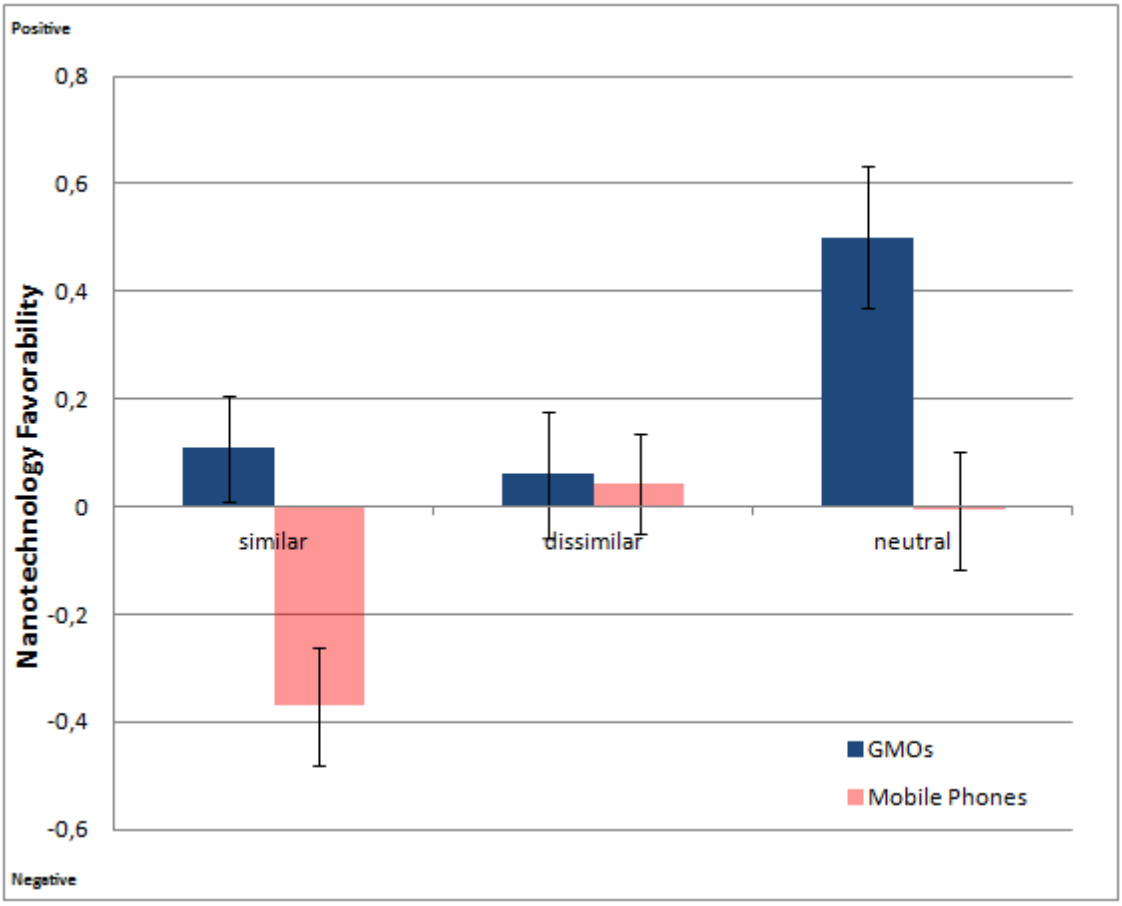
Respectively, in neutral condition, mobile phones share a M=-0.006 with P<0.05 significantly higher than M=-0.37; P<0.05 that it is found in similar condition. This comparison underlines that nanotechnology is more favorably evaluated when no frame is used compared to the condition that similar message frame is used.

In a more detailed analysis of the second hypothesis, the outcomes demonstrate that in the neutral situation GMOs are more negatively associated and nanotechnology much more positively with a Mean difference of M=0.393. In the same way in neutral situation Mobile Phones tends to zero with a Mean difference of M=-0.364 from the similar condition. That means, that when comparing similar framing and the neutral situation the difference between them is very high and it cannot be confirmed that in neutral situation the results can the same as in similar condition. In this case hypothesis two is rejected.

Table 1: Mean difference of Nanotechnology' Associations

			95% Confidence Interval	
GMOs	Mean	Std. Error	Lower Bound	Upper Bound
similar	0.108	0.1	-0.09	0.307
dissimilar	0.061	0.117	-0.171	0.294
neutral	0.501	0.132	0.240	0.762
Mobile Phones				
similar	-0.37	0.109	-0.585	-0.154
dissimilar	0.042	0.093	-0.143	0.226
neutral	-0.006	0.109	-0.222	0.210

