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Intentions and Inspiration in Shaping Visual Appearance of Products: The Practice of Professional Industrial Designers in India

Eliciting specific intentions and seeking inspiration are important activities in the process of shaping a product's visual appearance. A survey of the professional industrial designers was conducted to identify intentions (e.g. attributes, emotions) that they attempt to elicit, and also to identify inspiration sources and their media that they prefer not only in generating ideas to realise intentions but also in analysing and communicating intentions. The findings indicate that the designers frequently intend to elicit some specific attributes and emotions. Regarding inspiration sources and media, commonalities as well as differences were observed in the activities - analysing intentions, communicating intentions, and generating ideas to realise intentions.

Keywords - industrial design; design practice; aesthetics; intentions; inspiration

Introduction

The process of shaping a product's visual appearance is crucial in determining consumer perception and product success (Warell, 2001; Jagtap and Jagtap, 2015: p 375). In this process, designers intend to elicit some specific consumer response (e.g. Crilly et al., 2009: p 229-230; Ludden et al., 2008; Ramírez, 2014); for example, they may intend to elicit emotions such as surprise, joy, satisfaction, pride, etc. Figure 1 shows an example of a chest of drawers eliciting 'surprise' through its visual appearance.

In shaping products, designers may seek inspiration not only in the activity of *idea generation* to realise intended consumer response, but also to *analyse intentions* (e.g. defining intentions, understanding the context of intentions, etc.) and *communicate intentions* to stakeholders such as clients, marketers, retailers, etc. (e.g. Crilly et al., 2009: p 229; Jagtap and Jagtap, 2015: p 378). They may seek inspiration from a range of sources (e.g. similar products, natural objects), using media such as images, objects or text (e.g. Birtley, 1990; Jagtap and Jagtap, 2015: p 380).

While numerous studies have been undertaken to understand how consumers respond to product properties (e.g. Orth et al., 2008; Li et al., 2010), the subject of shaping a product's visual appearance has been relatively neglected in past and recent studies (e.g. Crilly et al., 2009: p 224; Jagtap and Jagtap, 2015: p 377; Person et al., 2016). Specifically, despite the recognition that designers intend to elicit some specific consumer response and use inspiration sources in shaping a product's visual appearance, the following important questions about these topics are still unanswered: (1) what do designers intend by the visual appearance of their designs? (2) what sources and media of inspiration do they use? This research aimed at answering these questions, using a questionnaire study with the professional industrial designers in India.

This paper is organised as follows. Relevant literature is presented in the next section, followed by details of the questionnaire study in the section 'Research Methodology'. While results of the study

are presented in the section 'Findings', they are discussed in a separate section 'Summary of Findings and Discussion', together with implications and limitations of the study and directions for future research. Finally, conclusions are presented.



Figure 1 Vanishing drawers by Front Design

Shaping Visual Appearance of Products

The research about consumer response to products and about the process of shaping products is related to numerous topics such as affordance theory, aesthetics, product semantics, design thinking, marketing, etc. This section presents literature relevant to the reported study.

Intentions

The design of a product's visual appearance affects consumer response and product success (Coates, 2002). A few studies report the general characteristics of the process of shaping products, for example, Tovey (1997) reports the general nature of this process in the car industry. Bangle (2001: p 11), drawing on his own experience of heading a design team at the car company BMW, highlights the communication problems between industrial designers and engineers. Some studies have examined sketching in shaping products, for instance, Warell (2001) examined sketches from the completed form design projects in companies, to verify the ability of their theoretical framework 'design syntactics' to describe and explain the nature of shaping a product's visual appearance.

Although much of the existing research on the process of shaping products focuses on some specific areas, Crilly et al.'s (2009: p 229) framework provides a holistic view of this process. Their framework focuses on the following eight *general intentions* that designers may hold in shaping products: (1) *comprehension* (e.g. to support consumers in understanding how a product works), (2) *attraction* (e.g. to make products attractive to consumers), (3) *identification* (e.g. to make a product identifiable with the lifestyle of target consumers), (4) *attention* (e.g. drawing consumer attention to the product, for example, by designing it differently from competing products), (5) *attribution* (e.g. to encourage attributes such as modern, feminine, etc.), (6) *emotions* (e.g. to elicit emotions such as joy, surprise, etc.), (7) *action* (e.g. to provoke consumers to purchase the product or to use it in a specific way), and (8) *recognition* (to design a product as coming from a particular country, brand, tradition, etc.). While these intentions are not mutually exclusive or collectively exhaustive, they represent a range of consumer responses mentioned by the industrial designers in their study.

While Crilly et al.'s (2009) research situates the eight general intentions within a broad context, there is research that has examined how companies attempt to elicit strategic intentions to foster brand recognition through product design (Karjalainen and Snelders, 2010). Furthermore, some studies have explored the strategies used by designers to elicit specific intentions through product design; in particular, to elicit the emotion 'surprise' (e.g. Ludden et al., 2008; Ramírez, 2014). In addition to these studies exploring some specific intentions, there are studies investigating attributes and emotions in shaping products or in consumer perception of product forms (e.g. Chakrabarti and Gupta, 2007; Desmet and Hekkert, 2007; Desmet, 2008). Previous studies have explored general intentions, including attributes and emotions in shaping products, but so far it is not clear which general intentions, attributes and emotions designers attempt to elicit in shaping a product's visual appearance.

Inspiration Sources and Media

During a design process, designers actively or passively search for physical as well as mental visual samples to seek inspiration, and may use natural and artificial systems as sources of inspiration (e.g. Keller et al., 2006). Several studies have investigated the influence of inspiration media on design problem solving, with an emphasis on understanding the effect of inspiration media on idea generation (e.g. Goldschmidt and Sever, 2010). These studies typically test the effect of textual or visual stimuli on idea generation in design. In addition to the activity of idea generation during a design process, inspiration plays an important role in problem analysis as well as communicating designs or aspects of a design process to different stakeholders, as reported by the studies of graphic designers and architects (e.g. Makri and Warwick, 2010).

Higher preference for visual stimuli has been observed in previous studies (e.g. Muller, 2001). A recent study found that student designers give higher importance to images over objects in generating ideas, whereas professional designers give equal importance to both images and objects (Gonçalves et al., 2014: p 41-42). Whilst this study revealed professional designers' preferences for inspiration media, the study did not deal with the design of a product's visual appearance as well as with problem analysis and communication in a design process.

