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Abstract

In this study, we investigate if it is possible to intentionally implement personalities into the physical interaction which people later can recognize. Prior studies showed that people can recognize personalities in the appearance of products. Few studies however address personality in physical interaction. From experience, we know that people in some situations describe their interaction with products in terms of personality traits. Designers also often claim that they can implement personalities in products. Still, quantitative research on product personality in interaction is lacking. Is it actually possible to intentionally implement personalities in physical interaction that people recognize?

Two artefacts (stimuli) were designed in the study, with the intention to elicit one personality each (dominant and elegant) while interacting with them. The personalities were selected from literature and from an exploratory study among design students. In preparation for the designing the artefacts, the characteristics of both personalities were studied in the workshop. Following the workshop, a set of personality characteristics were defined and implemented in the design of the two artefacts. The personality characteristics experienced while physically interacting with stimuli were later evaluated in a quantitative study with 60 respondents.

The results of the study indicate that people recognize personalities while physically interacting with the products. The results also suggest that it seems possible to predefine (and intentionally embody) the personality people experience in the interaction. Besides discussing the implications of these findings for designers and companies, the study also includes a design process to support the implementation of personalities in the physical interaction of products.

Keywords: Product physical interaction, personality, experiences, dimensions of interaction.

Objetos
Viven a nuestro lado, los ignoramos, nos ignoran. Alguna vez conversan con nosotros.

Octavio Paz

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1 Defining product personality

Studying product personality in interaction is related to the phenomenon of people describing products as if products were animated things. It is common to say that a particular product is fun, lively, boring, appealing, etc. These terms refer to unique personality characteristics that describe human behaviour. Humans identify those characteristics easily and accurately in other humans, but do they recognize them in products? The aim of this study is to investigate if people recognize a personality through interacting with a product.

In recent years, research to understand how people experience and understand products has increased considerably. It is evident that almost all the products in a specific category are alike in price, technology, and quality. In the light of the current context, there is a strong interest from companies, as well as designers, to know which aspects are assessed in order to buy, keep or reject products. The results of such studies can be implemented in products that differentiate from similar ones. Companies will have products that distinguish from others and designers will be creating products that satisfy current users' needs.

A current tendency in industrial design is to implement intangible aspects in products such as emotions (Desmet, 2002, Norman, 2004), character (Stolterman & Janlert, 1997), personalization (Mugge, Schifferstein & Schoormans, 2004) and personality. The use of personality has a long history: there are studies that refer to personality in brands (Aaker, 1997) computers (Nass, Moon, Fogg, Reeves, & Dryer, 1997) and products (Jordan, 1997, Govers, 2004). These studies aim that by implementing these concepts in products designers can create products for improving users' experience, eliciting emotions or personalities. At the same time, it is an innovative way to create products to draw consumers' attention.

1.1 Human personality

Personality refers to how people evaluate the personalities of other people, including 1: the characteristics or qualities that form an individual's character. 2 qualities that make someone interesting or popular (Oxford dictionary, 2006)

At a most sophisticated level psychology has had a strong tradition for defining and understanding what personality is; some of the most significant theories are: Psychoanalytic theory (Freud); Personality is the result of individual's feelings, thoughts, and behaviours which are the result of the interaction of the id (The inherited instinctive impulses of the individual, forming part of the unconscious), the superego, and the ego. Behaviourist theory (Skinner); Behaviourists explain personality in terms of reactions to external stimuli. Cognitive and social-cognitive theory (Bandura); In cognitivism behaviour is explained as guided by cognitions (e.g. expectations) about the world, and especially those about other people. Humanistic theory (Maslow & Rogers); focuses on subjective experiences of persons instead of factors that determine behaviour.

Social cognitive research shows that personality might operate at three levels: **denotative, evaluative, and descriptive** (Janlert, L.E., Stolterman, E., 1997). These three levels can be attached to products. People use personality in a denotative way when they ascribe symbols to products (Solomon 1983). For example a symbol of wealth could be a Rolex wrist watch; whereas a symbol of power could be a royal crown. People use personality traits in products to evaluate them. For example, it is a provocative and cheerful design. Moreover, people describe products. For example, this mobile phone is an elegant design, gently with steely glamour (Figure 1). The distinctions between a descriptive or an evaluative meaning are not discrete categories but a continuum. Most personality descriptors have both a descriptive and an evaluative component although to different extent (Di blas, Forzi and Peabody, 2000)

Fig. 1.1 Personality is used for evaluative, denotative and descriptive purposes

Some of the most general theories of personality were discussed previously. It is evident that there is not a general definition of what personality is, however there are some similarities between the different personality's concepts which are presented next:

- Personality is consistent: People react to specific situations like they normally do. There is a tacit acknowledgment of people's recognizable way of being (Sih, 2004, Carver & Scheier, 1996, Murphy & Davidshofer, 1994)

- Personality is concerned with the particular characteristics of each person; No two persons are exactly alike in temperament and behaviour (Carver and Scheier, 1996).
- Personality is regarded as an overall description of a person; It is an abstraction based on information about a person's behaviour, thoughts and feelings (Carver and Scheier, 1996)

1.1.1 The big five factor

During the last years a new trend in psychology has been to reduce the number of personality traits to a limited set of dimensions using clusters and analytic factors (e.g. Cattel 1945). The sixteen personality factor model (Cattel, 1950, Fehriinger, H.M. 2004). The big five factor model (Goldberg, 1981) also referred as the five-factor model (McCrae and Acosta 1997).

The big five are five broad factors or dimensions of personality discovered through empirical research by using a statistical procedure called factor analysis. The statistical procedure was used to analyze how various personality traits are correlated in humans. The big five proposes that the individual differences that are most salient and socially relevant come to be encoded into the natural spoken language. Therefore, the aim the five-factor model is to create a framework for understanding which traits go together, rather than to give a definition of what personality is.

Factor	Description
Extraversion	The broad dimension of Extraversion encompasses such more specific traits as talkative, energetic, and assertive.
Agreeableness	This dimension includes traits like sympathetic, kind, considerate, supportive and affectionate.
Conscientiousness	People high in Conscientiousness tend to be organized, thorough, neat serious and planful.
Neuroticism	Neuroticism is characterized by traits like tense, moody, and anxious.
Openness to Experience	This dimension includes having wide interests, and being imaginative, curious and insightful.

Table 1.1 The big five dimensions

This study aims to understand and use the most recognizable personalities; the big five offers this option. The big five includes the most common personalities such as: cheerful, dominant, honest, etc. In daily life, people refer to personalities in a general way; they can mention that some people are shy and others are extroverted and everybody can understand those

concepts in everyday conversations. This idea will be adopted throughout this project, the implementation of a personality into interaction should be as clear as it is used by people in their daily social interactions.

1.2 Brand Personality

The brand personality concept emerged because it became evident that people tend to attribute human characteristics to brands. Brand personality refers to the set of personality characteristics associated with a brand (Aaker, 1997). Brand personality aims to create a stereotypical image of the perfect consumer for a brand. The product-user image reflects the stereotypical image of users or a product class or a brand (Sirgy et al. 2000). As a second step, people decide whether they want to belong to that particular stereotype by buying products of a specific brand.

Brand personality differs from the aim that this study has for the following reasons: the aim of brand personality is to generate a stereotype of their customers. For example, Diesel as a brand wants to evoke freshness, freedom and youthfulness. At this level the products of that brand may be seen as an extension of that stereotype. Therefore, consumers see themselves as fresh, free and young. In contrast, this study wants to implement personality characteristics in the product itself, not in a brand or its users. A description of what is meant for product personality is presented below.

1.3 Product personality

This project is based on a number of prior product personality studies, Nass, Moon, Fogg, Reeves and Dryer (1995), Janlert and Stolterman (1997), Govers (2004) Govers, Hekkert and Schoormans (2004) Govers and Schoormans (2005). What is meant with product personality is the part of the symbolic meaning that refers to the physical product itself and is described with human personality characteristics (Jordan 1997, 2000). The set of human personality characteristics used to describe a specific product variant (Govers, 2004). The aim of the approach of product personality is to create products with clear and recognizable personality that people understand and evaluate as they normally do with other people.

Prior studies tried to understand how people recognize and understand symbols in products. If designers understand and apply those symbols in products they will be able to evoke some personalities (Govers 2004). Moreover, by using these symbols designers can translate personality characteristics into the product form in a way that consumers understand (Govers, Hekkert, Schoormans, 2003). Previous studies addressed the theory and viability of this approach. In the same line the relevance of this approach is that industrial designers can

benefit from it to establish a clear differentiation among products. A strong concern that companies have in the current context.

The approach of product personality has been studied extensively in product appearance; however, there are other aspects of the product that may be relevant for eliciting a personality. For instance, another way that could be used for eliciting a personality is physical product interaction. If a product elicits a personality not only by its appearance but also by interaction, people might perceive that personality stronger and easier. Govers and Mugge (2004) support this argument; product interaction may also influence and enhance the desired product personality.

1.4 Product personality in interaction

Design for interaction is an approach that emerged in the field of industrial design. The main idea is to analyze and conceptualize by designing for human-product interaction in relation to the physical, cultural technological and societal contexts in which the product is used.

Interaction focuses on how people use (e.g. with one hand, two hands,), understand (e.g. “This seems to be the turn on button”) and experience products (e.g. pleasant experience, emotions, personalities, etc). Examples of products that can be created considering this approach can range from a more intuitive interface (software), a laundry machine (analogue) to a more enjoyable mobile phone (software and analogue). Product interaction is related to how people understand, use and experience products; a product only becomes a functional product and meaningful product when it is seen, used, interpreted or possessed by people. (Hekkert, van Dijk).

The concept of interaction is broad, thus we have to establish the direction that this study will take to know what the role of interaction is for eliciting a personality. It has been proven that by using product appearance it is possible to elicit a personality, thus it is not relevant for this study to follow that line of research. In addition, by using the appearance product characteristic the difficulties to address reliable results would be complicated due the uncertainty of what characteristic (appearance or interaction) expresses the personality. For this reason the focus of this project is oriented exclusively on physical interaction. This implies that we focus on the characteristics of the product that are perceived when users physically manipulate the product rather than those characteristics that can be perceived without physical manipulation of it. For clarifying the meaning of physical interaction the follow example is given:

A joystick with an organic and strong shape, sharp edges and bright colours may be regarded as an extroverted product. While physically interacting with it, the user pushes the buttons, moves the joystick from right to left, and receives feedback in terms of a gentle shaking when something goes wrong. By interacting with the product people might say that the joystick is friendly and extroverted. In this particular example, product personality in interaction evolves into a different personality characteristic: friendly. In the same way, the interaction might support the personality that is recognized by the joystick's appearance: extroverted. All these characteristics can be only perceived when people physically interact with objects and they are the focus of this research

Fig. 1.2 An extroverted joystick

Implementing a personality into physical interaction seems to be quite a challenge, however designers delve more and more into similar issues; a difficulty of affective concepts such as emotion or personality is that they are probably as intangible as they are appealing (Desmet, 2002). Previous studies have demonstrated that designers can translate aspects in their designs to evoke specific personalities (Govers, Hekkert, Schoormans, 2003). Based on the successful translation of personality characteristics into products' appearance, it seems feasible to implement a personality into physical interaction.

1.5 The contribution of this thesis

Based on the literature review a gap in the approach of product personality was identified. Prior studies have paid a strong emphasis on analyzing the role of visual product appearance to communicate a personality. As a result other factors have not been explored in order to understand the role that they have for expressing a personality. A clear example is product interaction; products evoke different feelings and experiences that are exclusively perceived by people only when they physically interact with products. Based on the previous arguments, the first contribution of this thesis is to know whether a designer can intentionally implement a personality into physical interaction and whether people can perceive such personality. It will

be a first attempt to bridge the gap between product appearance and product interaction within the approach of product personality.

Another evident gap in the field of product personality is that prior studies based their findings on products that are already in the market; products that have a personality but they were not intentionally designed trying to elicit the personality that people might see on them. In contrast, there are products that express a personality by a literal translation of antropomorphical shapes into products. This study does not aim to reach a personality by using literality translations of anthropomorphical shapes. If designers wish to create products with a certain personality they should translate an intangible concept into visual and material features in such a way that it is recognizable to other people (Govers, 2004). Attempts that have followed the previous description for eliciting a personality have finished in 2 dimensional concepts rather than in detail designs that people can see and use. This study aims to go further than sketches, by building a product or an artefact that enables an interaction that people can use, test and experience. To make this possible and considering that there are no similar examples, a design process to elicit a personality in interaction has to be proposed. Through interaction people can perceive and experience characteristics that most of the times cannot be seen. Interaction is skeletal in nature, hidden beneath our more tangible and sensory details (Heller, D., 2005). It is clearly known that designers make choices regarding appearance characteristics, such as shape, proportion, material, colour and texture, and decide how to mix these elements (Bloch, 1995). Designers have to make choices regarding interaction to elicit a personality. Creating something that goes beyond paper and proposing a design process is another contribution of this study.

A happy product is visualized using round and open forms and is associated with bright, fresh colours, like yellow, orange and red (Govers 2004). There is a general agreement that by implementing these factors into product appearance there are lots of chances to create a product that elicits happiness. In the same line, is it possible to determine a set of directions in physical interaction in order to evoke a specific personality? This thesis will contribute in finding the answer to this (and similar) questions.