Figure 2: Mean difference of Nanotechnology' associations

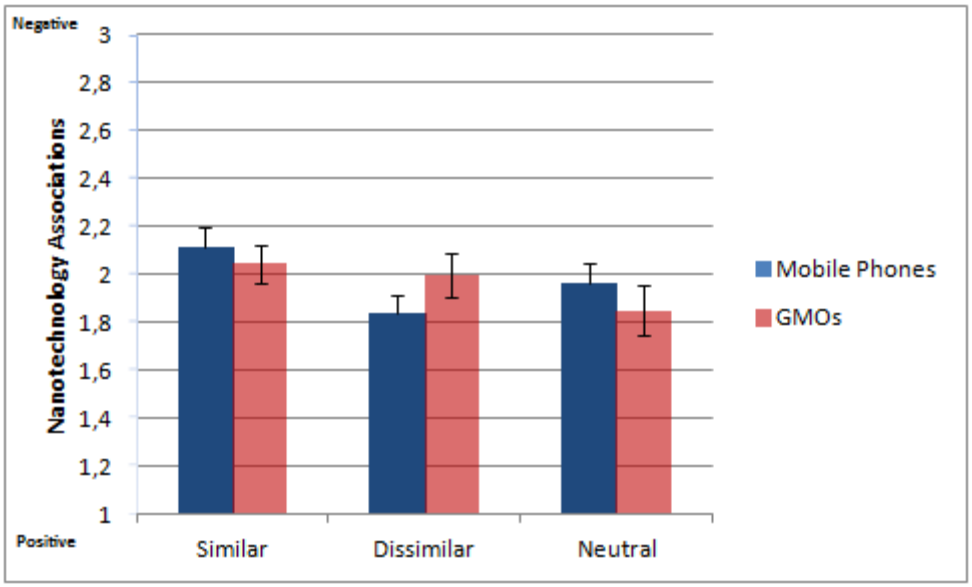


The reported test investigates the difference in valence of associations between nanotechnology and the comparison technology. Therefore, this measure is at least to some extent dependent on the associations with the alternative technology. In order to investigate the associations of nanotechnology themselves, some additional analysis has been done by using ANOVA with nanotechnology associations as dependent variable. In this examination, according to the test between subject effects, framing nanotechnology as similar or not was not was not significant with $F(2,129)=2.6$ $P>0.05$; the use of the alternative technology is insignificant as well with $F(1,129)=0.1$; $P>0.05$. The outcome of interaction of both variables is also not significant with $F(2,129)=1.43$;$P>0.05$. The interaction between Nanotechnology associations and fixed factors has shown that there are more positive nanotechnology associations when it is compared with the alternative technologies in similar condition compared to the dissimilar with the results not being significant ,$M=2.044$; $P>0.05$ and $M=2.114$ with $P>0.05$.

Figure 3, demonstrates the results of nanotechnology' associations where a higher number points out more negative associations.

In dissimilar condition according to figure 3, the line above explains that GMOs can produce more positive nanotechnology associations than mobile phones with M=1.99 for GMOs and M=1.8 for Mobile phones having both insignificant levels (P>0.05).

Figure 3: Mean of Nanotechnology' Associations



In the same ANOVA analysis, the results, indicate that in neutral condition nanotechnology' associations when mobile phones are used are more negative than when GMOs are used. According to figure 3, M=1.85 with P>0.05 for GMOs compared to M=1.96; P>0.05 for Mobile phones which shows that there is not statistically significant difference.

Finally a similar ANOVA analysis was conducted for the alternative technology. As expected, there was a significant valence of associations between GMOs and mobile phones ($F(1,167)=19.96$, $P<0.05$ where the associations scored 0.28 more negative compared to those with mobile phones. As expected there was no difference in framing ($F(2,167)=1.05$, $P>0.05$) nor the interaction between framing and the alternative technology ($F(2,167)=0.73$; $P>0.05$). This makes sense as the framing was provided after this measure and show there were no observable biases in sub samples across the conditions.

3. (H3). Associations will explain consumers' explicit attitudes.

Associations and attitudes were supposed to share similarities in order to confirm that the automatic affective reactions of associations can be the basis for the attitude formation. In order to check the degree that associations and attitudes correlate, Linear Regression Analysis has been used.
At first, positive attitudes of nanotechnology were used as dependent variable and nanotechnology associations (Q6) as independent. The results has shown that R^2 =0.068 indicating that 6.8% of the associations can account for explanation of attitudes and with a relatively small to medium adjusted R^2 = 0.06, 6%, (Field 2009). In ANOVA table the F ratio seems that is significant with F (1,131) =9.488 at P<0.05 (see appendixes VII). In the second regression of model parameters b_1=-0.69 with t=-3.08 at P<0.05 which explains a statistically significant portion of the variability in associations. The results support up to a certain level the part of the hypothesis in which positive attitudes can be explained by the associations generated.

Moreover, negative attitudes of nanotechnology with nanotechnology associations were examined in the same manner. Negative attitudes, give R^2 =0.183 (adjusted R^2 =0.176, 18%) which represents a medium to large size effect. In the same manner, in ANOVA table, F(1,131) =29.27 is significant with P<0.05 and *b1*= -1.267;P<0.05 , which also shows that the associations make a significant contribution in the attitude formation.

Likewise, in order to gain insight in associations' difference (alternative technology minus nanotechnology 'associations) related to attitudes' difference, an additional Regression analysis has been carried out (see appendixes IX). The variables used in this model are the associations' difference compared to the attitude difference (alternative technology positive/negative attitudes minus nanotechnology positive/negative attitudes).
The R^2 =0.085 (8.5%) and adjusted R^2 =0.078 (7.8%) with medium size effect show that only a small variance of the attitudes is explained. However, in the ANOVA table, it seems that F(1,131)=12.15 with P<0.05 which is statistically significant and coincides with the P<0.05 (*b1*= -0.136 and t= -3.485) in the coefficients table. So also in this case, the predictor variable (associations) significantly predicts the (positive) attitude as an outcome variable.
Similarly for the negative attitude difference as outcome variable the regression model has shown that R^2 = 0.011 and adjusted R^2 =0.003 with small size effect. Furthermore, the next regression tables indicate that F(1.131)=1.42; P>0.05 and *b1*=-0.041; t=-1.191, P>0.05 which is not significant. That means that in negative attitudes' difference, the results are not predicted by the predictor variable.

Some additional analysis of positive and negative attitude means of alternative technology was conducted in comparison to nanotechnology attitude means. A paired sample t-test has been used to compare differences between scores from the perspective of sampling distribution showing the results of mean comparison of the negative attitudes of nanotechnology with negative attitudes for the

alternative technology (see appendixes VIII). The value of t= 0.707 for 146 df and the (2-tailed) P<0.05 so there is a statistically significant difference between nanotechnology (negative) attitudes and alternative technology (negative attitudes).