In shaping a product's visual appearance, designers use different sources and media of inspiration to formulate intentions, and also to generate ideas that will satisfy those intentions (Jagtap and Jagtap, 2015: p 380). Crilly et al. (2009: p 241) found that sources of inspiration can include similar or dissimilar products, historic products and natural objects. Such inspiration sources can be non-products, e.g. human body or animals (Van Rompay and Ludden, 2015). Designers may implicitly or explicitly employ inspiration sources in the design of a product's visual appearance (Crilly et al., 2009; Karjalainen and Snelders, 2010). Eckert and Stacey (2000), from their empirical research in the knitwear industry, found that sources of inspiration help in defining the context for new designs, in the creation of designs, and in communicating designs by reference to those sources. To communicate designs (e.g. to describe a product's appearance and connote a feeling), sources of inspiration can help designers to use a variety of terms such as 'slippery', 'fluid', 'sheer', 'bath tub', etc. (Birtley, 1990). Designers seek inspiration to use appropriate language in communicating product form as well as their intentions to other stakeholders (Bangle, 2001: p 10). Much research on inspiration in design is centred on idea generation in solving design problems, and mainly deals with inspiration media (e.g. images, text) rather than their sources (e.g. similar products, natural objects, etc.). Furthermore, most of this research to date has explored design problems of

functional nature or related to graphic design and architectural design, with *relatively* little examination of inspiration in shaping a product's visual appearance.

Research Methodology

In design research, survey method has been used to understand many aspects of design processes, e.g. to evaluate perception and use of systematic design processes in industry (Spitas, 2011), to identify student and professional designers' preferences for idea generation methods (Gonçalves et al., 2014: p 35), to explore the use of external representations in a design process (Römer et al., 2001), to gather information requirements of designers (Jagtap and Johnson, 2011), to explore designers' perceptions of form characteristics in car styling (Liem et al., 2009), and more recently to identify some aspects of client-designer communication in graphic design (Cornish et al., 2016). In the present research, a survey method was deemed appropriate to address our research questions, presented in the first section. The survey questions were iteratively formulated and refined, based on an extensive literature review, discussions with researchers and practicing designers and a pilot study. The requirements about alleviating the effort of participating designers and enhancing the probability of completing the questionnaire were also considered. Appendix 1 [published as supplementary data] outlines the questionnaire.

In the case of the question regarding general intentions that designers may attempt to elicit, Crilly et al.'s (2009: p 231-233) list of eight general intentions was used (e.g. comprehension, attention, recognition, etc.), because this list is based on the interviews with practicing industrial designers - see the previous section for these general intentions. Compiling the lists of attributes and emotions was a highly iterative process. The initial step was to collate as many attributes and emotions as possible. Extensive literature review as well as discussions with researchers and practicing designers facilitated this task of gathering words. The attributes and emotions were collected from a large number of studies, e.g. Hsu et al., 2000; Chuang, 2001; Desmet, 2003; Chakrabarti and Gupta, 2007; Desmet and Hekkert, 2007; Desmet, 2008; Orth et al., 2008; Liem et al., 2009; Mugge et al., 2009; Demir et al., 2009; Desmet, 2012; Rodríguez, 2014; Blijlevens et al., 2009; etc. These initial lists of attributes and emotions were judged to be exhaustive when further literature search or discussions with researchers and designers did not reveal any additional words. The collected lists were reduced, taking into account designers' time and effort required to fill in the questionnaire, and to avoid their tiredness in completing the survey. This task of reducing the lists of collected words was facilitated by discussions with designers and researchers as well as the pilot study. The reduction criterion was to eliminate synonymous words. It is common to have up to 100 words in such lists (Tanoue et al., 1997); the final lists in the present study consisted of 71 attributes and 41 emotions. The pilot study identified that designers needed meanings of words in the lists. Therefore, dictionary meanings of the attributes and emotions were included. This assured that all the designers had a basic knowledge of the attributes and emotions included in the survey questionnaire. The designers in the pilot study suggested negative feelings about the term 'styling'; following their advice, this term was not used in the survey.

In the questionnaire, five sources of inspiration were included: (1) 'similar products' (e.g. products in the group of the product that is being designed), (2) 'dissimilar products' (e.g. products from other groups), (3) 'non-products' (e.g. plants, animals, etc.), (4) 'historic products' (e.g. cultural artefacts), and (5) 'works of art'. Three media of inspiration sources - images, objects and text - were included in the questionnaire. In addition to the pilot study and discussions with researchers and designers, literature sources such as Eckert and Stacey (2000), Burgess and King (2004), Crilly

et al. (2009: p 241), and Van Rompay and Ludden (2015) were useful in compiling the list of inspiration sources; likewise, studies such as Malaga (2000), Muller (2001), Goldschmidt and Sever (2011), and Gonçalves et al. (2014: p 49) contributed towards identifying the inspiration media. An additional 'other' option was also given in all the questions. The pilot study confirmed that the respondents were interpreting the questions as intended. Answers to the questions were in the form of five-point Likert scales; some questions assessed frequency (always, often, sometimes, rarely and never), while others assessed importance (very important, moderately important, neutral, slightly important, not at all important), see Appendix 1.

Conducting the survey was a tedious and time-consuming process. The survey was disseminated to the participants using emails to current contacts as well as contacts obtained by searching the Internet for industrial design consultancies and companies. 'Snowballing' was also employed, when a designer participated in the survey, she/he was requested to give contacts of other professional industrial designers in her/his network, who were in turn contacted to participate in the survey. Sources such as Coroflot and relevant groups on Facebook were also used. Design related groups on LinkedIn and alumni databases of universities were especially useful. If the designers did not respond within two weeks, they were re-contacted either by an email or a phone call. Sample size can be limited by the available resources (e.g. Robson, 2002); in the present research, it was limited by time and resources that were available. In total, 55 industrial designers - 44 males and 11 females - from India participated in the survey. This sample size was deemed appropriate as the study dealt with design process, requiring the study participants to be professional industrial designers involved in the specific design activity of shaping a product's visual appearance - this is different from the surveys that are conducted with students or consumers. Previous studies have used less than 55 professional designers or engineers in survey based research examining some facets of design processes, e.g. 23 engineers in Spitas' (2011) survey and 52 professional designers in Gonçalves et al.'s (2014: p 35) survey. The sample size in the present study was suitable for statistical analysis (Urdan, 2011: p 49).