2 Personality selection

The goal of this chapter is to select two personalities that will be implemented in product physical interaction. The selection process will be focused on selecting personalities that clearly describe product interaction.

2.1 Exploratory study

A previous study proposed a scale with 18 personalities to assess the personality that a product depicts by its appearance. This study did not prove that the personalities of the scale can be used as well to describe or assess product interaction. Table 2.1

Personalities			
▪ Cheerful	▪ Silly	▪ Modest	▪ Dominant
▪ Open	▪ Childish	▪ Honest	▪ Provocative
▪ Relax	▪ Untidy	▪ Serious	▪ Boring
▪ Pretty	▪ Idiosyncratic	▪ Aloof	
▪ Cute	▪ Interesting	▪ Lively	

Table 2.1 Eighteen personalities that can be recognized in products appearance

To determine if the personalities that were established by the prior study are used to describe product interaction an exploratory study was performed. The exploratory study was chosen on the basis of the following aspects:

- Designers can have a broad perspective of how people normally describe product interaction.
- Exploratory studies are implemented and performed in a very short period of time.
- The designer can take part actively in the exploratory studies to gain more knowledge.

2.1.1 Approach

9 graduate students from Delft University of Technology who are familiar with the approach of design for interaction participated in the exploratory study.

For the study the following materials were used:

- The scale with the 18 personalities that were proposed by Govers; including the description of each of them.
- Three different products to interact with: a coffee machine, a cassette tape player and a set of three different computer mice.

The experiment was conducted individually. A short introduction was given to each participant, explaining the aim of this study and a description of the findings of previous studies. It was also indicated that during the exploratory study they should refer to product interaction as if they were describing people in terms of personality. For example, the interaction is friendly, I feel that the product has a lively reaction; the sound of this button is very funny, etc. After participants received these indications they interacted with three different objects in the following order: Coffee machine, three computer mice, and a tape player.

Coffee Machine

In a previous study Govers (2004) this product was rated as a sociable, kind and warm coffee machine. It was rated based on pictures, thus interaction was excluded. This product was selected then, to determine if the interaction matches with those indicators of personality. Participants of the exploratory study were encouraged to imagine how a sociable, kind and warm interaction should be. After the participants described the possible interaction, they were allowed to interact with the product. Then, they describe the physical interaction that were experiencing. Finally, they explained if the imaginary interaction fit with the real one.

Computer mice

Participants interacted with three different computer mice. Each computer mouse was selected due similarities in: appearance, colour, weight, shape and especially in function. These conditions were established to diminish the influence of the appearance and to increase the perception of physical interaction. To enhance a strong difference in interactions, the scroll wheel of one mouse was modified; the changed eliminated the tactile and sound feedback by breaking an internal gear tooth. The participants interacted with each mouse as they normally do; clicking, scrolling and moving the mouse along the screen. After interacting with the three computer mice the participant assigned a personality to each of them. Further, they explained the main reasons of their selection and how it was related to product interaction.

Cassette tape player

The cassette tape cassette player was selected because it has a number of different buttons, sliders, and controls that enable a lot of physical interaction. The participants assigned at first impression a personality for this product. Then, by interacting with the product, the participants explained how the selected personality matched with product interaction.

Fig. 2.1 Exploratory study

After participants described the product interaction of three products by using personality traits, a small interview was performed. The interview was composed of questions related to what personalities could be implemented in product physical interaction. After performing some interviews, it turned to be a discussion in which participants were encouraged to imaging how a silly, dominant, or childish interaction should be. By using this approach participants reflected on these personalities and how they, as designers, could implement them in product interaction.

2.1.2 Results

From the exploratory studies, it was evident that some personalities from Govers' scale are to a greater extend attached to product appearance. For example, cute and pretty are naturally linked to visual aspects. People can describe something or someone pretty or cute mostly because of their look. As has been mentioned the scale was established to assess the personality that the product depicts by its appearance. It could be deduced that cute and pretty are exclusively used to describe visual aspect of products. Furthermore, we noticed that participants avoided using these personalities to describe product interaction. Other personalities that were avoided for describing product interaction are: open, aloof, untidy and boring. Avoiding their use might have happened due to the unfamiliarity of the participants with these personalities.

Based on the results of the interviews participants agreed that the following personalities can be implemented into physical interaction: relax, dominant, untidy, lively, provocative, honest, serious and boring.

An added finding gathered from the exploratory study is that personalities that are not included in Govers scale were used by participants to describe product interaction. It is notable

because these personalities describe product interaction clearly. The most relevant ones are: gentle, elegant, pleasant, and reliable.

2.1.3 Discussion

The exploratory study supported but also extended the findings of Govers (2004). Her study was supported by confirming that at least half of the personalities from the scale could be implemented in product physical interaction. Prior studies were extended by determining that there are personalities that describe physical interaction clearly. Based on these findings it was decided to pre-select five personalities to study them in detail. Three personalities will be selected Govers' scale and the other two from the exploratory study. The personalities that were clearly related to interaction from the scale are: relax, dominant, untidy, lively, provocative, honest, serious and boring. From the exploratory study the options are: gentle, elegant, pleasant, and reliable.

The main aspects that were considered to make the pre-selection were:

- The pre-selected personalities should have a strong relation with movements, sound and behaviour.
- The pre-selected personality should be well-known in daily life.
- To pre-selected personalities should represent different dimensions of the big five.
- The frequency of use of the personalities during the exploratory study to describe product interaction.

Based on the list of requirements, the five pre-selected personalities are: honest, dominant and lively (Govers, 2004) gentle and elegant (Exploratory study). These personalities are related to movements, sounds and they are frequently used in daily life. In addition they are a good representation of the different dimensions of the big five.

2.2 Selecting two relevant personalities

Two personalities will be selected among the set of five that were established previously. To have a general description of the five personalities a short summary of each is presented. (Oxford dictionary, 2006)

Gentle: Of persons: Mild in disposition or behaviour; kind, tender…Of language, actions, character, etc.: Courteous, polite. Referring to animals, Tame, quiet, easily managed…In things not harsh or irritating to the touch; soft, tender; yielding to pressure, pliant, supple… Of sound: soft, low; not loud or harsh. Moderate in operation, intensity, rate, or the like; esp. *a gentle heat*

Elegant: Of persons: Correct and delicate in taste. Refined in manners and habits. Of pursuits, studies (formerly also, of sentiments): Graceful, polite, appropriate to persons of refinement and cultivated taste. Characterized of physical movements: graceful, free from awkwardness. Sophisticated movements.

Dominant: Exercising chief authority or rule, governing, commanding, most influential. Occupying a commanding position.

Honest: Of persons: Held in honour; holding an honourable position; respectable. Of things, conditions, actions, etc …Of persons: Having honourable motives or principles; marked by uprightness or probity. a. In early use in a wide sense: Of good moral character; virtuous, upright, well-disposed. Of actions, feelings, etc.: Showing uprightness or sincerity of character or intention; fair, straightforward; free from fraud. Of a thing: Not seeming other than it is; genuine, unadulterated, unsophisticated.

Lively: Possessed of life; living, animate. Full of life. a. Of persons (occas. of animals), their faculties and actions: Vigorous, energetic, active, brisk. Of physical processes; Active, vigorous, brisk. Of liquor: Brisk, sparkling; opposed to flat. Of air: Fresh, invigorating…

From the previous descriptions it is clear that these terms are used not only for describing people, but also things, weather, materials, sounds, animals. It might indicate that the five personalities are good examples for implementing them into physical interaction. Considering that they are already identified in different things.

To select the two personalities we consider the next aspects:

- The nature of the personality should draw naturally people's attention.
- The personality should be rich in characteristics that are related to the personality itself. This will benefit to the translation and implementation of the personality into the interaction.
- There should be a clear differentiation between the two selected personalities.

From the exploratory study we pre-selected the elegant and gentle personalities. Gentle is used to describe the feelings of people (kind and tender). In things gentle is related to textures (not harsh or irritating to the touch). In terms of sound, gentle is associated with soft and low sounds. The characteristics of gentle seem to be quite similar among them: kind and tender, not harsh, soft. There is not much diversity among them.

Elegant is associated with movements, (graceful, free from awkwardness). In behaviour, an elegant person is refined in manners and habits. In terms of sound elegant is associated with low and smooth sounds. Additionally, this personality draws people's attention quite easily. Considering that this personality offers more diversity in movements and behaviour that could benefit the implementation of elegance into the interaction. From these arguments it can be

concluded that elegant is a personality that offers many possibilities for implementing it into physical interaction. Therefore, it is one of the selected personalities.

From Govers' scale the pre-selected personalities are: honest, gentle and dominant. It can be said that an honest personality exist when the product reacts as is expected to do (Not seeming other than it is). This normality can complicate the recognition of honesty in product interaction. Therefore, it does not fulfil the requirements that were previously mentioned and therefore it is not selected to be in the final list.

A lively personality is mostly pleasant, and it draws people's attention easily. The behaviour of lively persons is expressed by using particular movements and sounds. Additionally lively is seen as something full of life. This personality offers diversity in the different characteristics that are perceived from lively people. To decide however, it is necessary to describe the dominant personality.

A dominant person easily draws people's attention. He/she can be recognized because of their movements, tone of their voice and temperament. In addition, when interacting with a dominant person contradictory feelings are perceived. On one hand the dominant person is respected and on the other, it is not always a nice experience to interact with that person. The combination of these characteristics makes this personality very attractive for this study.

Lively and dominant fulfil all the requirements that were established for selecting the personalities. On the light of this fact new factors have to be determined to select one of them. A dominant interaction is particularly more appealing for the study because it is not completely seen as a pleasant personality. What is more, designers tend to select personalities such as: cute, friendly, provocative, cheerful. Little attention is paid to personalities that are not clearly perceived as pleasant. Based on the previous arguments dominant is selected to be implemented into physical interaction.

Fig. 2.2 five pre-selected personalities

2.3 Understanding elegant and dominant personalities

As was stated at the beginning of this project personality is an abstract concept that people used to evaluate, describe and detonate people as well as objects. Within this abstractionism designers have to determine a way to grasp these personalities to implement them into physical interaction. An effective way that designers use to deal with abstract issues is by using metaphors. A metaphor offers a model that allows a user's experience, knowledge and behaviour to be transferred from a familiar, real-world entity to, for example, a new computer interface. The metaphor, when well conceived, reduces the burden of grasping new concepts (Weir, Anderson, Jack, 2006). Another way to grasp abstract concepts is by organizing workshops. In these, people can discuss and express their thoughts about the theme that has previously been selected. Moreover, participants can build up over other's ideas, creating interesting concepts from which designers can be inspired for creating innovative designs. In addition, the structure of workshops is very flexible. It is possible to perform different activities like role playing, acting, etc. These activities help to designers to change their perception about the theme that they are concerned about.

2.4 Workshop: dominant and elegant personalities

The aim of this workshop was to come up with a consistent and broad meaning of elegant and dominant personalities. It will be used as source of inspiration for the next phase: designing interactions. The workshop was held two times to have as many participants as possible. They are referred as team 1 and team 2.

2.4.1 Approach

The structure of the workshop was divided in two parts. The first part was a group discussion and in the second part role playing exercises were carried out.

Participants

In the first workshop, there were 4 participants aged between 25 and 31 (team 1). In the second one there were three participants, aged between 26 and 31 (team 2). All the participants were master's students of Industrial Design.

Focus groups

As a pre-workshop activity all the participants were requested to bring two pictures. One should reflect dominance and the other one elegance. The starting point of the workshop was a focus group discussion in which participants explained why those pictures symbolized something dominant or elegant. The discussion concluded when participants defined a set of representative characteristics of dominant and elegant personalities. In the second part of the workshop two role playing exercises were performed.

Role playing in a restaurant

Groups of two participants had to interact elegantly or dominantly in a restaurant by using their body movements, tone of their voice, face reactions, etc. One participant acted as the client and the other one as the waiter. They performed the most common actions that are expected to do in a restaurant: the client asked for the menu, a drink and the main dish, he ate and finally, asked for the bill. The Waiter received the client, brought him to his table, and followed his orders. Participants performed the role playing two times: firstly acting elegantly and secondly acting dominantly. Each time that the role playing was performed, participants switched roles as it is showed next.

Participant A	**Participant B**
An elegant client	An elegant waiter
A dominant waiter	A dominant client

Role playing as a lamp

Groups of two people had to interact with a dominant and an elegant "product". One participant acted as the product, and the other one as the user. The product that was chosen to be performed was a foldable floor lamp because it involves a lot of physical interaction. Furthermore, it can be easily associated to the human body. For example standing a lamp up is similar to standing the human body up. Unfolding the parts of the lamp is similar to unfold the arms of the human body, etc. Participants performed the role playing two times. This time the participants did not switch roles. The participant that acted as the object had the chance to be a dominant and an elegant product. The user had to determine how to interact with it. Participants' role is showed next.

Participant A	**Participant B**
An elegant floor lamp	An neutral user
A dominant floor lamp	A neutral user

The participants received the next instructions to perform the role play: Inside of this package there is a foldable lamp that you just bought. You have to assemble, unfold, adjust its height and turn on the lamp for the first time. The lamp will react in a dominant or elegant way; you will perceive the characteristics of dominance or elegance by interacting with the lamp. When the interaction was occurring some questions were asked to the "product" and the user. Examples of these are: what is the weight of an elegant or dominant lamp? Is it easy to manipulate a dominant product? How does an elegant product reacts? Etc.