Similarly, for negative nanotechnology attitudes and negative attitudes of the alternative technology, the results in point out that t=3.651 with 146df and P>0.05 so there is not significance. The value of M=0.421 is low also in this case with SE=0.10 so positive attitudes about nanotechnology and alternative technology differ in a high level.

A similar analysis with a Paired Samples t-Test was also conducted to compare the means of positive and negative attitudes of nanotechnology (see appendixes X). This model, with t=-5.64 for 146df is significant with P<0.05 by having M=-0.583 with SE=0.1, indicates that the variability of the two conditions is significantly different.

7. Discussion

The present study examined the associations made for nanotechnology by uninformed consumers. Message framing was used in four out of the six conditions in order to test whether it can influence the associations generated. The results assert that the framing conditions played a role in the associations generated for nanotechnology when different cues were used. The outcomes brought forward by this study can be useful for understanding how comparison cues influence attitudes towards novel technologies. On the other hand, they are also very intriguing considering that they did not coincide with most of the hypotheses made. Judging from the fact that nanotechnology is an unfamiliar technology for most respondents, the results showed that their judgments can be manipulated by using certain cues and message framing such as many authors suggested; (Keller 1991, Gawronski&Bodenheusen 2006).

Another finding of this research is that the associations can contribute to the attitude formation of the respondents. Nanotechnology associations and attitudes seem to share a common negative or positive character in the different conditions. Another interesting finding is that the explicit attitudes and the associations are interconnected but not in a very high degree. Respondents' feelings and thoughts for nanotechnology are demonstrated in their associations and attitudes which are indeed linked to each other as Keller and Lehmann (2006) claimed.

A more detailed examination of the overall results showed that when GMOs were used as a comparative cue, both in similar and dissimilar condition the associations produced for nanotechnology were the same as those for GMOs which was not one of our expectations. Furthermore, the associations in similar and "not frame condition" were expected to be the same but the results revealed that in "no frame" condition the evaluations for nanotechnology were more favorable than for GMOs.

On the contrary, when mobile phones were used as a comparable cue, the associations generated in similar condition were more positive for mobile phones than for nanotechnology. Another unexpected result occurred in the dissimilar condition where the associations for mobile phones were the same as for nanotechnology. In the third condition in which message framing was not used, the findings were unexpected as well; the associations between the similar and in no frame condition were not the same. This outcome makes clear that without the use of framing the associations for mobile phones are the same as those for nanotechnology.

At first, by examining in depth the findings for GMOs, it seems that there is similarity between GMOs and nanotechnology associations in similar condition. According to this finding, only one part of the first hypothesis is accepted. The second part of the first hypothesis was not confirmed either since it was expected that in the dissimilar condition there will be more positive associations for nanotechnology which did not happen. The results showed that in dissimilar condition the associations for GMOs are the same as for nanotechnology although the message used was rated as

very believable and realistic. The outcomes verify that although the text was believable enough it did not influence enough the respondents to generate more positive associations for nanotechnology.
On the other hand, in the third condition for GMOs, when frame was not used, nanotechnology was much more positively associated. This result is totally different from the similar condition so the second hypothesis is rejected as well. The additional analysis made for the associations of both alternative technologies and nanotechnology indeed clarifies that GMOs are more negatively associated than nanotechnology in no framing condition.
By comparing the two conditions, it can be argued that there may have been a small reactance from respondents in similar condition. Considering that the associations for GMOs in no frame condition were very negative, then most probably in similar condition they refused to give more positive associations for nanotechnology. In other words, while there was a low appreciation for GMOs in no frame condition and nanotechnology was considered as a better technology, in similar condition respondents denied to make a connection between the two technologies after reading the text. More to the point, the reactance produced in similar condition it is indeed possible to happen as Kivetz (2005) claimed in his research when a product is promoted to the consumers. In the same line, Fitzsimons & Lehmann (2004), describe psychological reactance as a motivational state in which people tend to re-attain the restricted freedom. Fitzsimons & Lehmann's study which is based on recommendations and respondents' reactance, it gives a possible solution which is to provide more specific elements to consumers that drive recommendations, or even reframe the recommendations. In this way, the level of reactance may be reduced and consumers can be manipulated easier. Based on these studies, the small reactance occurred in similar condition of GMOs can by affirmed as a psychological state based on which respondents could not accept the framing nanotechnology the same as GMOs.

Furthermore, the results for mobile phones were unexpected and much different than the hypothesized outcomes of first and the second hypothesis. To be more specific, in similar condition the associations generated were more positive for mobile phones than for nanotechnology though it was expected to be the same. Alternatively, in dissimilar condition the associations for mobile phones were the same as those for nanotechnology while it was anticipated to have more positive associations for nanotechnology. Considering those findings, the first hypothesis is rejected since the results do not coincide with our expectations.
Moreover, framed text was rated as believable/realistic in the similar and as believable/realistic enough in the dissimilar condition. An explanation for the different findings can be attributed to the fact that that mobile phones are tangible products and very familiar to the respondents; this is the reason why the level of assimilation between mobile phones and nanotechnology is very low in similar condition. To be more specific, as Gawronski mentioned, the pre-existing associations were influential for respondents' answers, so the high level of experience and involvement with mobile phones might have been an influential factor in consumers' responses (Shocker et al. 2004). Additionally, it is also vital to mention that there is maybe reactance also in this case. Most probably, respondents' share a