Although the studies used to formulate questions were undertaken in countries other than India, discussions with practicing designers, researchers and the pilot study ensured that the questions were applicable to the participants from India. Table 1 shows the amount of experience of the participating industrial designers, and Figure 2 shows their areas of bachelors and masters level degrees. The designers all held a masters level degree: 92% in industrial or product design and the remaining 8% in other areas (e.g. transportation and automobile design). They completed their design education from institutes in India, such as National Institute of Design (NID) Ahmedabad, Indian Institute of Technology (IIT) Mumbai, IIT Guwahati, IIT Delhi, Indian Institute of Science (IISc) Bangalore, etc. In these institutes, education programmes in Industrial Design or Product Design offer a range of courses, covering a variety of topics, e.g. human factors, product aesthetics, form exploration and design, product semantics, design management, product planning and marketing - just to name a few, with design projects forming a core part of their education programmes.

The participants designed a range of products, covering a broad spectrum of categories such as electronic gadgets, kitchen utensils, healthcare devices, jewellery, furniture, automobiles, special purpose machines, military products, etc. Some examples are: washing machines, air coolers, electric geysers, water purifiers, refrigerators, juicers, grinders, headphones, speakers, TVs, LED

lamps, watches, chairs, school desks, motorcycles, cars, buses, trucks, defibrillator, pharmaceutical lab equipment, military vehicles, etc. While the designers engaged with both global and Indian clients, the majority of the clients were from India, and the designed products were mostly targeted at Indian markets. Depending on a number of factors, including, among others, product type, consumer expectations, and client requirements, the products were either mass manufactured or produced in small batches.

Table 1. Overview of the professional designers' experience

Years of experience	Number of designers
Less than 5	13
Between 5 and 10	23
Between 11 and 15	15
Between 16 and 20	2
21 and above	2

In the survey, instruction and information text preceded the questions, with a confirmation from the participants to check if they were practising the design of a product's visual appearance. Ethical clearance was also obtained. The designers were informed that their anonymity will be rigorously maintained. Furthermore, they were given sufficient time to decide if they wanted to participate in the survey, and were not given any incentives for their participation. Care was taken about the sensitivities of the participants, questions that might embarrass or upset them or invade their privacy were not asked. The participants were also informed that the collected data will be analysed and the resulting knowledge will be disseminated through scientific publications.

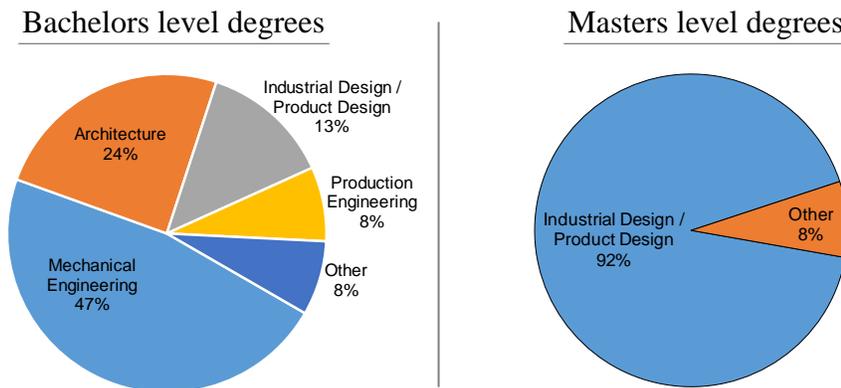


Figure 2. The areas of bachelors and masters level degrees of the participating designers

Findings

Findings are presented in this section first before they are discussed further in the paper. In total, 55 designers participated in the survey (see Table 1). While all the 55 designers answered questions about general intentions, inspiration sources, inspiration media, 52 answered questions about attributes and emotions. Thus, the findings presented in this section, about attributes and emotions correspond to the 52 designers, while all other findings correspond to the 55 designers. Data analysis was undertaken using SPSS software. The designers' frequencies of eliciting different intentions and their preferences on inspiration sources and media were examined to identify potential differences in the sample. This analysis was undertaken using one-way repeated measure

ANOVA (see Appendix 2 [online supplemental data] for information on selecting statistical tests and using SPSS to perform statistical analysis). While Appendix 3 [online supplemental data] presents the details of statistical analysis performed in this research, its results are presented in this present section.

In shaping products, the designers frequently expect specific consumer responses to their designs, in the range 'always' to 'often' ($M = 4.27$, $SD = 0.73$, on a scale from 1 to 5, in which 1 means 'never' and 5 means 'always'). The designers considered 'visual' sense most frequently to elicit intended consumer response ($M = 4.95$, $SD = 0.23$), followed by the senses – tactile, auditory, olfactory, and taste (see Figure 3). Two senses - 'visual' and 'tactile' - were reported to be considered in the range 'always' to 'often'. A repeated measures ANOVA suggested a significant effect on the designers' reported frequency of considering the five senses (See Appendix 3). Post-hoc tests indicated that each of the five senses differed significantly than other senses, in terms of their frequency as reported by the designers ($p < 0.01$). Thus, the 'visual' sense was reported to be considered most frequently than the other four senses ($p < 0.01$).

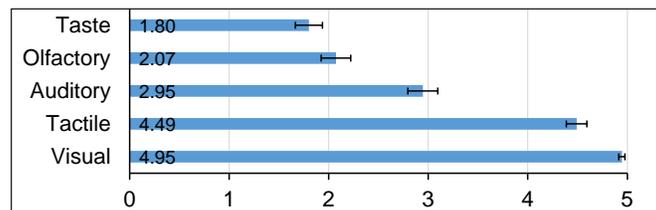


Figure 3. Senses considered in design process to elicit intended consumer response; standard error of means is shown (Scale: 1 – never, 2 – rarely, 3 – sometimes, 4 – often, 5 –always)

Intentions

General Intentions

The designers indicated comprehension as their most frequently elicited intention ($M = 4.44$, $SD = 0.76$), followed by attraction, identification, attention and attribution; all these 5 intentions were reported to be elicited in the range 'always' to 'often' ($M = 4.07$ to 4.44), on a scale 1 to 5, in which 1 means never and 5 means always (see Figure 4). The intention reported to be least elicited was recognition ($M = 3.53$, $SD = 1.12$), as compared to other 7 intentions. The mean score of all 8 intentions is above 3 ($M > 3$), indicating that they were reported to be elicited at least 'sometimes'.