Fig. 2.3 First workshop Team 1 –group discussion and role playing-

Fig. 2.4 second workshop Team 2 –group discussion and role playing-

2.4.2 Results and discussion

The main findings of the workshops are reported next. They include a description of the most important traits of each personality, as well as a possible translation of the personality in terms of physical interaction.

Dominant

A dominant person has a strong behaviour, is secure and confident. He/she manages the situation that he/she are dealing with, often goes straight to the point and likes to make rules. Moreover, he/she enjoys drawing people's attention, by having a strategic position (the general manager in a company) or by overwhelming size or presence. A dominant person is respected; people follow his/her commands. This shows the power that dominant people have over others.

Dominant relationships

An interesting issue that was observed when participants interacted dominantly was the identification of four different relationships. These relationships are important to mention because one of them will be used during the coming phases of this project.

1. Dominant person	vs.	Dominant user	= rude experience
2. Dominant object	vs.	Dominant user	= annoying experience
3. Dominant object	vs.	Neutral user	= accepted experience
4. Neutral object	vs.	Dominant user	= accepted experience

From the previous list, the most interesting relationship is the one in which the object is dominant and the user is neutral. It is so because people have to identify a personality in the product and not the other way around.

A dominant interaction

On the basis of the dominant description and on the set of characteristics that were established for the dominant personality in the workshop, a dominant interaction is described next: It might be characterized by overreaction, going beyond user's expectations. For example, a Lamborghini is a dominant car, if users push the pedal it goes faster, beyond users' expectations. In terms of sound it should be loud enough to draw attention without irritating people. In terms of movements dominant people is recognized by the short, fragmented, slow and rigid movements that dominant persons perform. This can be translated in physical interaction by creating something impetuous, heavier and complicated to manipulate. The strength is a characteristic that should be included in the interaction; strength above the standard should be needed to manipulate the product.

Other characteristics of a dominant personality are: confidence, quality, and seriousness. In terms of interaction these characteristics can be translated into the performance of the interaction to express quality and confidence. Finally, in terms of materials, dominant could be related to something tough and strong such as steel.

Elegant

Elegant is strongly attached to movements, motion, balance, smoothness and gracefulness. An elegant person is confident and he/she likes to draw people's attention. An elegant person enjoys controlling all the small details of her/his movements, the tone and rhythm of his/her voice. These slight and soft changes make something or somebody elegant. Examples of elegancy are not exclusively attached to people, for instance in the animal kingdom, swans or cats are often mention as elegant animals. Their softness, smoothness, natural flow and quiet behaviour symbolize elegance. Based on the set of characteristics of the elegant personality a possible translation in terms of physical interaction is given below.

An elegant interaction

In terms of movements, an elegant interaction could be characterized by a soft flow. Everything moves naturally, following a soft pattern and without interruptions. Moreover, long, balanced and smooth movements should be considered to elicit elegance by physical

interaction. The interaction has to follow the rhythm of people; as soon as the user stops an action, the interaction has to react in the same way. It is clear that interacting with an elegant people is easy and efficient; people have to perceive the same feeling by interacting with an elegant product. In terms of weight it should be heavy enough to be used comfortably. It is expected that little effort is needed to interact with an elegant product.

Sophistication and refinement are qualities of elegance; reaching these qualities is essential to elicit elegance. To implement them into physical interaction a very detailed product should be constructed. Through the quality of the product sophistication and refinement can be perceived by people while interact with a product.

An elegant person is quiet and calmed; these characteristics can be translated in terms of sounds by using soft, smooth and short duration sounds. In terms of materials and textures a material that could be used to elicit elegance is glass. It is very smooth, and fragile.

This was a first attempt to translate the characteristics of dominance and elegance in terms of physical interaction. In the coming phase a detail translation of the characteristics of the two selected personalities into dimensions of interaction will be made.

2.5 Findings of the chapter

This phase of the project has been very valuable; it was confirmed that personality traits can be used, for describing, denoting and evaluating product interaction. Additionally, two personalities were selected to be implemented in product physical interaction. It is evident that describing interactions by using personality traits is to far from implementing them. The expectations to do it however, are high. Designers have a set of tools to grasp abstract issues and transform them in tangible results such as a product, a service, a logo or even an interaction.

The next step of this project is to design two interactions, each based on a personality. It will be done by using all the knowledge that was gathered through the exploratory study and mainly the workshops. The discussion group and the role playing offered alternatives to delve deep into how an interaction based on a particular personality might be. The results of this chapter are vast and they are the basis of the next phase of this study.

3 Designing interactions

The goal of this chapter is to create the stimuli through which an elegant and a dominant interaction will be experienced. To start with, we describe the research method that is used in this project. Further, the dimensions of interaction are explained and how these will be used for implementing a personality into physical interaction. Then, the selection of the product or object through which the interactions will be experienced is described. Afterwards, the design process is reported and the stimuli are shown.

3.1 Research through design

One of the most interesting aspects of this project is to implement personality traits into physical interaction; the result will be reflected in a product or an artefact that people can use to interact with. Therefore, through a design activity a hypothesis will be answered. Based on this condition, this project can be considered a research trough design project.

Research through design proposes the use of the design process as a form of research to contribute or improve the field of design or another one. Basically, it is about generating scientific knowledge through the act of designing. Research through design is a form of action research. Archer (1999) defines it as systematic enquiry conducted through the medium of practical actions, calculated to devise or test new, or newly imported information, ideas, forms or procedures and to generate communicable knowledge.

Under these conditions this study wants to answer a research question (Is it actually possible to intentionally implement personalities in physical interaction that people recognize?) through a design activity (designing the interactions). Once that the research method has been explained, the following action is to delineate the dimensions of product interaction that will be used to perform the design activity.

3.2 Dimensions of product interaction

To implement the characteristics of the selected personalities different dimensions of interaction will be used. Examples of these dimensions are: motion (fast, slow, long, short movements, etc.), forces (strength, pressure, weight, etc.), textures (smooth, rough, soft, etc.) sound (loud, low, etc.), performance (refinement, balance, restrictiveness, etc.). Fig. 3.1

depicts the dimensions of product interaction. These dimensions of interactions are proposed on the basis of prior studies about design for interaction (Janlert and Stolterman, 1997, Klooster, 2002 and Saffer, 2006).

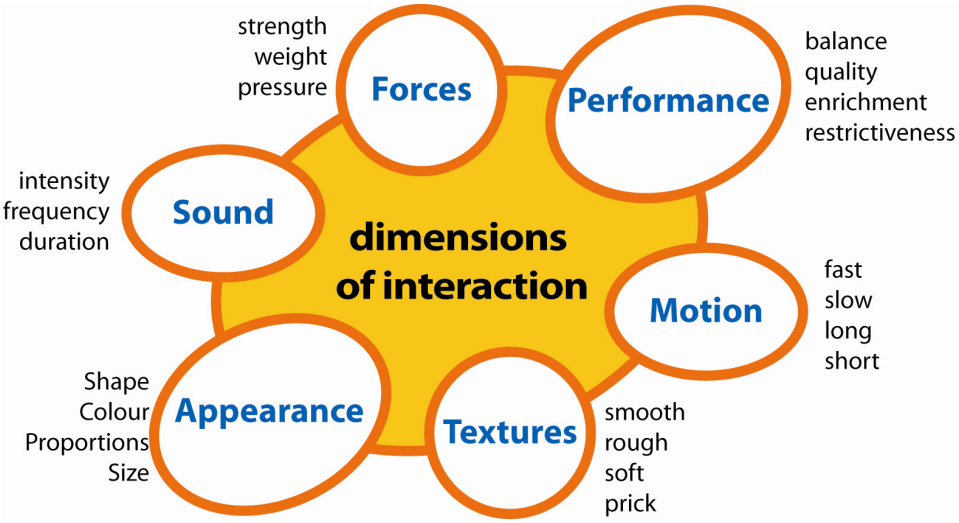


Fig.3.1 Interaction Dimensions

Appearance

One important dimension of interaction is appearance. Further product appearance is one central aspect to elicit a personality (Govers, Hekkert, Schoormans, 2003). This study however is focused on product physical interaction. For this reason, product appearance has to be excluded from this study. It stands to the reason that by using product visual appearance it might be complicated to determine by which via (appearance or interaction) the personality was recognized. As a result of this exclusion five dimensions of interaction will be used, these are: forces, performance, motion, textures, and sound.

3.2.1 Interaction characteristics to elicit dominance

Based on the input that was gathered from the workshops, in combination with the interaction dimensions that will be used, it was possible to establish the characteristics that a dominant interaction should express.

Force	The interaction should be manipulated by applying strength above the standard. Additionally, heaviness has to be perceived through the interaction.
Sound	The sound should be loud enough to catch people's attention.
Motion	The interaction should allow slow, short and straight movements.
Texture	the texture that should be perceived are roughness and harshness.

Performance The interaction should elicit, quality, restrictiveness and unbalance.

3.2.2 Interaction characteristics to elicit elegance

As in the previous case, based on the input that was gathered from the workshops, in combination with the interaction dimensions that will be used, it was possible to establish the characteristics that an elegant interaction should express.

Force the interaction should be manipulate with little effort. Standard heaviness should be perceived.
Sound The sound should be soft and quiet. Its duration should be short.
Motion The interaction should allow unrestrictive and long extended movements.
Texture Smoothness is the texture that should be perceived.
Performance The interaction should elicit quality, balance, refinement and sophistication

3.3 Product selection

After establishing the requirements to design an elegant and dominant interaction, the next step was to decide in which form the stimuli will turn to be (a product, an artefact, etc.).

The only restriction that had to be considered for designing the interactions was the exclusion of product appearance from this study. Two options were proposed to deal with this restriction. The first one was to blindfold people when interacting with the stimulus. The second one was to hide the stimulus from people's eyes; showing only the elements that people will use to interact with the stimuli. By solving this restriction more elements will be gathered to decide the best form that stimuli has to adopt.

To test which of these two options was better three mock-ups were created. Each of them was designed based on the requirements that were established for creating a dominant or elegant interaction. The first concept was similar to a sliding block puzzle; blindfolded people have to shift the blocks in horizontal or vertical direction for solving a puzzle. The second concept was similar to a pantograph; blindfolded people use it for drawing a predefined shape. The third concept was an artefact. It enables the actions of pushing, pulling, and lifting up. Fig. 3.2

Fig. 3.2 From left to right concepts one, two and three.

When people test the three mock-ups the following results were gathered:

- People that are momentaneously blindfolded are stressed and anxious because they had to perform a task with something that they cannot see.
- Designing an interaction to be used by blindfolded people is more complex than to hide the artefact. This is because the designer has to determine how a blindfolded person has to interact with the stimuli and at the same time to implement a personality into the interaction.
- By building the stimuli into the form of an artefact the design process was faster and people interacted better because they could see some elements of the artefact. These elements were visible because through using them the interaction was performed.

One advantage that the artefact has over the other concepts is that it offers more freedom to manipulate the different dimensions of product interaction. This is because the artefact fulfils only the function of expressing a personality by physical interaction. Furthermore, this artefact can easily be covered up to avoid the influence of its appearance. Based on the previous reasons, the stimuli of the main experiment will be built into the form of an artefact.

3.4 Concepts

Creating mock-ups was the starting point of the design process. The next action was to build some prototypes based on the characteristics that were defined to elicit a dominant or elegant interaction (section 3.2.1 and 3.2.2.). The process of creating and building the prototypes consisted of three phases; first, the characteristics of dominance/elegance were implemented into the stimulus. It was done by using the different dimensions of interaction. Second, some students of industrial designed tested the interactions. Based on their comments some improvements were done in the stimuli. Third, an evaluation was performed. The evaluation consisted in checking the correct implementation of the characteristics that the

dominant/elegant interaction should express. If the prototype did not express the characteristics of dominance/elegance a new stimulus was built, taking into account the knowledge gathered from the previous prototype. The evaluation of the prototypes was done by the supervisory team of this project. Figure 3.3 shows some examples of the prototypes that were built.

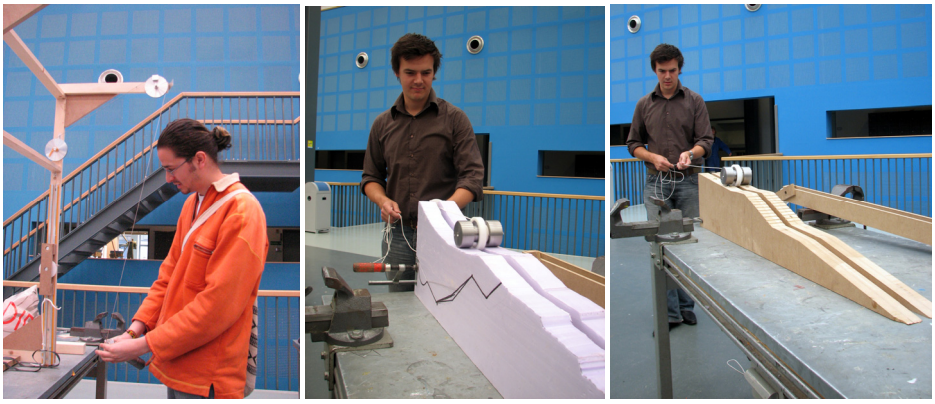


Fig. 3.3 Prototypes that were built to create the interactions.