positive opinion and did not accept the fact that a common and everyday product as mobile phones, could share the same negative characteristics with nanotechnology.
As far as the dissimilar condition is concerned, it seems that this positive opinion the respondents had for mobile phones was an obstacle for producing more positive associations for nanotechnology. Respondents seem to copy previous associations they had for mobile phones without any further consideration of the text given. Still, another influential factor in the results produced might have been the researcher's decision as far as the coding of the associations is concerned. Most likely, by coding the words given only in three levels (positive, negative, neutral), certain information has been lost so the results might have been affected.
In another level, the third condition without framing showed that the results are much more different compared to the similar condition which also rejects the second hypothesis.
Respondents in no frame condition seem to generate almost the same associations for mobile phones as for nanotechnology and share an equal opinion for both (see appendixes XIV, XV), This finding, fits well with the theory of reactance mentioned in the similar condition, since the associations would have been the same in the two conditions if reactance was not produced. It is important also to note that the lack of knowledge for nanotechnology might also have in general an impact in the responses given when mobile phones were used. In any case, it was difficult for the respondents to associate an everyday product with nanotechnology for which they have no experience.

The third hypothesis was confirmed by the results derived from the analysis. The outcomes showed that up to a certain level, attitudes can be explained by the associations produced. The level of explanation of nanotechnology' attitudes could be characterized as satisfactory since the results confirmed the relationship between associations and attitudes. It is also essential to note that since explicit attitudes are connected with high elaboration (Rydell & McConnell 2006), if more time was provided to think of their answers then the results might have been more consistent. According to the test conducted by Ranganath and., Nosek 2008), explicit evaluation can be influenced by the associations as time passes. Based on this theory, the findings of the study at hand could be different if there was more time given to the respondents to consider their answers. This might have worked better if there was a small space of time available between the part of the associations and the attitudes.
On the other hand, considering associations' difference and difference in the negative attitude component, no significant effect is found. This most likely, implies a methodological issue specific to the negative attitude components.

Moreover, when the association difference between alternative technology and nanotechnology was used in the additional analysis with regard to their attitude difference, the results clearly indicated that alternative technology' associations can similarly be considered as a small predictor variable of nanotechnology positive attitudes. This finding shows that attitudes can equally well be predicted to a high degree when alternative technology's associations are taken into account.

There are, of course, limits to the present research. This study, included participants from different educational backgrounds with some of them having a very relevant technological education to comparative the technologies used. The results would be more homogenous if participants were from the same educational field.

Another limitation of this study was the possible reactance of respondents towards GMOs and mobile phones in similar condition which affected their evaluations for nanotechnology. Respondents' reactance should be measured in any further research or even follow the suggestions of previous studies on this topic (Fitzsimons & Lehmann, 2004) in order to reduce it.

Additionally, in any future research, the framed text used should be tested thoroughly in the pilot test and ask respondents for more detailed explanations and suggestions after examining their answers. Furthermore, another significant suggestion is that in any future research about nanotechnology, the comparative cues used should belong to the same category. To be more specific, when using as a cue GMOs products the other cue should be also be a food product and non-tangible by the respondents. Respectively, in the case that the mobile phones are used, the second cue should also be visible and belong to the same category of a communication technology.

Last but not least, in line with the findings of the study that the associations can explain up to a certain level the explicit attitudes, future research should focus as well on the implicit consumers' attitudes in order to examine the outcomes derived under conditions of low cognitive capacity.

8. Conclusion

This study contributes to the research about consumers' attitudes and associations towards nanotechnology by using a specific methodology of product category cues and message framing.

On the bases of the results of the study, the use of message framing determines the associations produced and as more positive or in some cases more negative towards nanotechnology. The condition in which message framing was not used can gave an interesting result since the associations for nanotechnology are more positive when GMOs are used as a cue. This outcome justifies the assumptions of respondents' reactance in some of the framed conditions and provides suggestions for future researches.

In general it can be claimed that the comparative cues used can have influential effect in associations and thus in attitude formation; nevertheless associations can be an indicator of attitudes to some degree.

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Appendixes

I. Cronbach's α

Reliability Statistics

Cronbach's Alpha	N of Items
,709	6

Reliability Statistics

Cronbach's Alpha	N of Items
,730	6

II. Factor Analysis (Alternative Technology attitudes)

Communalities

	Initial	Extraction
In the next question we would like to learn your opinion towards GMOs. You are kindly asked to indic...-I consider the presence of GMOs important for future products.	1,000	,718
In the next question we would like to learn your opinion towards GMOs. You are kindly asked to indic...-I would buy products based on GMOS.	1,000	,674
Q3_3R	1,000	,749
Q3_4R	1,000	,736
In the next question we would like to learn your opinion towards GMOs. You are kindly asked to indic...-I consider that producing GMOs is worthwhile.	1,000	,675
In the next question we would like to learn your opinion towards GMOs. You are kindly asked to indic...-I feel confident about the scientific research on GMOs.	1,000	,480

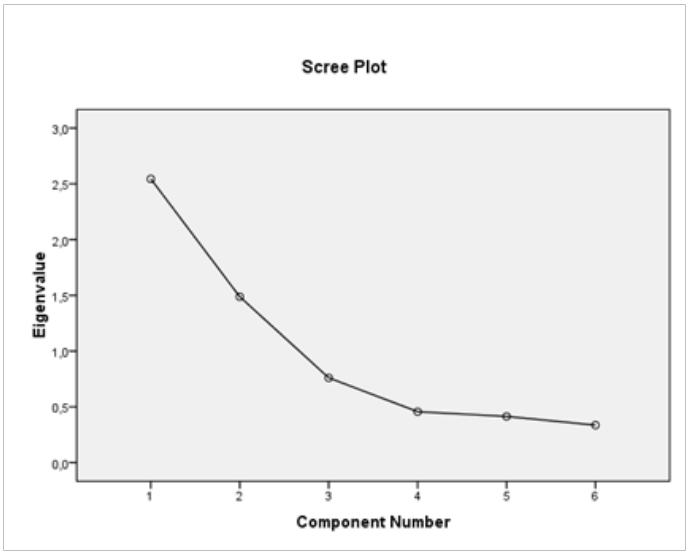
Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	2,544	42,406	42,406	2,544	42,406	42,406	2,455
2	1,488	24,799	67,205	1,488	24,799	67,205	1,710
3	,760	12,672	79,877				
4	,457	7,614	87,490				
5	,414	6,905	94,395				
6	,336	5,605	100,000				

Extraction Method: Principal Component Analysis.

a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance.