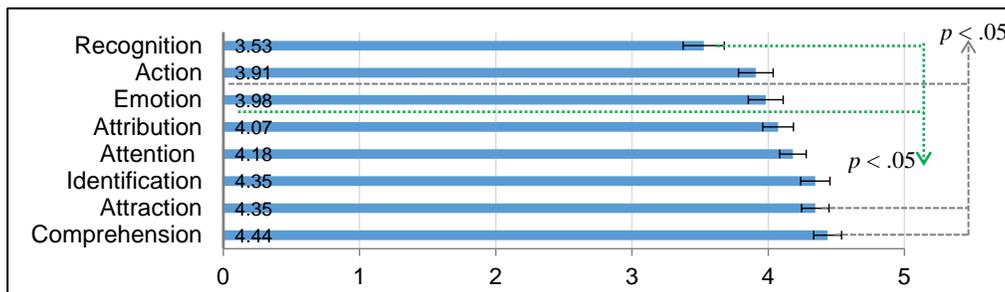


Figure 4. The designers' elicitation frequency of general intentions in shaping products, standard error of means is included (Scale: 1 – never, 2 – rarely, 3 – sometimes, 4 – often, 5 –always)

One way repeated-measures ANOVA showed a statistically significant difference between the elicitation frequency of different intentions (see Appendix 3). Post-hoc tests showed that the

intentions - comprehension and attraction - were reported to be elicited significantly more than recognition and action ($p < .05$). The intention recognition was found to be least elicited, compared to the five intentions - comprehension, attraction, identification, attention and attribution ($p < .05$).

Attributes

The 11 attributes - high-quality, modern, innovative, reliable, practical, harmonious, elegant, convenience, beautiful, simple, and honest - received mean score of above 4, on a scale from 1 - never to 5 - always, indicating their always-to-often frequency (see Figure 5). In terms of the designers' reported elicitation frequency, this set of 11 attributes is called '*high frequency*' set. The 30 attributes, hi-tech to provocative (see Figure 5), received mean frequency score between 3 and 4, i.e. often to sometimes. This set of 30 attributes is called '*medium frequency*' set. Similarly, 23 attributes (soft to discordant, see Figure 5), received mean score between 2 and 3, i.e. sometimes to rarely. This set of 23 attributes is termed as '*low frequency*' set. Seven attributes, namely, unstable, in-elegant, backward, low-quality, obtuse, ugly and dishonest, received mean score between 1 and 2, i.e. rarely to never. These seven attributes are classified under '*least frequency*' set. Figure 5 summarizes the above findings.

One way repeated-measures ANOVA showed a statistically significant effect on how frequently designers elicit different attributes (see Appendix 3). Post-hoc tests indicated that the attributes high-quality, modern, innovative, and reliable were reported to be elicited most frequently. The attributes least elicited, as reported by the designers, are dishonest and ugly.

Emotions

Of the 41 emotions, 20 (e.g. joy, satisfaction, pride, etc.) received mean score between 3 to 4, on a scale from 1 - never to 5 - always, indicating their often-to-sometimes elicitation frequency (see Figure 6). These 20 emotions are classified under '*medium frequency*' set. The mean score of the seven emotions, namely, dreaminess, courage, kindness, sympathy, worship, lust and alarm, on a scale from 1 - never to 5 - always, is between 2 to 3, suggesting their sometimes-to-rarely elicitation frequency. This set of seven attributes is called '*low frequency*' set. The remaining 14 emotions, e.g. jealousy, isolation, anxiety, etc., received a mean score in the range 1 to 2, suggesting their reported elicitation frequency from rarely to never. This set of 14 emotions is termed as a '*least frequency*' set. These findings are summarised in Figure 6.

A repeated measures ANOVA showed that there was a significant effect on designers' reported frequency of eliciting 41 emotions (see Appendix 3). Post-hoc tests suggested that the emotions - joy, satisfaction, pride, interest, and confidence - were reported to be elicited most frequently ($p < .05$). The emotions least elicited by the designers are irritation, sadness, boredom, dissatisfaction, disappointment, shame, and disgust ($p < .05$). The above findings regarding general intentions, attributes and emotions are discussed further in a separate section.

Inspiration Sources and Media

Sources of Inspiration

Designers reported they use the inspiration source 'similar products' most frequently in *analysing intentions* ($M = 4.22$, $SD = 0.71$), with 'always-to-often' usage frequency. The usage frequency of other sources is 'often-to-sometimes' (see Figure 7a). A repeated-measures ANOVA indicated that in analysing intentions the frequency of using inspiration sources differed significantly (see

Appendix 3). Post-hoc tests revealed that the source ‘similar products’ is used most frequently in analysing intentions ($p < .05$, in relation to all other inspiration sources, see Figure 7a).