For the dominant interaction three prototypes were built, and for the elegant interaction two. The elegant stimulus was built after the dominant was completed. As a result some extra requirements had to be accomplished. The most relevant requirement was the way of interacting. It had to be the same in both stimuli to compare results.

As has been said the evaluation of the prototypes was made on the basis of the requirements that each interaction has to fulfil. The evaluation however, was very subjective and complex to describe. It is easier then, to illustrate the most recurrent deficiencies that were made during the design process. It might help other designers to avoid similar inconveniences.

- An interaction was often rejected because of wrong translation of personality characteristics into physical interaction. An elegant sound should be soft and quiet. When implementing these characteristic into the stimuli the sound turned to be loud. In other occasions the implementation of one characteristic was overused. For example, the interaction was heavier than it was planned to be.
- Another recurrent problem was the unbalanced used of the dimensions of interaction. Dimensions such as sound or force diminish the effect of others such as performance or motion.

It has to be stressed that designing products or interaction to express a personality is based on auto-critical process. If the designer is not satisfied with the result of his/her design in

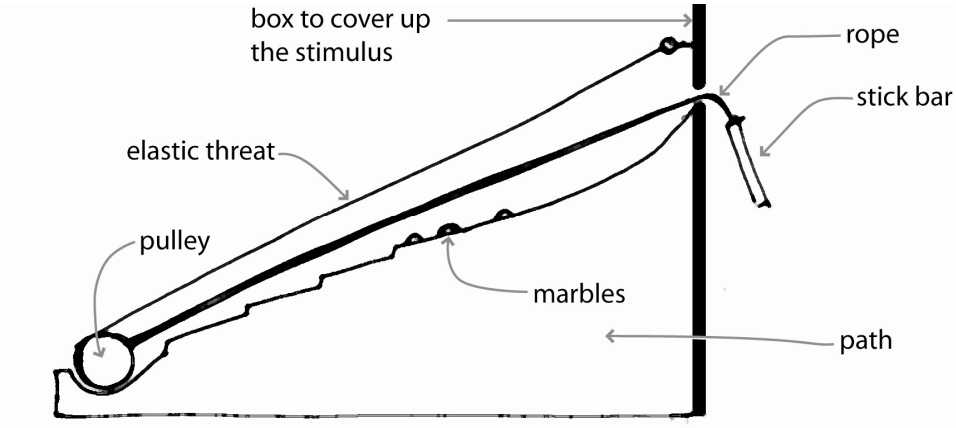
terms of personality, it might be because by his experience in judging personality in other humans he/she realizes that some aspects are not reached in the design. It is recommended then that designers reflect in what he is missing and improve it into the design.

After a long design process in which trail and error was the main way to reach the desired interaction, the stimuli that enables the interactions was finished, a description of each stimulus is given next.

3.5 Dominant stimulus

The design of the interaction was based on a set of characteristics of dominance and they were implemented into five dimensions of interaction. These dimensions will be used to describe how the stimulus elicits dominance by a particular way of interacting, which is described first.

To interaction with the artefact a stick bar has to be pulled in different directions. The stick bar is attached to a rope, and the rope is connected to a pulley. All the effects to reach dominance are transmitted through the rope and the pulley to the stick bar. The pulley has to follow a path which has a specific shape, specially designed to express dominance. Each time that the stick bar reaches its limits, the pulley winds up, going back to its original position. The stimulus then is ready to be used for the next time. Fig. 3.4



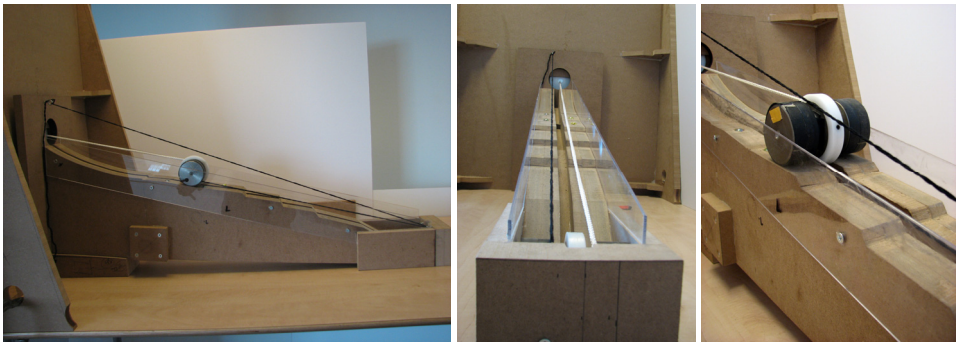


Fig. 3.4 Dominant stimulus

The description of the characteristics of dominance that were implemented into each dimension of interaction is explained below.

Force dimension: heaviness and strength
A pulley made of steel adds the heaviness into the interaction. The same pulley is attached to an elastic threat to increase the strength needed to interact with the stimuli. The elastic threat reacts against the pulling, thus, the more the stick bar is pulled, the more strength is needed. These characteristics were implemented considering that a dominant person wants to have the control of the situation.

Sound dimension: loudness
The loud sound is made by the combination of two materials (steel covered with rubber and MDF) and the shape of the path that the pulley had to follow.

Motion dimension: slow, short and straight movements
The slow movements are reached by combining the weight of the pulley and the shape of the path that it has to follow. The short movements are established by the length of the cord. The straight movements were defined by using an external factor (the location of some elements that were reached with the stick bar).

Texture dimension: roughness
The rough texture is perceived through the cord that is used to connect the pulley with the stick bar.

Performance dimension: quality, restrictiveness and unbalance
To include restrictiveness the path has some slopes that stop the pulley and therefore the interaction. These slopes break the fluency of the interaction, characteristic that influences the perception of restrictiveness (there are 5 slopes that constantly stop the pulley). To create an unbalanced interaction a set of marbles is used to lift up the pulley at different points.

3.6 Elegant stimulus

To interact with the elegant stimulus a stick bar has to be pulled in different directions. The stick bar is attached to a rope, which is connected to a mechanism. The mechanism is composed by a plate, a spring air and a small wheel and it follows the waving path. All the elements go back to its original position by using a counterweight. The stimulus then is ready to be used for the next time. Fig. 3.5

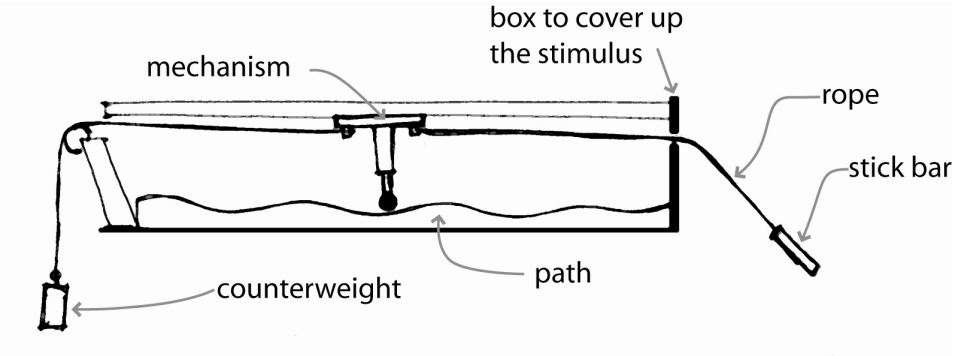


Fig. 3.5 Elegant artefact

The description of the characteristics of elegance that were implemented into each dimension of interaction is explained below.

Force dimension: little strength, standard heaviness
The interaction should be manipulated with little strength and it should have a standard weight. These characteristics were reached by using plastic and aluminium materials (light and soft materials). The little strength was reach by using the standard weight, in combination with the smoothness of all the elements of the stimulus.

Sound dimension: soft and low sounds
Using plastic materials was the way to create quiet and soft sound. Plastics have the characteristic that when their surfaces are in contact, the sound that they make is very soft. The sound of the mechanism however was louder than expected. For this reason a cardboard box was built to enclose the sound and diminish the effect on users.

Motion dimension: long extended and unrestrictive movements
The long extended movements were implemented by the length of the cord. The unrestrictive movements were implemented by conceiving a stimulus in which all its parts work together. A small complication was the way in which the mechanism rolled back. Sometimes it rolled back so slow that interrupts the interaction; others, it rolled back so fast that distracts the perception of elegance.

Texture dimension: smoothness
Smoothness was implemented into the stimulus by polishing all the elements of the stimuli. The waving path and the wheel are examples of this. They were completely polished to avoid friction and express smoothness.

Performance dimension: balance, refinement and sophistication
For implementing these characteristics all the components of the stimulus were built precisely and accurately. In addition to elicit refinement and sophistication the path has a waving shape. These waves have different heights and lengths to make soft motion changes when the stick bar is pulled.

3.7 Conclusions of the chapter

Throughout the course of this phase of the study, various prototypes were built to elicit a personality by physical interaction. The first prototypes were very simple solutions, only some dimensions of interaction were integrated into the stimuli. Each time that a prototype was rejected, new knowledge was gathered, which was really helpful to enrich the final interaction. It was designed by combining in a balanced way the different dimensions of interaction. In contrast, the process of building the stimuli (trial and error) was too long and demanding.

As was mentioned in the introduction of this chapter, the aim of this phase was to create the stimuli through which an elegant and a dominant interaction will be experienced. After an intensive design process the goal was achieved; an elegant and a dominant stimulus are ready to be tested by physical interaction. The assessment will be performed in the next phase of this study, which is reported next.

4 Main study

The goal of this chapter is to report the main study of this project, as well as the results that were gathered from it.

This study has the following aim:
1) To test whether the interaction with the stimulus elicits the personality trait that was implemented in the physical interaction. Moreover, is the personality recognized as such by users?

- **H1a**: Is the physical interaction with the dominant stimulus recognized as dominant?
- **H1b**: Is the physical interaction with the elegant stimulus recognized as elegant?

2) To test if the characteristics implemented in the interaction (e.g. loudness, heaviness, roughness) are related to a specific personality (e.g. dominant).

- **H2a**: Is there a correlation between a set of interaction characteristics (heavy, loud, restrictive, complicated to manipulate, strength to use) with the recognition of the dominant personality?
- **H2b**: Is there a correlation between a set of interaction characteristics (balance, accessible, flexible, refined and smooth) with the recognition of the elegant personality?

4.1 Method

A convenient sample of 60 participants (N = 60) was used for this study. Participants were approximately equally distributed in gender (n = 31 males, n = 29 females) their ages ranged from 21 to 40 years old (M=26.1 years old). Participants were approached at Delft University of Technology and they received a gift for their participation. The original number of participants was 63 people, due complications in the experiment the data of 3 participants were excluded from the final analysis.

Stimuli

The stimuli were the two artefacts that were designed previously; their description can be found in sections 3.5 and 3.6 of this report.

Material

A paper questionnaire was used for collecting the data. It included 2 parts: the first one have questions regarding name, age, profession and gender. In the second one, participants had to fill in the questionnaire which includes a set of 7 personalities that are depicted in table 4.1., and a set of questions regarding to the interaction characteristics (e.g. I found this artefact very smooth, I found that this artefact requires a lot of strength to use it, etc.). Participants assessed the questions of the second part of the questionnaire on a seven point scale. The complete setup of the experiment can be found in appendix A.

Not boring	1	2	3	4	5	6	7	**Very boring**
Not dominant	1	2	3	4	5	6	7	**Very dominant**
Not honest	1	2	3	4	5	6	7	**Very Honest**
Not easy going	1	2	3	4	5	6	7	**Very easy going**
Not gentle	1	2	3	4	5	6	7	**Very gentle**
Not lively	1	2	3	4	5	6	7	**Very lively**
Not elegant	1	2	3	4	5	6	7	**Very elegant**

Table 4.1 Seven personalities

Setup

The experiment was performed in a laboratory of the Faculty of Industrial Design of Delft University of Technology. In the laboratory a practical arrangement was set. The stimuli were placed inside of two boxes, almost two meters in height. The reason for this was to avoid the influence of their appearance in participants as much as possible. Additionally, seven aluminium tubes (10 mm diameter) were hanging down from the ceiling and in front of each stimulus. The tubes were used to perform the task. Image 4.1 shows the experimental setting.

Fig. 4.1 experimental setting

Procedure

The experiment was conducted in an individual basis. Participants received verbal and written instructions. The written instructions included: a general description of the approach of product personality in interaction, one example that clarified the meaning of physical interaction and the instructions to perform the task. Through verbal instructions the last instructions to perform the task were given and it was indicated the stimulus that they had to interact with at first. Participants performed the task and afterwards they received the questionnaire. The last part of the experiment was an interview. From the interview information was gathered to determine what aspects the participant perceived to recognize a personality. As well as, to know if they were influenced by the elements which were placed in the laboratory to assess the interaction.

Task

Participants interacted with the stimuli by pulling a stick bar that was alike in both artefacts (by using the same material, length and diameter). By pulling the stick bar participants had to hit 7 tubes that were hanging down from the ceiling and in front of each stimulus. After the participants hit the first tube, they were instructed to go back to the starting point. This action enabled the stimulus to be used for the next time. This interaction was performed 7 times, (hitting one tube and going back). Participants did not have to follow an order for hitting the tubes but they were instructed to hit them all. The Fig. 4.2 shows the interaction with the stimuli by performing the task.