III. Factor Analysis (Nanotechnology attitudes)

Communalities

	Initial	Extraction
In the next question we would like to learn your opinion towards Nanotechnology. You are kindly requ...-I consider the presence of Nanotechnology important for future products.	1,000	,739
In the next question we would like to learn your opinion towards Nanotechnology. You are kindly requ...-I would buy products based on Nanotechnology.	1,000	,540
Q7_3R	1,000	,477
Q7_4R	1,000	,795
In the next question we would like to learn your opinion towards Nanotechnology. You are kindly requ...-I consider that producing with Nanotechnology is worthwhile.	1,000	,703
In the next question we would like to learn your opinion towards Nanotechnology. You are kindly requ...-I feel confident about the scientific research on Nanotechnology.	1,000	,517

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	2,591	43,182	43,182	2,591	43,182	43,182	2,252
2	1,180	19,665	62,847	1,180	19,665	62,847	1,928
3	,852	14,208	77,055				
4	,612	10,195	87,249				
5	,427	7,114	94,363				
6	,338	5,637	100,000				

Extraction Method: Principal Component Analysis.

a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

IV. Cronbach's α after the Factor Analysis

Reliability Statistics

Cronbach's Alpha	N of Items
,779	4

Reliability Statistics

Cronbach's Alpha	N of Items
,698	2

V. ANOVA_ Associations Difference

Tests of Between-Subjects Effects

Dependent Variable:ASSOCIATIONDIFF

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	7,053[a]	5	1,411	5,394	,000
Intercept	,402	1	,402	1,538	,217
similar_ornot	2,931	2	1,465	5,603	,005
GM_or_MOBILE	3,581	1	3,581	13,693	,000
similar_ornot * GM_or_MOBILE	1,659	2	,829	3,171	,045
Error	33,477	128	,262		
Total	40,680	134			
Corrected Total	40,530	133			

a. R Squared = ,174 (Adjusted R Squared = ,142)

Pairwise Comparisons

Dependent Variable:ASSOCIATIONDIFF

(I) similar_ornot	(J) similar_ornot	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
similar	dissimilar	-,182	,105	,086	-,391	,026
	neutral	-,378*	,113	,001	-,602	-,154
dissimilar	similar	,182	,105	,086	-,026	,391
	neutral	-,196	,114	,087	-,421	,029
neutral	similar	,378*	,113	,001	,154	,602
	dissimilar	,196	,114	,087	-,029	,421

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

*. The mean difference is significant at the ,05 level.

VI. ANOVA _ Nanotechnology Associations

Tests of Between-Subjects Effects

Dependent Variable:Q6_CODED_AVERAGE

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1,344[a]	5	,269	1,677	,145
Intercept	497,600	1	497,600	3102,655	,000
similar_ornot	,843	2	,421	2,627	,076
GM_or_MOBILE	,002	1	,002	,010	,921
similar_ornot * GM_or_MOBILE	,460	2	,230	1,433	,242
Error	20,689	129	,160		
Total	544,577	135			
Corrected Total	22,033	134			

a. R Squared = ,061 (Adjusted R Squared = ,025)

3. similar_ornot * GM_or_MOBILE

Dependent Variable:Q6_CODED_AVERAGE

similar_ornot	GM_or_MOBILE	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
similar	GM	2,044	,079	1,889	2,200
	Mobil phone	2,114	,085	1,945	2,283
dissimilar	GM	1,997	,092	1,816	2,179
	Mobil phone	1,839	,073	1,694	1,984
neutral	GM	1,850	,103	1,645	2,055
	Mobil phone	1,960	,084	1,795	2,125

Pairwise Comparisons

Dependent Variable:Q6_CODED_AVERAGE

(I) similar_ornot	(J) similar_ornot	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Lower Bound	Upper Bound
similar	dissimilar	,161	,083	,054	-,002	,324
	neutral	,174	,088	,051	,000	,348
dissimilar	similar	-,161	,083	,054	-,324	,002
	neutral	,013	,089	,883	-,162	,188
neutral	similar	-,174	,088	,051	-,348	,001
	dissimilar	-,013	,089	,883	-,188	,162

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

VII. Linear Regression_Nanotechnology Associations/Nanotechnology Attitudes

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,260[a]	,068	,060	1,04079

a. Predictors: (Constant), Q6_CODED_AVERAGE

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10,278	1	10,278	9,488	,003[a]
	Residual	141,905	131	1,083		
	Total	152,183	132			

a. Predictors: (Constant), Q6_CODED_AVERAGE

b. Dependent Variable: NANOTECH_pos

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,427[a]	,183	,176	1,08947

a. Predictors: (Constant), Q6_CODED_AVERAGE

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5,972	,450		13,259	,000
	Q6_CODED_AVERAGE	-,689	,224	-,260	-3,080	,003

a. Dependent Variable: NANOTECH_pos

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	34,742	1	34,742	29,270	,000[a]
	Residual	155,491	131	1,187		
	Total	190,233	132			

a. Predictors: (Constant), Q6_CODED_AVERAGE

b. Dependent Variable: NANOTECH_neg

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	6,488	,472		13,760	,000
	Q6_CODED_AVERAGE	-1,267	,234	-,427	-5,410	,000

a. Dependent Variable: NANOTECH_neg

VIII. Paired Samples T-test _ Alternative technology/Nanotechnology Attitudes

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	alternativeTECH_neg - NANOTECH_neg	-,42177	1,40047	,11551	-,65005	-,19348	-3,651	146	,000
Pair 2	alternativeTECH_pos - NANOTECH_pos	-,07143	1,22579	,10110	-,27124	,12838	-,707	146	,481