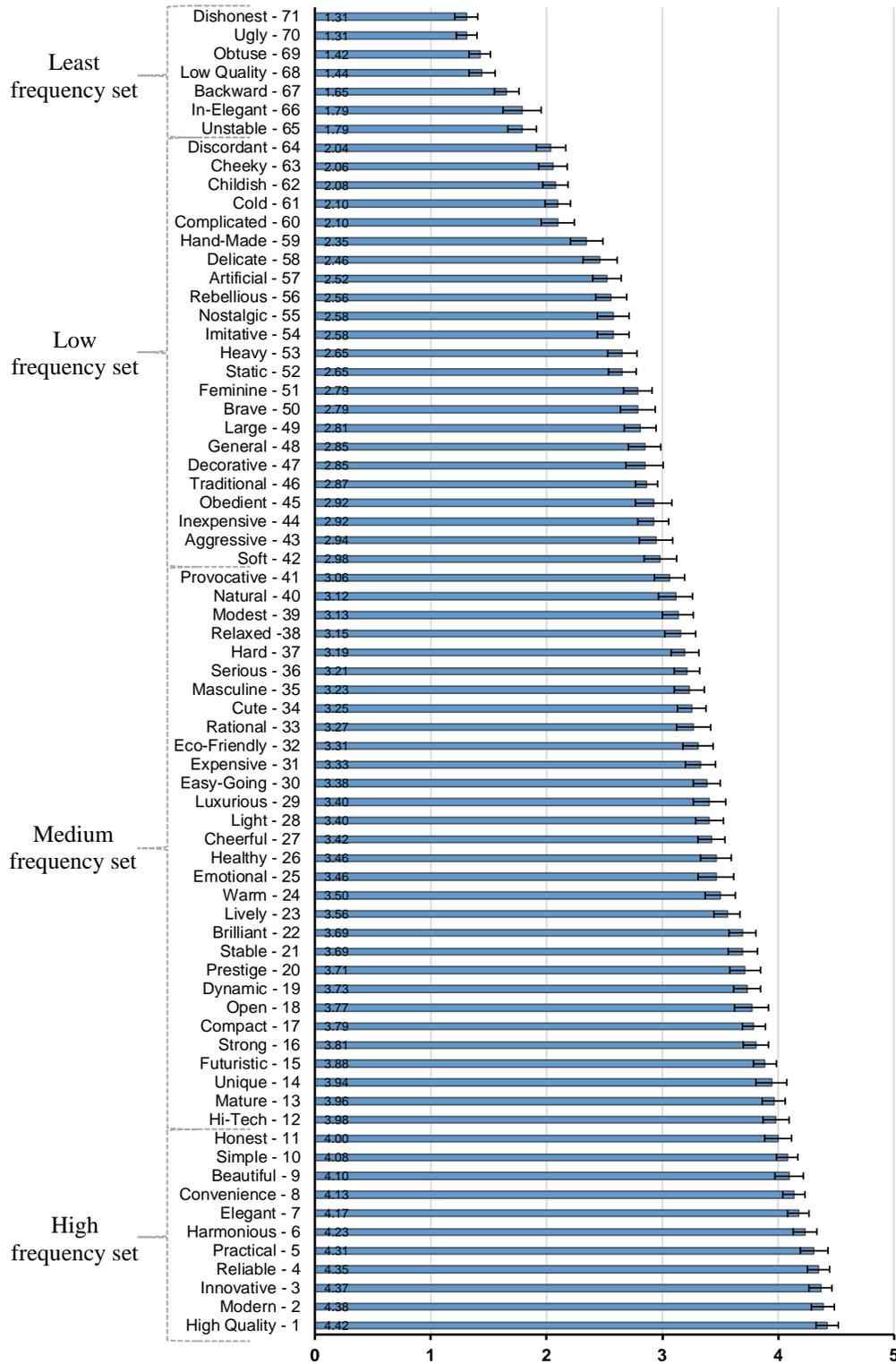


Figure 5. The designers’ elicitation frequency of different attributes, standard error of means is shown (Scale: 1 – never, 2 – rarely, 3 – sometimes, 4 – often, 5 –always), literature sources: Hsu et al., 2000; Chuang, 2001; Desmet, 2003; Chakrabarti and Gupta, 2007; etc. (see the section on research methodology for more sources)

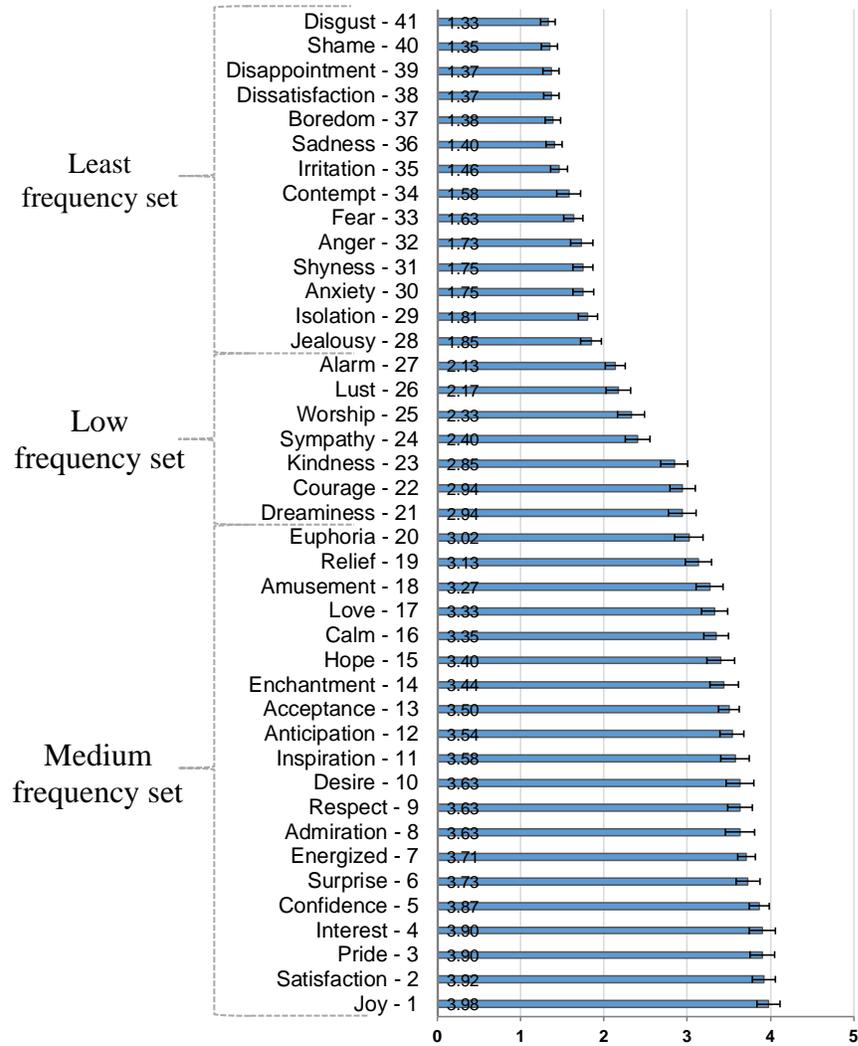


Figure 6. The designers' elicitation frequency of different emotions in shaping a product's visual appearance, standard error of means is shown (Scale: 1 – never, 2 – rarely, 3 – sometimes, 4 – often, 5 – always), literature sources: Hsu et al., 2000; Chuang, 2001; Desmet, 2003; Chakrabarti and Gupta, 2007; etc. (see the section on research methodology for more sources)

The designers reported that in *generating ideas to realise intentions* they ‘often’ use the inspiration source ‘similar products’ ($M = 4$, $SD = 0.79$), followed by the remaining sources (see Figure 7b). There was a statistically significant effect on the designers’ reported frequency of using five inspiration sources in generating ideas ($p < .01$), see Appendix 3. Post-hoc tests indicated that the source ‘similar products’ was reported to be used significantly more than two other sources – works of art and historic products ($p < .05$, Figure 7b). The source ‘dissimilar products’ was reported to be used more frequently than the source ‘works of art’ ($p < .05$, Figure 7b).

The most frequently used inspiration source in *communicating intentions* is ‘similar products’, with usage frequency close to ‘often’ ($M = 3.95$, $SD = 0.87$), see Figure 7c. The least used inspiration source in communicating intentions is non-products ($M = 2.89$, $SD = 1.10$). In communicating intentions, the reported frequency of using the five inspiration sources differed significantly ($p < .01$, see Appendix 3). Post-hoc tests indicated that the inspiration source ‘similar

products' is used most frequently (used more often than 4 other inspiration sources, $p < .05$, see Figure 7c).