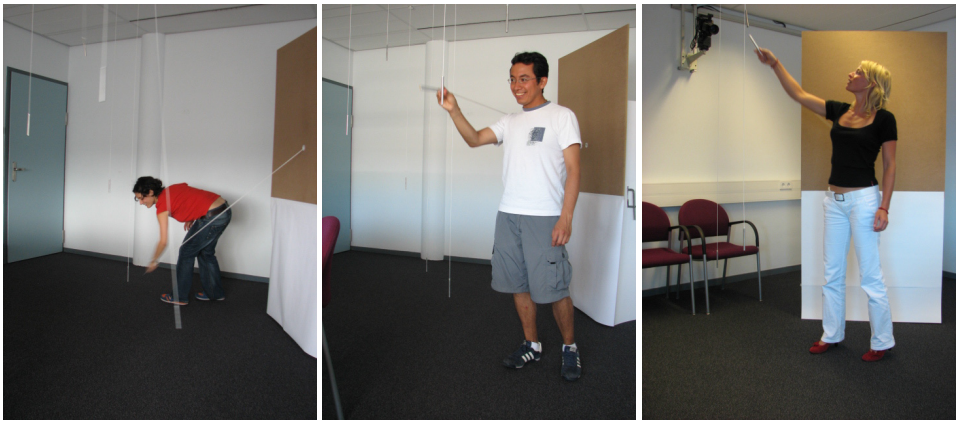


Fig. 4.2 interacting with the stimuli

Sequence of interaction

During the experiment a specific sequence was followed: the first 30 participants interacted individually with the dominant stimulus, they assessed it and finally participants were interviewed. The same participants then, interacted with the elegant stimulus following the same procedure. The other 30 participants first interacted individually with the elegant stimulus, they assessed it and they were interviewed. The same participants then, interacted with the dominant stimulus following the same procedure.

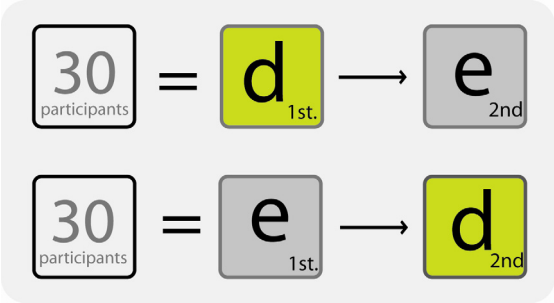


Fig. 4.3 data that was consider for the between and within subject analysis

4.2 Results

The results of the experiment are divided into two sections. Sections 4.2.1 and 4.2.2 report the results of the between subject analysis of the dominant and elegant stimulus respectively. The between subject analysis only includes the data in which participants could not compare the interactions; the first 60 questionnaires. Participants assessed the interaction as they experienced, understood and perceived it. To confirm our hypothesis the results of the between subject analysis are used, considering that they better reflect the perception of the personalities.

4.2.1 Between subject analysis of the dominant stimulus

In order to determine whether the respondents recognized the personality that was implemented in the interaction with the dominant stimulus (test of H1a) a repeated measures variant analysis was conducted. It compares the Mean score of each personality that was included in the questionnaire. The results are shown in table 4.2. which are depicted graphically in Fig. 4.4. A complete overview of the repeated measures variant analysis can be found in appendix B.

Estimates

Dependent variable	Stimulus	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Boring	dominant	3.033	0.267	2.499	3.567
Dominant	**dominant**	**4.867**	**0.289**	**4.287**	**5.446**
Honest	dominant	3.933	0.270	3.393	4.474
Easy going	dominant	2.467	0.269	1.929	3.005
Gentle	dominant	2.567	0.267	2.032	3.102
Lively	dominant	4.667	0.289	4.089	5.244
Elegant	**dominant**	**3.033**	**0.303**	**2.427**	**3.640**

*p<.05

Table 4.2 Results of the repeated measures analysis for the dominant stimulus

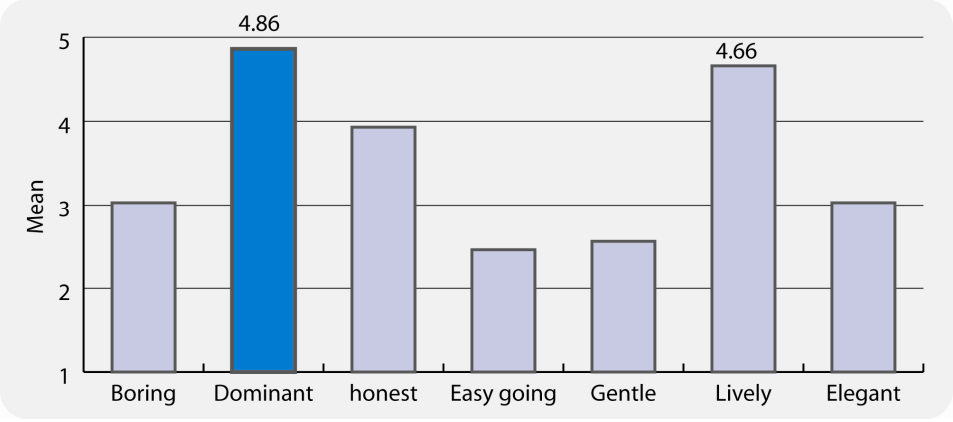


Fig. 4.4 Score of the seven personalities when participants interacted with the dominant stimulus

Based on the results of table 4.2 it is possible to answer hypothesis H1a: is the physical interaction with the dominant stimulus recognized as dominant? The results show that the interaction with the dominant stimulus was rated as dominant ($M=4.867$, $p<.001$). This result confirms hypothesis H1a. In addition, a second personality was highly perceived: lively ($M=4.667$, $p<.001$).

The role of interaction characteristics for eliciting dominance

A T-test and a regression analysis were conducted to determine hypothesis H2a (Is there a correlation between a set of interaction characteristics with the recognition of the dominant personality?). The results of the T-Test are depicted graphically in fig. 4.5. The complete results of the T-Test analysis can be found in appendix B.

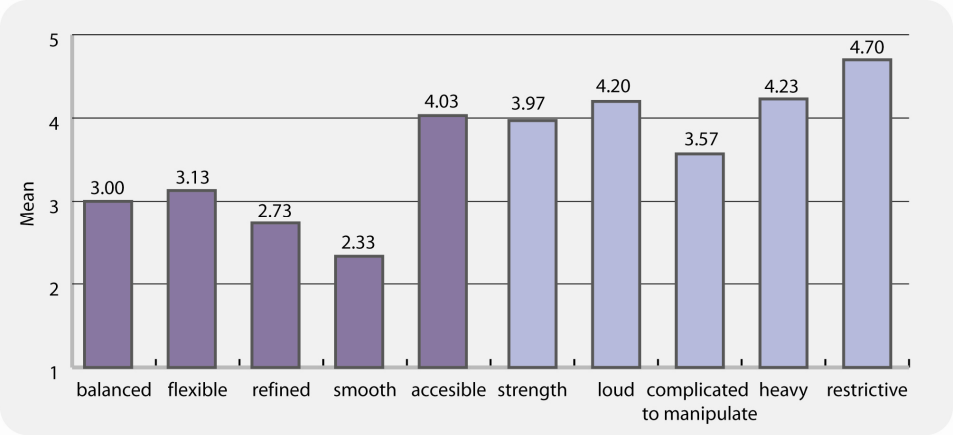


Fig. 4.5 Scores of the characteristics of interaction for the dominant stimulus

For eliciting dominance the following characteristics were intentionally manipulated in the stimulus: heaviness (M=4.23), loudness (M=4.20), complicated to manipulate (M=3.57), restrictiveness (M=4.70), and strength (M=3.97). Based on the Mean score that these characteristics obtained we can observed that they were highly perceived. To know whether these characteristics have a significant effect in eliciting dominance, a correlation analysis was conducted.

The result of the correlation analysis shows that these characteristics do not have a significant effect to elicit dominance: strength to use ($p<.62$) restrictiveness ($p<.49$) heaviness ($p<.92$) and loudness ($p<.31$). Based on these results it is not possible to confirm a correlation between the previous interaction characteristics and dominance. Hypothesis H2a cannot be confirmed.

4.2.2 Between subject analysis of the Elegant stimulus

In order to determine whether the respondents recognized the personality that was implemented in the interaction with the elegant stimulus (test of H1b) a repeated measures variant analysis was conducted. It compared the Means score of the seven personalities that were included in the questionnaire. The results are shown in table 4.4. and depicted

graphically in figure 4.6. A complete overview of the repeated measures variant analysis can be found in appendix B.

Estimates

Dependent variable	Stimulus	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Boring	elegant	4.200	0.267	3.666	4.734
Dominant	**elegant**	**3.300**	**0.289**	**2.721**	**3.879**
Honest	elegant	4.633	0.270	4.093	5.174
Easy going	elegant	4.700	0.269	4.162	5.238
Gentle	elegant	4.033	0.267	3.498	4.568
Lively	elegant	3.300	0.289	2.722	3.878
Elegant	**elegant**	**3.200**	**0.303**	**2.593**	**3.807**

*p<.05

Table 4.4 Results of repeated measure analysis for the elegant stimulus

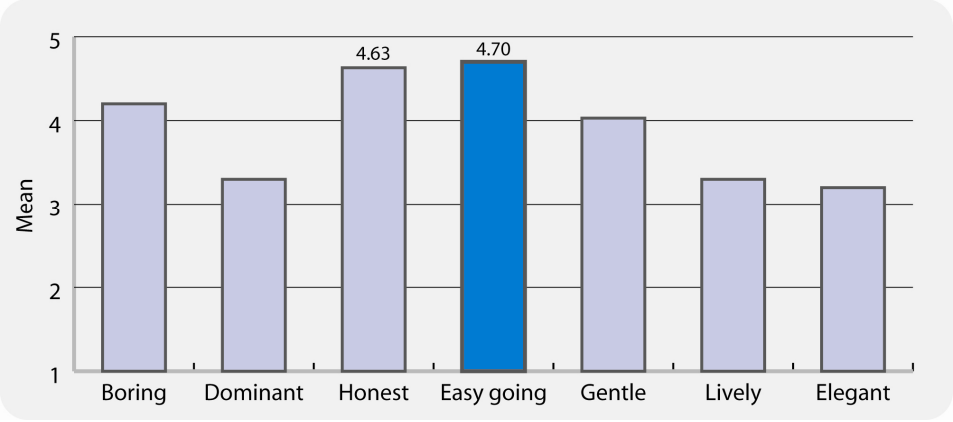


Fig. 4.6 Means Score of the seven personalities when participants interacted with the elegant stimulus

Based on the results of table 4.2 it is possible to answer hypothesis A1b: is the physical interaction with the elegant stimulus recognized as elegant? The results show that the interaction with the elegant stimuli was recognized as easy going (M=4.700, p<.001). Based on this result, it is not possible to confirm hypothesis H1b. Additionally, a second personality was highly perceived: honest (M=4.663, p<.001).

The role of the characteristics of the interaction for eliciting elegance

The elegant interaction was perceived as easy going, therefore it is not possible to confirm hypothesis H2b (Is there a correlation between a set of interaction characteristics with the recognition of the elegant personality?). Nevertheless, to determine how the characteristics were perceived a T-Test analysis and subsequently a correlation analysis were conducted.

This will help to gain a general understanding of the possible causes that influenced the recognition of an easy going personality in the elegant stimulus. The results of the T-Test are depicted graphically in fig. 4.7. The complete results of the T-Test analysis can be found in appendix B.

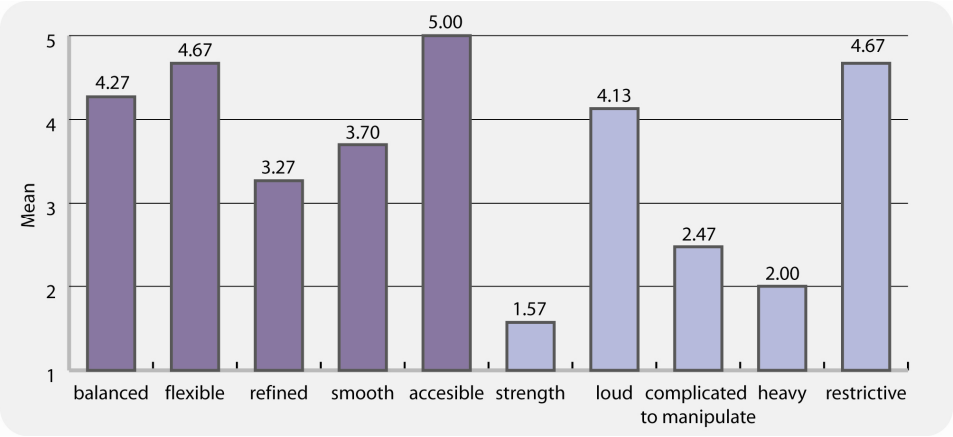


Fig. 4.7 Scores of the characteristics of interaction for the elegant stimulus

For eliciting elegance the following characteristics were intentionally manipulated in the stimulus: balance (M=4.27), accessibility (M=5.00), flexibility (M=4.67), refinement (M=3.27), and smoothness (M=3.70). The first three characteristics were highly perceived and to a less degree the other two. In contrast, two characteristics were unexpectedly perceived: loudness (M=4.13) and restrictiveness (4.67). The perception of these characteristics might have influenced the recognition of the interaction as easy going. An additional analysis is needed to determine whether there are characteristics that have a significant effect on eliciting elegance. For this reason a correlation analysis was conducted.