IX. Linear Regression_ Association Difference/ Attitude Difference (positive)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,292[a]	,085	,078	,53151

a. Predictors: (Constant), ALT_NANO_POS

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3,432	1	3,432	12,148	,001[a]
	Residual	36,725	130	,283		
	Total	40,157	131			

a. Predictors: (Constant), ALT_NANO_POS

b. Dependent Variable: ASSOCIATIONDIFF

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,014	,046		,300	,765
	ALT_NANO_POS	-,136	,039	-,292	-3,485	,001

a. Dependent Variable: ASSOCIATIONDIFF

(negative)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,104[a]	,011	,003	,55277

a. Predictors: (Constant), ALT_NANO_NEG

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,435	1	,435	1,423	,235[a]
	Residual	39,722	130	,306		
	Total	40,157	131			

a. Predictors: (Constant), ALT_NANO_NEG

b. Dependent Variable: ASSOCIATIONDIFF

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,012	,050		,244	,808
	ALT_NANO_NEG	-,041	,035	-,104	-1,193	,235

a. Dependent Variable: ASSOCIATIONDIFF

X. Paired Samples t-test_ Nanotechnology Negative-Positive attitudes

Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1 NANOTECH_neg - NANOTECH_pos	-,58333	1,25490	,10350	-,78789	-,37878	-5,636	146	,000

XI. ANOVA_ Alternative technology associations

Tests of Between-Subjects Effects

Dependent Variable:Q2_CODED_AVERAGE

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	4,010[a]	5	,802	4,744	,000
Intercept	677,176	1	677,176	4005,006	,000
similar_ornot	,354	2	,177	1,046	,354
GM_or_MOBILE	3,374	1	3,374	19,956	,000
similar_ornot * GM_or_MOBILE	,248	2	,124	,734	,481
Error	28,237	167	,169		
Total	711,440	173			
Corrected Total	32,247	172			

a. R Squared = ,124 (Adjusted R Squared = ,098)

3. similar_ornot * GM_or_MOBILE

Dependent Variable:Q2_CODED_AVERAGE

similar_ornot	GM_or_MOBILE	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
similar	GM	2,159	,079	2,003	2,315
	Mobil phone	1,769	,076	1,618	1,920
dissimilar	GM	2,078	,082	1,916	2,240
	Mobil phone	1,849	,068	1,716	1,983
neutral	GM	2,175	,082	2,012	2,337
	Mobil phone	1,948	,075	1,800	2,097

XII. ANOVA_ Alternative technology attitudes (positive and negative)

3. similar_ornot * GM_or_MOBILE

Dependent Variable:alternativeTECH_pos

similar_ornot	GM_or_MOBILE	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
similar	GM	4,213	,228	3,762	4,663
	Mobil phone	4,562	,224	4,120	5,005
dissimilar	GM	4,631	,259	4,120	5,142
	Mobil phone	4,792	,198	4,401	5,182
neutral	GM	3,818	,253	3,319	4,317
	Mobil phone	4,534	,220	4,100	4,969

3. similar_ornot * GM_or_MOBILE

Dependent Variable:alternativeTECH_neg

similar_ornot	GM_or_MOBILE	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
similar	GM	4,389	,264	3,868	4,910
	Mobil phone	3,286	,259	2,774	3,797
dissimilar	GM	4,095	,299	3,504	4,686
	Mobil phone	3,500	,228	3,049	3,951
neutral	GM	3,523	,292	2,946	4,100
	Mobil phone	3,000	,255	2,497	3,503

XIII. ANOVA_ Nanotechnology Attitudes (positive/Negative)

3. similar_ornot * GM_or_MOBILE

Dependent Variable:NANOTECH_pos

similar_ornot	GM_or_MOBILE	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
similar	GM	4,269	,192	3,888	4,649
	Mobil phone	4,750	,209	4,338	5,162
dissimilar	GM	4,800	,224	4,358	5,242
	Mobil phone	5,042	,183	4,681	5,403
neutral	GM	4,025	,224	3,583	4,467
	Mobil phone	4,370	,192	3,990	4,751

3. similar_ornot * GM_or_MOBILE

Dependent Variable:NANOTECH_neg

similar_ornot	GM_or_MOBILE	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
similar	GM	4,056	,220	3,621	4,490
	Mobil phone	3,630	,238	3,159	4,101
dissimilar	GM	4,450	,255	3,945	4,955
	Mobil phone	4,167	,209	3,754	4,579
neutral	GM	4,000	,255	3,495	4,505
	Mobil phone	3,611	,220	3,176	4,046

XIV. Associations and attitudes Mean of the alternative technologies

Alternative Technology						
	Associations		(positive) Attitudes		(Negative) Attitudes	
	GMOs	Mobile Phones	GMOs	Mobile Phones	GMOs	Mobile Phones
similar	2,159	1,769	4,213	4,562	4,389	3,286
dissimilar	2	1,849	4,631	4,792	4,095	3,5
neutral	2,175	1,948	3,818	4,534	3,523	3