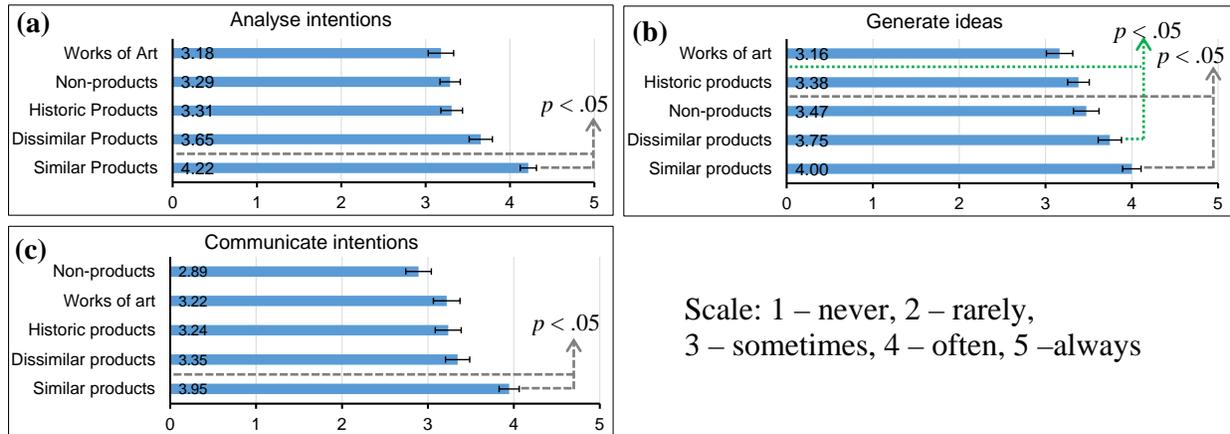


Figure 7. The sources of inspiration used by the industrial designers in analysing and communicating intentions, and in generating ideas to realise intentions, standard error of means is shown

When comparing the differences in usage frequency of the five sources (similar products, non-products, etc.) across three activities (analysing intentions, communicating intentions, etc.) (see Figure 8), we found significant differences only in the case of dissimilar products ($p < .05$) and non-products ($p < .05$), see Appendix 3. Post-hoc tests indicated that the source 'dissimilar products' is used more frequently in generating ideas than in communicating intentions ($p < .05$, see Figure 8b), and that the source 'non-products' is used more frequently both in generating ideas and analysing intentions than in communicating intentions ($p < .05$, see Figure 8d).

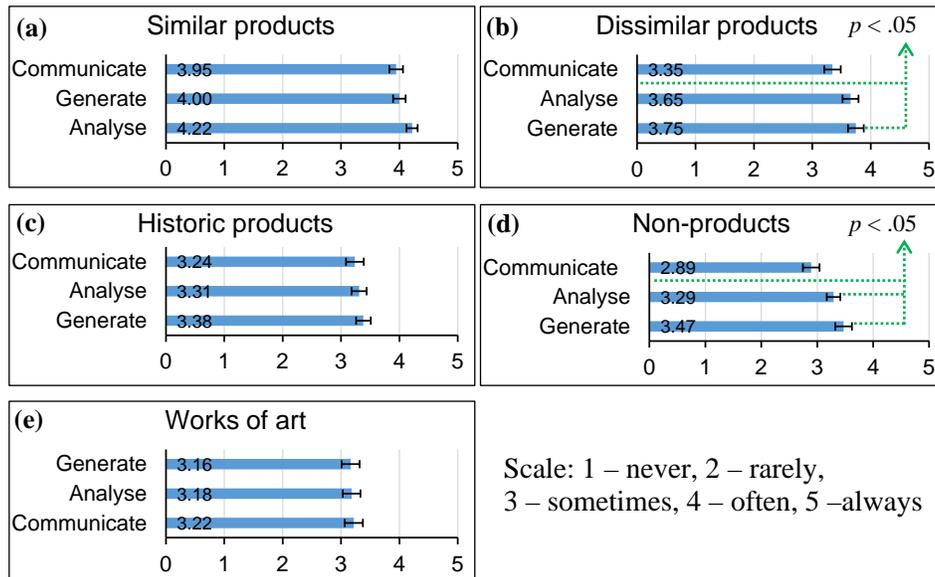


Figure 8. The sources of inspiration across three design activities – analysing intentions, communicating intentions and generating ideas (standard error of means is shown)

Inspiration Media

The designers rated images and objects as very and moderately important in *analysing intentions* (images, M = 4.71, SD = 0.53; and objects, M = 4.65, SD = 0.55), in *communicating intentions* (images, M = 4.82, SD = 0.43; and objects, M = 4.71, SD = 0.53), as well as in *generating ideas to realise intentions* (images, M = 4.76, SD = 0.43; and objects, M = 4.64, SD = 0.62), see Figure 9. The reported importance given to the inspiration media differed significantly in analysing intentions ($p < .01$), generating ideas to realise intentions ($p < .01$) and communicating intentions ($p < .01$), see Appendix 3. Post-hoc tests indicated that images as well as objects were more important for the designers as compared to text in analysing intentions ($p < .05$), in generating ideas to realise intentions ($p < .05$), and in communicating intentions ($p < .05$) (see Figure 9).

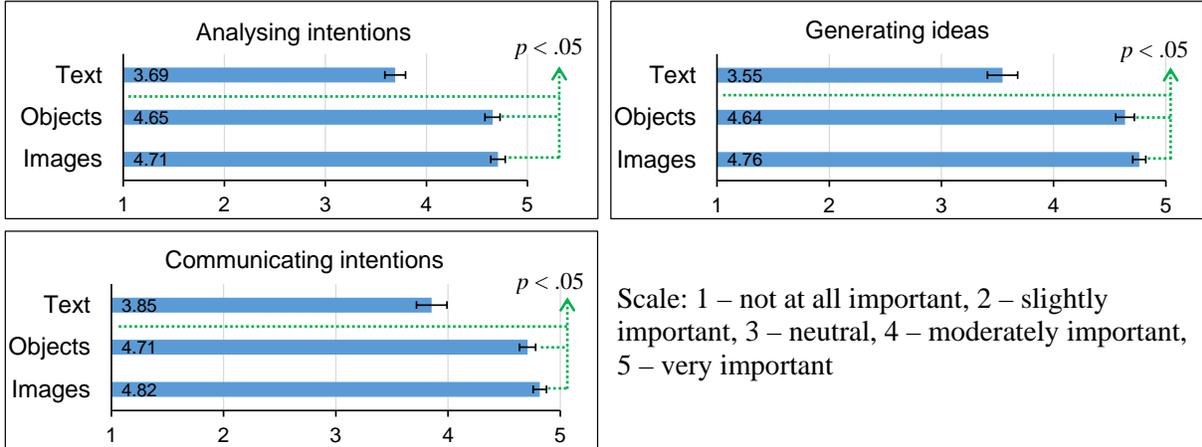


Figure 9. Importance given to the inspiration media, standard error of means is shown

As shown in Figure 10, when comparing the importance given to the inspiration media (images, objects and text) across three activities (e.g. analysing intentions, communicating intentions, etc.), we found significant difference only in the case of text ($p < .05$), see Appendix 3. Post-hoc tests indicated that the designers gave more importance to text in communicating intentions than in generating ideas to realise intentions ($p < .05$, see Figure 10a).