The characteristics that have a significant effect to elicit elegance are: balance ($p<0.01$), heaviness ($p<.01$, $r=-.446$) refinement ($p<.01$) and smoothness ($p<.01$). Balanced, smoothness and refinement were intentionally manipulated in the interaction to elicit elegance.

It is evident that a post hoc analysis has to be conducted to depict a general scenario. Through the post hoc analysis understanding of what characteristics were attached to each personality will be gained. The post hoc study is reported in the last section of this chapter.

4.2.3 Post hoc study

Considering that the elegant interaction was recognized as easy going a correlation analysis was conducted to identify what characteristics have a significant effect on eliciting an easy going personality. The complete results of the correlation analysis can be found in appendix D.

The characteristics that have a significant effect to elicit an easy going personality are: heavy ($r=-.424$, $p<0.02$), complicated to manipulate ($r=-.380$, $p<.03$), smooth ($p<.05$) and strength to use ($r=-.494$, $p<.001$,).

The different analyses that were conducted in this chapter depicted a general view of how people perceived the interactions. These will help to establish why the participants recognized the personalities as they did. In the coming chapter, the discussion of the results, design implications and recommendations for future research will be reported.

5 Discussion

The aim of this study was to investigate if it is possible to intentionally implement a personality in product interaction that users can recognize. To investigate how users recognize personalities in interaction, we first designed two stimuli based on two different personalities (dominant and elegant). Second, we performed an experiment where people assessed which personalities they experience while interacting with the stimuli.

5.1 Perception of product personality in interaction

The first hypothesis that was investigated was the recognition of product personality in physical interaction. Based on the results of our study we assume that people do recognize personalities through physical interaction. People recognized the personality of the dominant interaction. The elegant interaction however, was recognized as easy going. Although one personality was not recognized we still can conclude that personalities can be embodied in physical interaction. The following arguments are presented to support the previous assumption.

- We propose a design process to implement intentionally a personality into physical interaction. This process consists of three phases. Selecting and analysing the personality. Implementing the characteristics of personality into physical interaction and testing the design. We claim then, that by using this design process we created congruent stimuli that elicit a specific personality.
- The conclusions are addressed on the basis of the between subject analysis because it only considers the assessment that each stimulus obtained without any comparison. The assessment is based on the performance of each interaction. The personality that is recognized then, it is directly recognized from the interaction and not from other aspects.
- The elegant interaction was recognized as easy going. This recognition can be the result of inconsistencies in the implementation of the characteristics of elegance into the stimulus. More evidence can be adduced to corroborate this argument by mentioning which characteristics were incorrectly implemented and how they influenced the perception of different personalities.

5.2 Design evaluation

In this section, it is explained why the dominant stimulus was recognized to have a dominant personality, as well as why the elegant stimulus was recognized to have an easy going one. The evaluation starts with the elegant stimulus.

5.2.1 Elegant interaction

The correlation analysis indicates that characteristics as balanced, flexible and smoothness have a significant effect in people's perception of elegance. This finding indicates that we were in the right direction to elicit elegance; however, other characteristics such as quietness, and refinement did not improve significantly the elegant experience in the interaction.

The characteristics that were implemented in the elegant stimulus were not perceived as they were planned due to two main reasons. A partial implementation of the characteristic; e.g. refinement was implemented into the interaction. It was perceived however, in a less degree than it was intended. An unsuccessful implementation of the characteristic; we tried to implement a soft and peaceful sound nonetheless we did not succeed due to problems with the sound of the mechanism.

Three possible reasons why respondents did not recognize the elegant personality are presented below:

1) In our perception an elegant interaction allows the user to do the things that he wants without interference, smoothly and gently. The elegant stimulus did not completely reach these aspects due to complications with the mechanism that winded up the rope. Winding up the rope was so slow that the respondents were obliged to wait, interfering in the interaction rather than facilitating it.
2) We proposed that elegance is related to long movements. To enable this characteristic in the interaction we increase the length of the rope in the elegant stimulus. The length however was not enough to let the participant experience long movements.
3) The interaction with the elegant artefact was too simple. This caused the participants not being demanded to pay attention to it. The interaction lacks of elements to capture participants' attention. An elegant person in contrast, captives his/her audience easily.

The way of interacting with the stimulus (pulling a rope) might not be the best form to interact elegantly. At the end of the designed process we observed that elegant might be expressed better by a direct contact with products. For example, by pushing a button, or by sliding up the cover of a mobile phone to reveal its buttons.

During the design process we tested the stimulus by interacting with it slowly and gently. During the experiment however, people realized that they could manipulate the stimulus quite easy. It resulted in a fast and rough interaction. A way to solve this complication was by telling participants that they had to interact with the stimulus slowly and gently. It was not done because in our opinion, the design had to be good enough to speak for itself. It seems appropriate to presume that the elegant interaction lacks in the use of elements that enrich the message of elegance.

5.2.2 Dominant interaction

The interaction was designed as a whole entity. All the interaction characteristics that were used for eliciting dominance: heaviness, loudness, restrictiveness, complexity to manipulate and strength to use are balanced in the design. This creates a strong message that communicates dominance, which might be the result of a good selection and translation of dominant characteristics into the interaction. In contrast, there is no factual evidence to suggest a correlation between the interaction characteristics with dominance.

The dominant interaction was designed first. The freedom to select a particular way of interaction and to include dominant characteristics at the same time had a positive effect in creating a dominant interaction. The benefits were reflected in the number of prototypes that were built, as well as, different options to implement personality characteristics into physical interaction were tried. As a result, by building different prototypes enriched the final stimulus.

A finding that was gathered through interviewing is that participants were captive by the interaction. This might happened because different elements to enrich the message of dominance were implemented.

5.2.3 An easy going interaction

The design evaluation includes an analysis to address the reasons why the interaction with the elegant stimulus was recognized as easy going.

Easy going: someone that takes things easily; comfort-loving; He is a careless, always cheerful. Loose, informal, leisurely; unhurried. Living without undue worry or concern; calm. Relaxed or informal in attitude or standards: *an easygoing teacher who allowed extra time for assignments.* Not rigorous, demanding, or stressful. (Oxford Dictionary, 2006)

From the previous description some characteristics of this personality can be easily attached to the elegant stimulus, some examples are described below:

The results of the correlation analysis show that lightness, easiness to manipulate, little strength to manipulate and smoothness have a significant effect to express an easy going

personality. The interaction with the elegant stimulus reacted easily, smoothly and rapidly without any resistance and collaborates with the participant. In addition, the interaction was perceived as light and little strength was necessary in the interaction. All these characteristics can be clearly related to the easy going personality.

The sound was a characteristic of the interaction that elicited an easy going personality. Participants mentioned that the sound reacted according to their movements, going up and down. If people manipulate the interaction faster, the sound reacted in the same way similar to an easy going person who is always willing to chat and adapts himself to the rhythm of the conversation.

The results of the correlation analysis showed that the characteristic smoothness can be implemented to elicit an elegant and an easy going personality. The main difference is the way in which the implementation is performed. For eliciting elegance more emphasis in the quality of the implementation has to be considered. In contrast, in an easy going interaction it is enough to have a draft implementation. It might happen that the characteristics of the elegant stimulus did not reach the quality that is needed to elicit elegance.

We tried to design an elegant interaction that turned to be an easy going one. It can be now established with some certainty that the main difficulty to deal with was the implementation of elegance characteristics into the interaction. From this result it was learnt that some of the characteristics that were selected should have had a stronger effect (e.g. refinement, heavy and strength). Furthermore, more attention has to be paid for the analysis of the desired personality that will be implemented in products or interactions. In this way a better understanding will be gain, which will be reflected into the design.

5.3 Interaction characteristics and personality attachment

To design the interactions we used five interaction dimensions: forces, performance, motion, textures and sound. The motion dimension includes aspects such: fast, slow, long or short; these characteristics can be either related to users' movement or to product's reactions. The force dimension incorporates characteristics like the strength that people apply when interacting with objects, pressure, weight, etc. The texture dimension includes characteristics such as: smoothness, roughness, softness, prickliness, etc. The performance dimension refers to the quality of interaction, as well as aspects like balance, restrictiveness, enrichment, etc. The sound dimension considers characteristics like: intensity (loudness), frequency (pitch) and duration. In this study we focused on the sound which is the result of physical interaction.

As has been mentioned previously, there might be correlations between the characteristics that were implemented into the stimulus and the personality embodied into physical interaction. The results will be discussed for each personality.

Dominant

The results of the correlation analysis showed that none of the characteristics that were manipulated in the interactions have a significant effect to elicit dominance. This result was unexpected because the personality was actually recognized as dominant. A possible explanation for the results is that interaction qualities are hard to verbalize. Another explanation is that interaction design is about behaviour, and behaviour is much harder to observe and understand than appearance (Saffers, 2006). It is much easier to notice and discuss a flashy colour and an organic shape than the softness that you perceive when pushes the shutter button of a digital camera.

Elegant

Based on the results of the correlation analysis balanced, smooth and flexibility have a significant effect to elicit elegance. From these results it can be presume that the interaction had some traits of elegance; however, the interaction as a whole entity was not perceived as elegant.

Easy going

Although we did not intentionally decide to create an easy going interaction there was a correlation between the characteristics that were manipulated and the easy going personality. These are: smoothness, heaviness (negative result), complex to manipulate (negative result) and strength to apply (negative result). It has to be pointed out however, that if we would have decided to do design an easy going personality, a different set of characteristics might have been selected. This result leads to assume that a personality can be accidentally achieved. We do not consider however that it is the way to do it.

5.3.1 Extra perceived personalities

The results of our main study show that extra personalities were perceived in the interactions. The extra personality that was perceived in the dominant interaction was lively. The extra personality that was recognized in the easy going interaction was gentle. It might be explained because it is known that judgments of the presence of some human personality characteristics almost always go together with the perceived presence of other personality characteristics (Zebroiwitz, 1990). For example, a person that is perceived as original is often also perceived as curious or open-minded. These associations refer often to the description of the same characteristic. In our study dominance and lively or easy going and gentle describe different characteristics of the interaction. We presume that the interaction express more than

one personality. Designers therefore have to be aware of this aspect; they have to be sure that the selected personality will be correctly implemented into the product. A way to do it is by a good analysis and translation of the selected personality.

5.3.2 The role of product interaction

Throughout this thesis it has been demonstrated that the approach of product personality can be extended to physical interaction. Hence, we discuss the role that physical interaction has into the approach of product personality. At first sight, physical interaction seems to assist product appearance for eliciting a personality. We believe however, that appearance and interaction complement each other because products should be conceived as a whole.

5.4 Design implications

The approach of product personality offers the option to create products by using the same language that people use to evaluate, describe and denote people. We claim that our study has a positive influence on consumers, designers and companies in the following ways:

- People can feel more appealed towards a product that elicits a particular personality as they can base their purchase decision on this aspect.
- Companies will benefit from the approach of product personality by offering products that will distinguish from other similar ones. Designing on the basis of personalities leads to consider product's characteristics that will act as possible differentiators from products of a same line (blenders, vacuum cleaners, etc).
- Designers have the option to use the approach of product personality. It can help them to visualize products from a perspective that might improve their design process by considering different aspects to create a product. Designers can decide whether they should design a product with a personality, or a product on the basis of a different approach.
- Designers often argue that their new design is cheerful and friendly even if they are not sure if people notice the cheerfulness and friendliness of their designs. The results of this study offer evidence that it is possible to intentionally implement a personality into physical interaction and that people recognize it. Designers however, have to be trained to do it.

Design process

When the project started, there were not many examples available that could help us define how designers should implement personality characteristics into products. Thus, we had to propose a way to deal with this project. The design process that was followed is a good precedent to design products within the approach of product personality. A summary of the design process is shown in Fig. 5.1

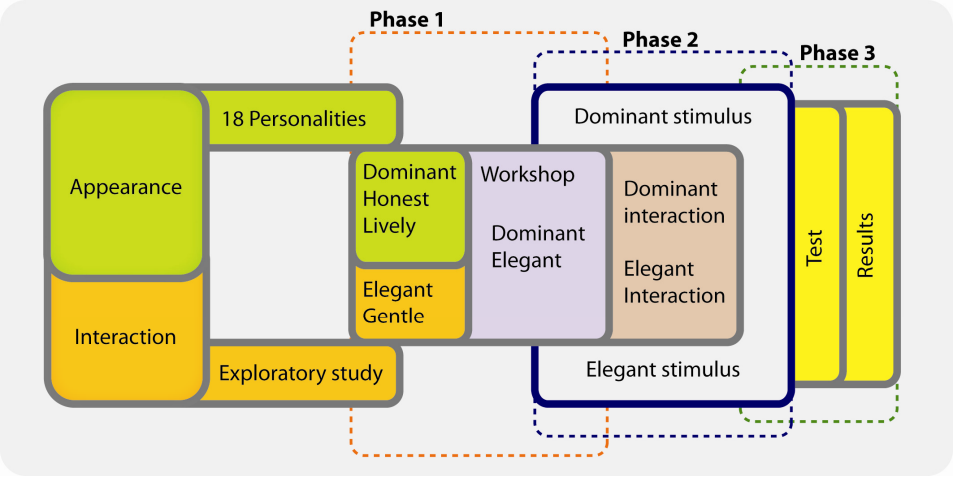


Fig. 5.1 design process

Three phases are proposed to implement a personality in products: Selecting phase; a personality is selected to be implemented in the product. The analysis of the characteristics is done in this phase by organizing workshops, focus groups or role plays. Implementation phase; the most relevant characteristics of the personality are translated in terms of physical interaction and implemented into the product. It can be done by considering the dimensions of personalities that are used. Testing phase; people interact, use and experience the product and assess its personality. It seems appropriate to presume that this design process is a precedent that could be used to deal with similar projects.