XV. Associations and attitudes Mean of Nanotechnology

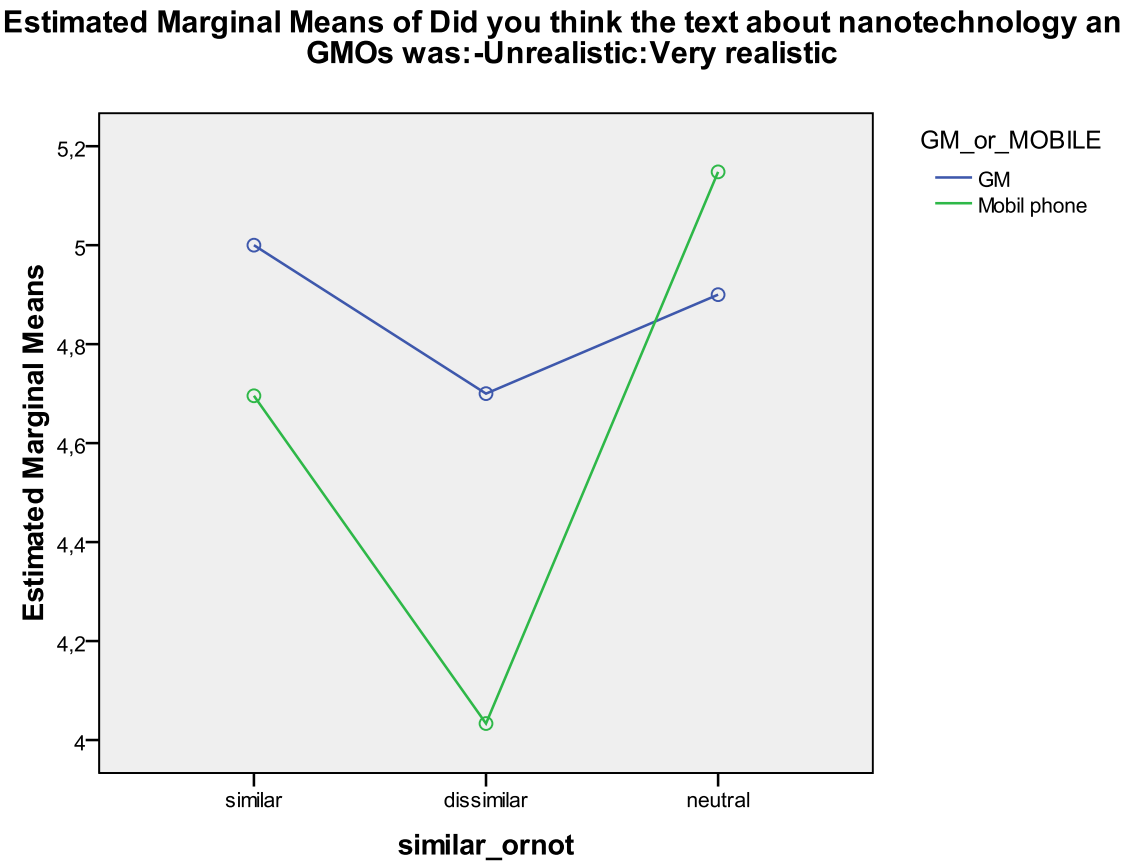
Nanotechnology						
	Associations		(positive) Attitudes		(Negative) Attitudes	
	GMOs	Mobile Phones	GMOs	Mobile Phones	GMOs	Mobile Phones
similar	2,044	2,114	4,269	4,75	4,056	3,63
dissimilar	2	1,839	4,8	5,042	4,45	4,167
neutral	1,85	1,96	4,025	4,37	4	3,611

XVI. ANOVA _ Evaluations of the text (Realistic or not)

3. similar_ornot * GM_or_MOBILE

Dependent Variable:Did you think the text about nanotechnology and GMOs was:-Unrealistic: Very realistic

similar_ornot	GM_or_MOBILE	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
similar	GM	5,000	,208	4,588	5,412
	Mobil phone	4,696	,226	4,249	5,142
dissimilar	GM	4,700	,242	4,221	5,179
	Mobil phone	4,033	,198	3,643	4,424
neutral	GM	4,900	,242	4,421	5,379
	Mobil phone	5,148	,208	4,736	5,560