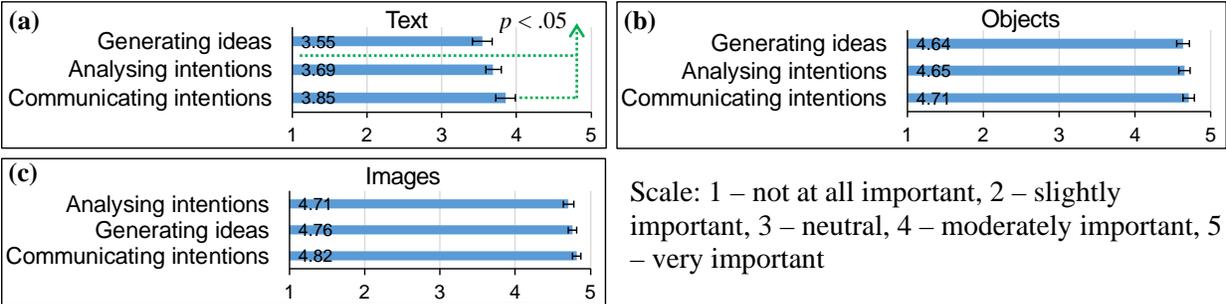


Figure 10. The inspiration media across three design activities – analysing intentions, communicating intentions and generating ideas, standard error of means is shown

Summary of Findings and Discussion

While the previous section presented the survey findings, they are now discussed and opportunities for further work are suggested. The findings indicate that in shaping products the designers frequently expect specific consumer responses to their designs, and that they consider ‘visual’ sense most frequently to elicit intended consumer response. The findings also indicate the crucial role of inspiration sources and media not only in generating ideas to realise intentions but also in analysing and communicating intentions. These findings support the relevance and importance of this research focusing on intentions and inspiration in shaping visual appearance of products.

Intentions

The reported elicitation frequency of all the general intentions (e.g. comprehension, attraction, etc.) is high, with minimum average frequency score of 3.5, suggesting that the lowest elicitation frequency is in the ‘sometimes-to-often’ range. While some general intentions (e.g. comprehension, attraction) are elicited more frequently, some are elicited less frequently (e.g. recognition). The reasons behind these differences might be explained by different aspects. Elicitation frequency of a general intention, as reported by the professional designers, indicates the proportion of design projects in which they might have attempted to elicit that intention. As mentioned previously in the section on research methodology, the participants in the survey have designed different types of products, covering a broad range of product categories. Some intentions can be crucial in designing products from a wide range of categories (e.g. automobiles, electronic gadgets, kitchen utensils, etc.), whereas some can be important only in a small range of product categories. It is likely that professional designers will consider and elicit broadly applicable intentions in most of the design projects, resulting into high frequency score of such intentions. For example, the intention ‘comprehension’, which is about supporting users in understanding how a product works, appears to be important in many product categories, as suggested by its high frequency score. On the other hand, the intention ‘recognition’, which is about designing a product as coming from a particular country, brand or tradition, appears to be applicable to some specific product categories, as indicated by its relatively low frequency score.

Some attributes, e.g. high-quality, modern, innovative, reliable, etc., are frequently elicited, suggesting their broad applicability and importance for product success. Professional designers are likely to consider those attributes which are critical for product success, as product failures can have serious financial consequences for companies or consultancies designing products. Likewise, some emotions (e.g. joy, satisfaction, pride) appear to be broadly applicable and important for product success, resulting into their high frequency score. Rarely elicited attributes (e.g. dishonest, ugly) and emotions (e.g. shame, disgust) may be narrowly applicable and tend to communicate negative messages, resulting into their low frequency score.

It is interesting to note the designers’ behaviour towards the attributes ‘traditional’ vs ‘modern’. The reported elicitation frequency of the attribute ‘traditional’ is low (sometimes-to-rarely), whereas that of the attribute ‘modern’ is high (always-to-often), suggesting that the designers frequently attempt to elicit the attribute ‘modern’ as compared to the attribute ‘traditional’. While there are 11 attributes in the high frequency set, i.e. in the ‘always-to-often’ frequency range, there is not a single emotion in this range (see Figures 5 and 6). This finding is further supported by the results about the general intentions - while the general intention ‘attributes’ is reported to be elicited in the ‘always-to-often’ range, the general intention ‘emotions’ is in the ‘sometimes-to-

often' range (see Figure 4). This finding indicates that designers deal more often with attributes than emotions in shaping products.

The findings about intentions have crucial implications for design research and education. The findings reveal that some attributes and emotions are frequently elicited. It is worthwhile to understand the strategies that professional designers use in eliciting these high-frequency attributes and emotions. While there are some studies on understanding the strategies used by professional designers in eliciting the emotion 'surprise' (e.g. Rodríguez, 2014), there is absence of such studies on many other high-frequency attributes or emotions. Knowledge about strategies of professional designers in eliciting such attributes and emotions can form a sound foundation upon which methods or pedagogical interventions can be developed to assist design students or novice designers in learning those strategies to elicit specific attributes and emotions, which are important in market success of products from a broad range of categories.

A variety of problems with varying requirements is useful to develop different design skills (Atman et al, 2005). The findings of this research can provide an empirical foundation upon which assignments can be formulated to assist students to develop different skills related to the subject of shaping products. The classification of the 71 attributes and 41 emotions into different sets (see Figures 5 and 6), based on the designers' reported elicitation frequency, can form a basis to develop such design assignments, asking students to elicit a broad range of attributes and emotions in the design of a product's visual appearance.