5.5 Limitations

Designers are skilfully trained in using different shapes, colours, sizes, etc. All these elements are part of product's visual appearance. Appearance is a dimension of interaction that can be used to indicate the usage of a product, how people can interact with products or to provide affordances. Additionally, It is strong way to express a personality to people. In this project it was decided to leave out product appearance and instead focus on if by physical interaction a personality can be recognized by people. As a result, the focus on interaction as a whole concept could not be used.

A special setup was arranged to perform the main study of this project. Each stimulus was placed inside of a box and some tubes were hanging down from the ceiling. All these elements were clearly visible for participants and they might have had an influence on them to assess the stimuli. Although, it was not possible to avoid the influence of appearance totally, the participants mentioned that they were little influenced.

5.6 Future research

An immediate step for continuing this project could be to perform the main experiment that was carried out in this study, by inviting blinded or blindfolded participants. By doing so, the influence of product appearance will be completely excluded. It has to be considered however, that blinded people might evaluate personalities in a different way.

This study attempted to bridge the gap between appearance and interaction. Based on the results of this study, it is argued that we succeeded in bridging the gap. We propose that future studies consider the approach of product personality as a whole concept by implementing personality characteristics into appearance and interaction. Additionally, we encourage that future projects aim to create a product that people actually can use, see and experience. These will help to people to assess a product as they normally do.

This study was performed on the basis of physical interaction. Product interaction, however, it is a more diverse concept. People can for instance interact with a product without physically interacting; consider for example, a smart system that selects the music based on people's mood. People do not touch the system but can still enjoy his favourite music. Future research should conceive product interaction as a whole concept; including all the dimensions of interaction.

In prior studies, a product personality scale including eighteen personalities was proposed to assess product personality in products. We used the scale as the starting point of the design process. Throughout the whole process, however, it was evident that the scale includes personalities that are complicated to recognize by persons. Examples of these are: idiosyncratic, untidy, and aloof. Additionally, some personality traits are too general to be used, for example interesting, modest, serious and honest. The term interesting is for example used so broadly that is complicated to identify what people mean when they say that something is interesting. In congruence with Govers (2004) we found that the personality honest is less reliable than other personalities. During the experiment some participants mentioned that they could not relate honesty to product interaction. Thus, it is recommended to replace it with another personality. Based on the findings of this study, we consider that the scale has to be reviewed to select personalities that can be used to describe, denotate and evaluate product appearance and interaction, within the approach of product personality.

5.7 Conclusions

Nowadays, many industrial designers are appealed to implement abstract issues (emotions, experience, personality, etc.) into products. Grasping and implementing these abstract issues is complex and demanding. Designers therefore need a better set of design tools to deal with

these abstract issues better and more easily. We observed this necessity and we reacted by performing this study.

Design for Interaction wants to improve the communication between designers, consumers and companies. This study argued that product interaction is an open channel that designers should use to improve the message that they, as designers, and the companies, that they work for, want to give to consumers. Nowadays, companies seek to present a unified face to consumers, with consistent messages communicated through advertising, corporate policy, and, of course, their product (Oppenheimer, 2005). In our opinion, one way to achieve this is by designing products within the approach of product personality.

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Appendix A: Setup of the experiment

Research question
The aim of this study is to test product personality in Interaction. To make this possible two prototypes were built (stimuli) based on two personality traits: dominant or elegant. Thus, the research questions of this experiment are next:

Is the artefact A perceived as more dominant?
Is the artefact B perceived as more elegant?

What elements of the artefacts are responsible to elicit that personality?

Participants
The participants for this experiment will be students of TU Delft. The study will include 60 participants; 30 participants per artefact. Thus, there will be two groups of 30 people which will test rather the elegant or the dominant artefact. The participants will be equally divided in gender.

Material
The experiment will be conducted with a paper questionnaire. This paper questionnaire uses a seven point scale to measure the personality that was implemented in the artefacts. There are seven personality traits that are included in this questionnaire. The selection process was based on the six different groups that were established by Govers (2004). Considering that this study wants to be as rigorous as possible, selecting personalities that are similar among them is possible. This could lead to have a more reliable result. If the selection would have been based on diverse personality traits the results selecting the right personality would be easier for the participant. For this reason the personality traits that were part of the final pool that was used for selecting the personalities that are implemented in the stimuli are included in the questionnaire, these are: elegant, dominant, lively, honest and gentle (For more details see chapter 2 of this thesis). Additionally two more personalities were added, which are part of the six groups that were established by Govers (2004) these are: Easy going and boring. In this way all the groups that were established in previous studies are represented by at least one personality trait in the questionnaire.

Stimuli

The stimuli for this experiment are two artefacts that were designed to elicit a particular personality which could be either elegant or dominant (see previous chapter). It was decided to use stimuli that differed only in interaction because the aim of this project is to know the role of physical interaction into the approach of product personality. Thus, characteristics such as product appearance were left out of this project. If the stimuli would have been designed considering appearance and interaction, the final outcome of the experiment could be unclear to draw conclusions for this project.

During the experiment the next instructions were given to the participants:

Introduction

Thank you very much for participating in this experiment. The experiment is part of my graduation project, which is called: Product personality in interaction. The title of my project refers to the idea that products can be distinguished, or described, by using personality characteristics. For example, a clock can be described as friendly or cheerful.

The focus of today's experiment is on interaction. Thus, I am interested in what you experience when interacting with one of the two artefacts that you see in this room. Examples of your experience when interacting with the artefact could refer to weight, sound, effort, quality of the product, movements, etc. As the focus of my project is on physical interaction, the two artefacts are covered up to reduce the influence of their appearance during the experiment.

The experiment is divided in three parts. First, you will interact with the artefact while performing a task. Second, you will assess the artefact by filling in a questionnaire. Finally, I would like to perform and interview with you. The whole experiment will take approximately 25 minutes.

Performing a task

As has been mentioned there are two artefacts in this room. During the experiment you will interact with one of them by pulling the stick bar that is hanging down from the artefact. By only using the stick bar you have to hit each tube that is hanging down from the ceiling. After you have touched the first tube, you have to go back and attempt to hit the next tube. There is not an order for touching the tubes with the stick bar; the only requirement is that you have to touch all of them. It is important to mention you can reach all the tubes with the stick bar, thus it is not allowed to bring them close to you by any way. As soon as you have touched all the tubes the task is completed. If you now or later have any questions please do not hesitate to ask. When you feel ready you can begin performing the task.

Now that you already interacted with the artefact, please fill in the next questionnaire:

Name: _____
Age: _____
Profession: _____
Date: _____
Nationality: _____
Sex: Female Male

If you would consider this artefact to have a personality what would it be?
(Please fill in the relevant box or circle a number)

Not lively	1	2	3	4	5	6	7	**Very lively**
Not boring	1	2	3	4	5	6	7	**Very boring**
Not easy going	1	2	3	4	5	6	7	**Very easy going**
Not dominant	1	2	3	4	5	6	7	**Very dominant**
Not gentle	1	2	3	4	5	6	7	**Very gentle**
Not elegant	1	2	3	4	5	6	7	**Very elegant**
Not honest	1	2	3	4	5	6	7	**Very Honest**
Other:								
Not _____	1	2	3	4	5	6	7	**Very** _____

This part of questionnaire is designed to find out a few things about how it feels to interact with this artefact. Please answer the questions truthfully. There are no right or wrong answers.

I found the task complicated to perform

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I found enjoyable to interact with this artefact

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I found this artefact very accessible

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I found this artefact very smooth

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I found this artefact very flexible

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I found that this artefact requires a lot of strength to use it

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I found this artefact very balanced

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I found the sound of this artefact very loud

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I found this artefact complicated to manipulate

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I found this artefact very refined

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I found this artefact very restrictive

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

I found this artefact very heavy

Strongly disagree	1	2	3	4	5	6	7	Strongly agree

To finish the test I would like to ask you some questions:

If you have to choose one personality that best describes the artefact that you interacted with, which one would it be? Can you explain why?
What aspects of the artefact made you perceive the personality?
E.g. for dominant: heaviness, powerful, loudness, restrictiveness, and rigidness.
E.g. for elegant: smoothness, balance, sophistication, lightness, quietness, low effort.
Was it complicated to assess exclusively the interaction?
Do you think that you had an influence to assess the artefact by the appearance or the task itself?
Would you like to add something else?

Thank you very much for participating in this project, I really appreciate your help.

Appendix B: Between subject analysis

Between Subject Results

Between-Subjects Factors

		Value Label	N
stimulus	1	dominant	30
	2	elegant	30

Stimulus

Estimates

Dependent variable	Stimulus	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Boring	dominant	3.033	0.267	2.499	3.567
	elegant	4.200	0.267	3.666	4.734
Dominant	dominant	4.867	0.289	4.287	5.446
	elegant	3.300	0.289	2.721	3.879
Honest	dominant	3.933	0.270	3.393	4.474
	elegant	4.633	0.270	4.093	5.174
Easy going	dominant	2.467	0.269	1.929	3.005
	elegant	4.700	0.269	4.162	5.238
Gentle	dominant	2.567	0.267	2.032	3.102
	elegant	4.033	0.267	3.498	4.568
Lively	dominant	4.667	0.289	4.089	5.244
	elegant	3.300	0.289	2.722	3.878
Elegant	dominant	3.033	0.303	2.427	3.640
	elegant	3.200	0.303	2.593	3.807

Pairwise Comparisons

Measure	ARTEFACT (I)	ARTEFACT (J)	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference(a) Lower Bound	Upper Bound
P01	1	2	-0.834	0.283	0.005	-1.402	-0.266
	2	1	0.834	0.283	0.005	0.266	1.402
P02	1	2	2.635	0.272	0.000	2.088	3.182
	2	1	-2.635	0.272	0.000	-3.182	-2.088
P03	1	2	-0.720	0.313	0.025	-1.349	-0.092
	2	1	0.720	0.313	0.025	0.092	1.349
P04	1	2	-3.163	0.303	0.000	-3.771	-2.555
	2	1	3.163	0.303	0.000	2.555	3.771
P05	1	2	-2.313	0.285	0.000	-2.885	-1.740
	2	1	2.313	0.285	0.000	1.740	2.885
P06	1	2	1.100	0.315	0.001	0.467	1.732
	2	1	-1.100	0.315	0.001	-1.732	-0.467
P07	1	2	-1.108	0.313	0.001	-1.736	-0.481
	2	1	1.108	0.313	0.001	0.481	1.736

Based on estimated marginal means

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

a. Adjustment for multiple comparisons: Bonferroni.