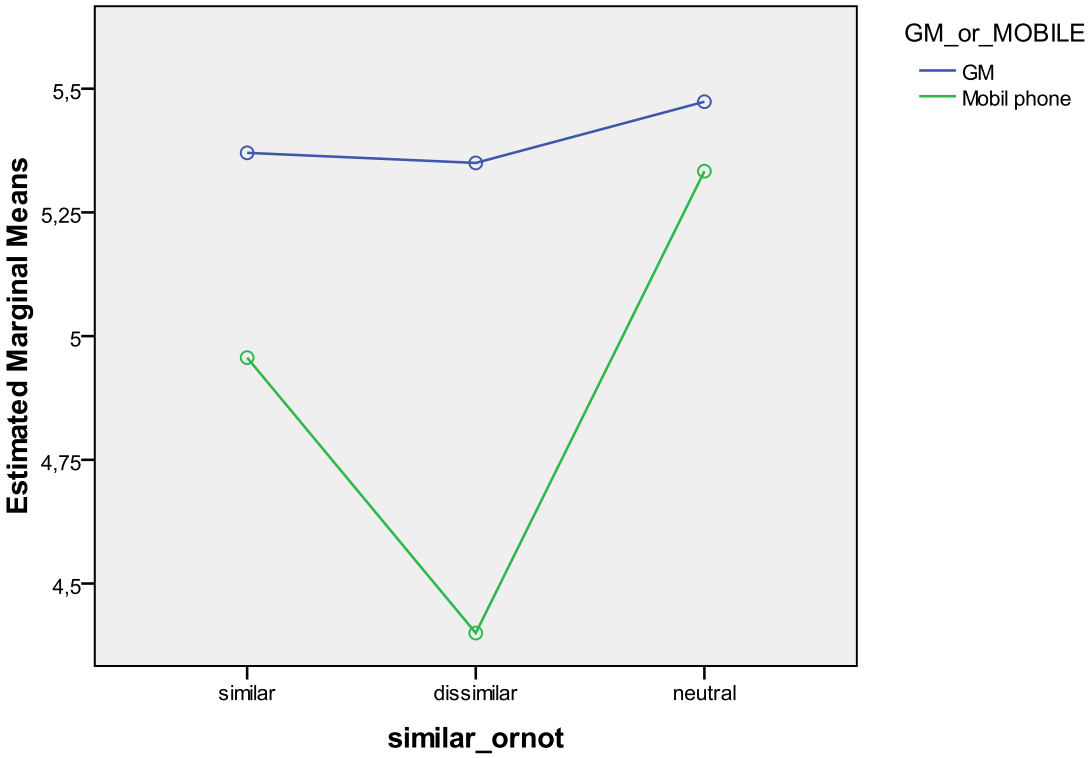
XVII. ANOVA_ Evaluations of the text (Believable or Not)

3. similar_ornot * GM_or_MOBILE

Dependent Variable:Did you think the text about nanotechnology and GMOs was:-Unbelievable:Believable

similar_ornot	GM_or_MOBILE	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
similar	GM	5,370	,232	4,912	5,829
	Mobil phone	4,957	,251	4,459	5,454
dissimilar	GM	5,350	,270	4,817	5,883
	Mobil phone	4,400	,220	3,965	4,835
neutral	GM	5,474	,277	4,927	6,021
	Mobil phone	5,333	,246	4,847	5,820

Estimated Marginal Means of Did you think the text about nanotechnology and GMOs was:-Unbelievable:Believable



XVIII. Framed Texts

- Condition 1 (GMOs- Nanotechnology_Similar)

GMOs and Nanotechnology: Much the same?

The fast growing technological development of the last century has brought into surface the production of Genetically Modified Organisms. Nanotechnology is also a new technological discipline created to serve many scientific purposes for the sake of human and the environment. It consists of a technological function that uses specific properties of materials applied at extremely small sizes.

It seems that these two new technological domains, share some similarities. There are societal issues related to nanotechnology that are similar to those of GMOs. At first, in health level, considering that they both manipulate materials on a sub-molecular level in many cases they can cause dangerous health effects that can only appear after certain years of use. The environmental concern in the manufacture and use of both technologies as the threat of the crop biodiversity and the toxicological effects is that they can affect environmental balance. Although, the level of safety is not yet known for both technologies, it seems that different factors play a role.

- Condition 2 (Mobile Phones-Nanotechnology _Similar)

Mobile phones and Nanotechnology: Much the same?

The fast growing technological development of the last century has brought to the surface the production of Mobile phones. Nanotechnology is also a new technological discipline created to serve many scientific purposes for the sake of human and the environment. It consists of a technological function that uses specific properties of materials applied at extremely small sizes.

It seems that these two new technological domains, share some similarities. There are societal issues related to nanotechnology that are similar to those of mobile phones. At first, in health level, they can both result in the generation of electromagnetic field. In many cases the radiation can be harmful for human life since it affects the brain cells and often lead to cancer. The environmental concern in the manufacture and use of both technologies as the pollution of the land is that they can affect environmental balance. Although, the level of safety is not yet known for both technologies, it seems that different factors play a role.

- Condition 3 (GMOs- Nanotechnology_Dissimilar)

GMOs and Nanotechnology: Do they share similarities?

The fast growing technological development of the last century has brought into surface the production of Genetically Modified Organisms. Nanotechnology is also a new technological discipline created to serve many scientific purposes for the sake of human and the environment. It consists of a technological function that uses specific properties of materials applied at extremely small sizes.

It seems that these two new technological domains, do not share any similarities. There are not any societal issues related to nanotechnology that can be considered as similar to those of GMOs. At first, in health level, nanotechnology is not responsible for the manipulation of living materials (DNA), while GMOs are. In many cases GMOs can cause dangerous health effects that can only appear after certain years of use. The environmental concern in the manufacture and use of GMOs is that they can be a threat of the crop biodiversity and affect environmental balance. In contrast, nanotechnology in manufacturing cause less pollution and reduces contamination. Although, the level of safety is not yet known for both technologies, it seems that different factors play a role.

- Condition 4 (Mobile Phones-Nanotechnology_Dissimilar)

Mobile phones and Nanotechnology: Do they share similarities?

The fast growing technological development of the last century has brought into surface the production of Mobile phones. Nanotechnology is also a new technological discipline created to serve many scientific purposes for the sake of human and the environment. It consists of a technological function that uses specific properties of materials applied at extremely small sizes.

It seems that these two new technological domains, do not share any similarities. There are not any societal issues related to nanotechnology that can be considered as similar to those of mobile phones. At first, in health level, nanotechnology it is not an electronic device so it does not produce electromagnetic fields; in contrast mobile phones are responsible for this production. In many cases the radiation can be harmful for human life however nanotechnology differentiates since it produces medicines which are vital for human life. The environmental concern in the manufacture and use of cell phones, as the pollution of the land is that they can affect environmental balance. In contrast, nanotechnology in manufacturing cause less pollution and reduces contamination. Although, the level of safety is not yet known for both technologies, it seems that different factors play a role.