Inspiration and Intentions

This research examined the designers' use of inspiration in generating ideas to realise intentions as well as in analysing and communicating intentions. One of the findings is that the designers frequently use the inspiration source 'similar products' in analysing intentions. We propose the following two reasons to explain this finding. First, product success depends on how well it competes with similar products in markets (Kotler and Armstrong, 2010). Serious financial consequences of product failure in markets mean that the professional designers will attempt to design a product such that it can successfully compete with similar products, requiring them to seek inspiration from similar products in analysing intentions. Second, in most of the design projects that the designers work on are about designing products which have similar products to compete with; this is also evident from the types of products designed by the participating designers, see the section on research methodology for some examples of products designed by them.

As with analysing intentions, designers frequently use the inspiration source 'similar products' in communicating intentions, indicating its importance and effectiveness in communicating intentions. Because a designed product needs to compete with similar products in markets, designers will use references to products similar to the one being designed when they communicate intentions with stakeholders such as clients, manufacturers, marketers and retailers. In addition to this commercial aspect of competing with similar products, it is more effective and efficient to communicate intentions in relation with similar products than with distant sources, which can increase the likelihood of uninterpretability, hampering the communication (e.g. Crilly et al., 2004).

While the designers frequently use the inspirational source ‘similar products’ in analysing and communicating intentions, they frequently use more sources in idea generation, e.g. similar products, dissimilar products and non-products. This suggests that by seeking inspiration from a range of sources, designers may encourage a flow of ideas, indicating an exploratory nature of their idea generation activity in shaping a product’s visual appearance. This interpretation might also be supported by the findings of previous experimental studies focusing on functional aspects of product design which show that seeking inspiration from a diverse range of stimuli can increase the number of ideas (Perttula and Liikkanen, 2006).

The findings about the importance given to the media of inspiration-sources indicate that both images and objects are considered highly important not only in generating ideas to realise intentions but also in analysing and communicating intentions. This suggests the importance of images as well as objects in the process of shaping products. Images are easily accessible, e.g. through magazines or search engines on the Internet. Using images in a design process is cognitively efficient because transferring information from source to target is fast when the way of representing information at these two ends is visual (e.g. Goldschmidt and Sever, 2011). Furthermore, industrial designers, in general, keep collections of images, either in digital or non-digital formats, which they can use in the current or future design projects (e.g. Keller et al., 2009). Our findings regarding images in the process of shaping a product’s visual appearance are in line with prior research focusing on functional aspects of product design (e.g. Gonçalves et al. 2014: p 35-36), indicating the prevalence of the use of images in designing products.

As compared to images, it may take more time and effort to access objects. Despite this, the designers consider objects to be highly important, indicating a vital role of objects in the design of a product’s visual appearance. Professional designers’ access to financial and material resources can enable them to use objects in a design process. In general, they also make tangible prototypes, e.g. using 3D printing or some other process. High importance attributed to objects also suggests that they can provide more information, e.g. details about surface finish, colours, form, information about how a product is assembled or how it can be used, etc. Designers may use such additional and detailed information provided by objects in generating ideas as well as in analysing and communicating intentions.

Comparison of the medium ‘text’ across three activities (e.g. analysing intentions, communication intentions, and generating ideas) shows that it is reported to be significantly more important in communicating intentions. Designers may use annotated sketches/images or some specific words in communicating intentions to different stakeholders, resulting into its higher importance in communicating intentions, as compared to activities of analysing intentions and generating ideas to realise intentions. The findings about inspiration sources and media suggest differences in their usage in the activities - analysing intentions, communicating intentions, and generating ideas to realise intentions. These findings imply that future studies can be focussed on one or more of these activities, for example, studies can be focused on understanding how designers use inspiration sources and media in communicating intentions.

Limitations and Further Research

While survey method, like any other research method, has some limitations, it has been used in several previous studies to understand many aspects of design processes, in fields such as engineering design, graphic design and industrial design (see the section on research methodology

for examples of such studies). In the present research, the survey was conducted with the professional designers in India; their education, training is from institutes in India; and while they have designed products from a broad range of categories, they are mostly targeted at markets in India. Such factors might influence what designers intend by their designs and what inspiration sources they use in shaping products, e.g. cultural differences may affect design process (e.g. Tomico et al., 2009). Therefore, whilst our findings can be applicable to other professional designers with similar background, we need to be careful in such generalization. Future studies can be focused on professional designers from diverse cultures, allowing for comparative analyses. Design research in this field can also gain by examining how male and female industrial designers shape a product's visual appearance, e.g. understanding differences between their preferences and use of inspiration sources. Future research, based on a better understanding of intuitive use of inspirations by designers, can also aim at supporting them in enhancing their intuitive use of a broader range of inspirations in the delivery of intentions. To study the subject of shaping products, neither quantitative (e.g. surveys or experimental techniques) nor qualitative studies are superior. Future studies might use qualitative methods, e.g. case studies and real-time observations of design processes. Such qualitative methods, for example, can allow to understand how designers use inspiration sources to elicit some specific intentions and if these intentions are successfully embodied in the final product. The applicability of this research is restricted to the visual sense in shaping products. Further research should consider other senses, specifically the 'tactile' sense, which is reported to be considered in the 'always-to-often' range.

Conclusions

This research, using a survey of the professional industrial designers, offered new insights into the intentions that they attempt to elicit and their use of inspiration sources and media in shaping visual appearance of products. The survey revealed that while some general intentions (e.g. comprehension, attraction) are elicited more frequently, some are elicited less frequently (e.g. recognition). In contrast to previous research about shaping a product's visual appearance, this study compiled lists of numerous attributes and emotions, and assessed their elicitation frequency as reported by the designers. The designers frequently intend to elicit some attributes (e.g. high-quality, modern, innovative, reliable) and emotions (e.g. joy, satisfaction, pride). Future studies should attend to such high frequency attributes and emotions, uncovering the strategies that designers use to elicit them.

In contrast to the previous inspiration studies that typically focus on the role of inspiration media in generating ideas to address functional aspects of product design, this survey assessed the importance of such inspiration media plus the frequency of their sources in idea generation as well as in analysing and communicating intentions in shaping visual appearance of products. The survey revealed that the inspiration sources and their media are not just of relevance in idea generation but also in analysing and communicating intentions. Whilst the inspiration source 'similar products' is frequently used in analysing and communicating intentions, a broader range of inspiration sources is regularly employed in generating ideas to realise intentions. The findings about the importance given to the inspiration media indicate that both images and objects are considered highly important not only in idea generation but also in analysing and communicating intentions. Future studies might usefully focus on the effects of inspiration sources and their media not only on idea generation but also on other aspects of a design process, e.g. problem analysis, communication during a design process.

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