Multivariate Tests

	Value	F	Hypothesis df	Error df	Sig.
Pillai's trace	0.476	6.74[a]	7.000	52.000	0.000
Wilks' lambda	0.524	6.740[a]	7.000	52.000	0.000
Hotelling's trace	0.907	6.740[a]	7.000	52.000	0.000
Roy's largest root	0.907	6.740[a]	7.000	52.000	0.000

Each F tests the multivariate effect of STIMULUS. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Exact statistic

Univariate Tests

Measure		Sum of Squares	df	Mean Square	F	Sig.
Boring	Contrast	20.417	1	20.417	9.568	0.003
	Error	123.767	58	2.134		
Dominant	Contrast	36.817	1	36.817	14.649	0.000
	Error	145.767	58	2.513		
Honest	Contrast	7.350	1	7.350	3.361	0.072
	Error	126.833	58	2.187		
Easy going	Contrast	74.817	1	74.817	34.503	0.000
	Error	125.767	58	2.168		
Gentle	Contrast	32.267	1	32.267	15.052	0.000
	Error	124.333	58	2.144		
Lively	Contrast	28.017	1	28.017	11.209	0.001
	Error	144.967	58	2.499		
Elegant	Contrast	0.417	1	0.417	0.151	0.699
	Error	159.767	58	2.755		

The F tests the effect of Stimulus. This test is based on the linearly independent pairwise comparisons among the estimated marginal means

T-Test analysis, characteristics of interaction dominant and elegant

Report

stimulus		balanced	accessible	flexible	heavy	loud	complicated to manipulate
dominant	Mean	3.00	4.03	3.13	4.23	4.20	3.57
	N	30.00	30.00	30.00	30.00	30.00	30.00
	Std. Deviation	1.60	1.67	1.61	1.28	1.97	1.45
elegant	Mean	4.27	5.00	4.67	2.00	4.13	2.47
	N	30.00	30.00	30.00	30.00	30.00	30.00
	Std. Deviation	1.57	1.34	1.49	1.05	2.06	1.48
Total	Mean	3.63	4.52	3.90	3.12	4.17	3.02
	N	60.00	60.00	60.00	60.00	60.00	60.00
	Std. Deviation	1.70	1.58	1.72	1.62	2.00	1.56

stimulus		refined	restrictive	smooth	strength
dominant	Mean	2.73	4.70	2.33	3.97
	N	30.00	30.00	30.00	30.00
	Std. Deviation	1.46	1.42	1.30	1.77
elegant	Mean	3.27	4.67	3.70	1.57
	N	30.00	30.00	30.00	30.00
	Std. Deviation	1.57	1.60	1.73	0.77
Total	Mean	3.00	4.68	3.02	2.77
	N	60.00	60.00	60.00	60.00
	Std. Deviation	1.53	1.50	1.66	1.82

Appendix C: Correlation analysis

Dominant correlation, between subjects study

Correlations

		Dominant	balanced	accessible	flexible	heavy	loud
Dominant	Pearson Correlation	1	0.05	0.03	0.08	-0.02	0.19
	Sig. (2-tailed)		0.81	0.87	0.66	0.92	0.31
	N	30	30	30	30	30	30

		complicated to manipulate	refined	restrictive	smooth	strength to use
Dominant	Pearson Correlation	0.27	-0.12	0.13	-0.20	0.09
	Sig. (2-tailed)	0.15	0.54	0.49	0.29	0.62
	N	30	30	30	30	30

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Elegant correlation, between subjects study

Correlations

		Elegant	balanced	accessible	flexible	heavy	loud
Elegant	Pearson Correlation	1	0.48	0.17	0.20	-0.45	-0.53
	Sig. (2-tailed)		0.01	0.38	0.29	0.01	0.00
	N	30	30	30	30	30	30

		complicated to manipulate	refined	restrictive	smooth	strength to use
Elegant	Pearson Correlation	0.25	0.44	-0.05	0.50	-0.14
	Sig. (2-tailed)	0.18	0.01	0.81	0.01	0.46
	N	30	30	30	30	30

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Appendix D: Post hoc study

Easy going correlation, between subjects study

Correlations

		Easy going	balanced	accessible	flexible	heavy	loud
Easy going	Pearson Correlation	1	0.06	-0.12	0.33	-0.42	0.04
	Sig. (2-tailed)		0.77	0.52	0.08	0.02	0.83
	N	30	30	30	30	30	30

		complicated to manipulate	refined	restrictive	smooth	strength to use
Easy going	Pearson Correlation	-0.38	0.06	-0.28	0.37	-0.49
	Sig. (2-tailed)	0.04	0.77	0.14	0.05	0.01
	N	30	30	30	30	30

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Appendix E: Within subjects analysis

The results of the within subjects analysis will be directly compared with the results of the between subjects analysis. It will help to clarify if there are strong differences in results or if they are consistent in both analyses.

In order to determine whether the respondents recognized the personality that was implemented in interaction (test of H1a) a repeated measures variant analysis was conducted. The results are depicted in Fig. 4.8. The complete results of the repeated measures variant analysis are reported in appendix C.

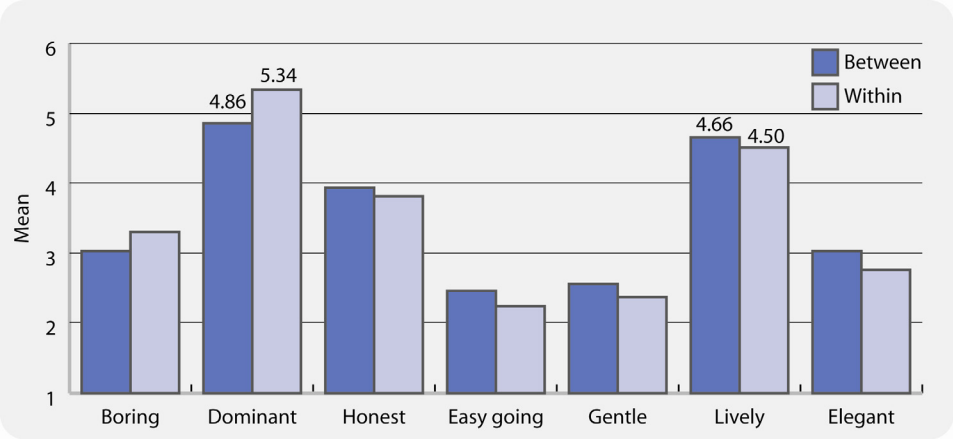

Fig. 4.8 Score of the seven personalities when participants interacted with the dominant stimulus

Hypothesis H1a was confirmed in the previous section. The results of the within subject analysis addressed the same finding. The interaction with the dominant stimulus was recognized as dominant ($M=5.345$, $p<.001$). The Mean score of the dominant personality reached a higher score in this analysis. It might have happened because participants had a reference to compare the interaction with, in this case the elegant stimulus. As was expected, when people are able to compare two things is easier for them to identify strong differences. The second most perceived personality is lively ($M=4.504$, $p<.001$).

The role of characteristics of interaction for eliciting dominance

In the between subjects analysis the hypothesis H2a was not probed. Considering that this interaction was recognized as dominant a second attempt to prove hypothesis H2a will be done. The Mean score that each characteristic obtained in the between and within subject analysis are depicted in figure 4.9. The Means score were obtain by conducting a T-Test analysis.

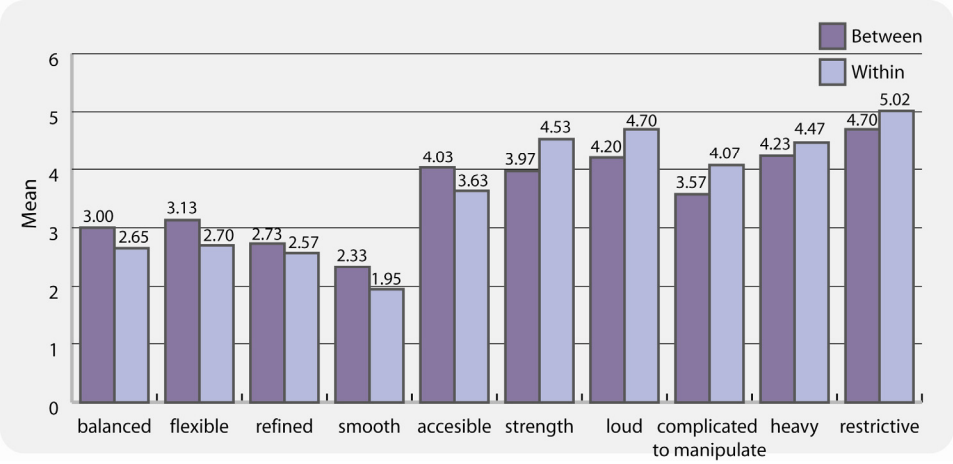

Fig. 4.9 Score of the characteristics of interactions for the dominant stimulus

The results depicted in the previous figure show that the five characteristics to elicit dominance were strongly perceived. Heaviness (M=4.47), loudness (M=4.70), complex to manipulate (M=4.07), restrictiveness (5.02) and strength (4.53). The comparison between stimuli might have a positive effect to perceive the characteristics that were implemented in the dominant stimulus. It can be suggested because the characteristics that were mentioned obtain a higher score in this analysis than in the previous one.

To know if a there is a significant effect between the characteristics that were highly perceived and dominance a correlation study was conducted. To simplify the findings we report the characteristics that have a significant effect to elicit dominance, which are: loudness ($p<.04$), complicated to manipulate ($p<.001$), restrictive ($p<.002$), and strength to use ($p<.01$). Four of the five characteristics that were implemented in the dominant interaction have a significant effect to elicit dominance. Heaviness ($p<.233$) did not have a significant effect. Based on these results we can say that hypothesis H2a was proved. These results however, are not consistent between analyses. The complete results of the correlation analysis are reported in appendix C.

Within subject analysis of the elegant stimulus

I

n the between subjects analysis the hypothesis H2a was not probed. It is important, however to conduct a repeated measures variant analysis to determine if there is consistency in the recognition of easy going when interacting with the elegant stimulus. The results are depicted in Fig. 4.10.

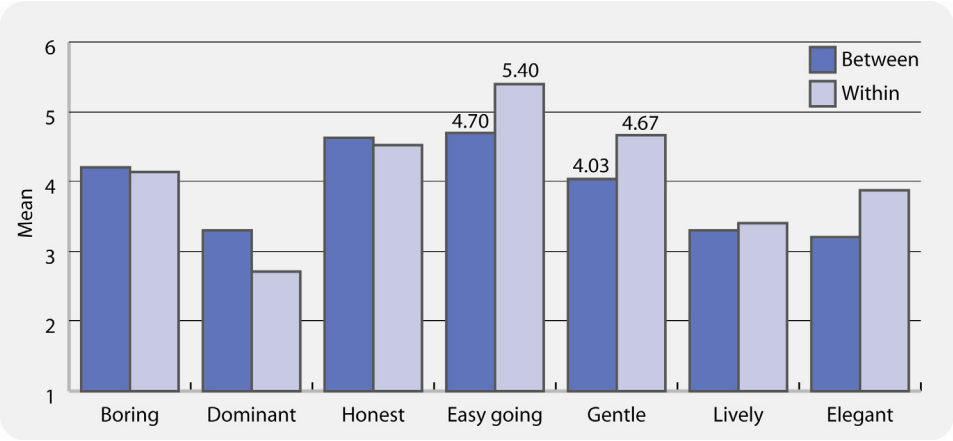

Fig. 4.10 Score of the seven personalities when participants interacted with the elegant stimulus

The results depicted in the previous graphic show that the interaction with the elegant stimulus was perceived as easy going ($M=5.401$, $p<.001$). This result is consistent in both studies (between subject analysis and within subject analysis). In addition, gentle ($M=4.678$, $p<.001$) was strongly perceived in the interaction.

The role of characteristics of interaction for eliciting elegance

Base on the fact that the elegant personality was recognized as easy going the hypothesis H2a cannot be proved. It is important however, to conduct a T-Test and a correlation analysis to address how the characteristics of the interaction were perceived when interacting with the elegant stimulus. Figure 4.11 depicts the results of the T-Test analysis that was conducted.

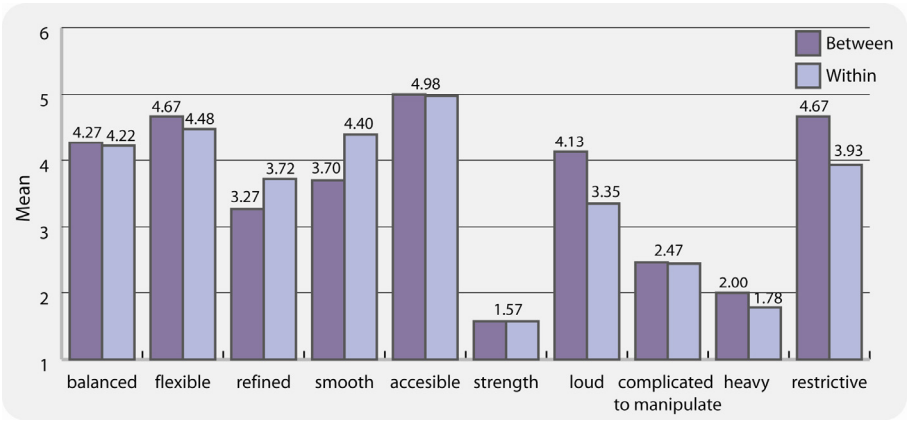

Fig. 4.11 Score of the characteristics of interaction for the elegant stimulus.

The results depicted in the previous figure show that four characteristics to elicit elegance were strongly perceived. Balance (M=4.22) Accessible (M=4.98) flexible (M=4.48) and smooth (M=4.40). The three first characteristics were almost rated equally in both analyses; it might indicate that although these characteristics were perceived they might not be exclusively related to elegance. In contrast refined was not perceived as it was planned; refinement is a strong characteristic of an elegant person.

To know if the characteristics that were perceived, have a significant effect to elicit elegance a correlation study was conducted. The results indicated that: balance ($p<.01$), flexible ($p<.001$) refine ($p<.001$), smoothness ($p<.001$) have a significant effect to elicit elegance. Although we cannot prove hypothesis H2b we have identified that four of the five characteristics that we selected have a significant effect to elicit elegance and that the same four characteristics were strongly perceived. It might indicate that the elegant personality was partially identified, however the influence of characteristics that were not expected change the recognition towards easy going. These results will be discussed in the next chapter.

Gender, profession and sequence of interaction

It has been argued that the sequence of interaction with the stimulus might have an effect in the results. To determine if sequence of interaction (1st dominant, 2nd elegant and 1st elegant and 2nd dominant) have a significant effect in the results a repeated measures variant analysis was conducted (the complete results are reported in appendix C).The results show that sequence have a significant effect in the results in general ($p<.021$) and in next personalities: dominant ($p<.001$), easy going, ($p<.002$) and gentle ($p<.001$). This result illustrates that there is an effect in the assessment when participants could compare interactions. It was a good decision then to address our conclusion on the basis of the between subject analysis (there is not space for comparison). To confirm consistency it is proposed a within subject analysis (comparison allows to identify the strongest differences between the stimuli).