

Sentence Completion Test – Research and Inspirational Tool for Industrial Designer

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Abstract. The traditional documentation techniques used by designers fail to capture the needs, expectations and interests of the subconscious of the targeted market segment. Sentence completion test is a technique that can identify these elements both at conscious level and subconscious level. The purpose of this research was to verify on a practical case the usefulness of the technique as a research and inspirational tool for designers and also to propose a test structure when applying the technique in the field of product aesthetics.

Keywords. sentence completion, research tool, industrial design.

1. Introduction

Along with design brief, the designer also receives information about the market segment that will use the product she/he is designing. Beyond the demographic data, it is important for the designer to know and understand the needs, and expectations of the future users, as well as how they usually use the products in the respective class, but especially the interest and attitude of the future users towards the activities carried out with the new product. Part of this cardinal information is sometimes included in the design brief, as a result of the activity performed by the marketing department or other departments.

Almost always, the designer should carry out a supplementary documentation activity. It has a plethora of documentation techniques at her/his disposal. The questionnaire and the interview have become classic tools for obtaining direct input from the representatives of the market segment. The advantages of these techniques are obvious. The questionnaire is easy to administer, and the data obtained is quick and easy to process. The interview allows a more nuanced approach to the interviewee. But the disadvantages are also clear. The questionnaire provides only information related to the aspects addressed by the questions; nothing unexpected will appear. The interview takes a long time, and it costs a lot to approach a significant number of people.

But the big question is whether these techniques really provide true and relevant information. The questionnaire, the interview and the derived techniques appeal to the respondent's consciousness, but the topics addressed (needs, expectations and interests) also belong to the subconsciousness. In addition, the respondent may self-censor for reasons of social desirability (she/he may be afraid that others will form a bad impression about her/him or may be laughed at) or because she/he may believe that certain information that is requested may be used against her/him [1].

One way to overcome the questionnaire and interview limitations is to borrow some qualitative techniques from psychology, namely projective techniques. Projective techniques are based on tasks that the subject must perform with ambiguous stimuli at her/his disposal, revealing inner feelings, and

interests. It is appreciated that projective techniques amplify anthropological observation with useful information, undetectable by traditional techniques, which reflect the psyche, but also reveal the culture of the individuals studied in terms of attitudes, values and even prejudices [2].

Projective techniques are classified into five categories depending on the task the respondent is asked to perform [3, 4]: association (connecting an object with words, images or thoughts); completion (completion of sentences or stories); construction (filling in speech bubbles in a cartoon, for example); choice ordering (classification of product benefits, for example); expressive (role playing, drawing or other creative activities).

Completion techniques are projective techniques that require the respondent to complete a task based on incomplete stimuli, such as an unfinished sentence or story [5, 6] for example. **Sentence completion** is a combination of a projective technique and a questionnaire, whereby respondents are given incomplete sentences (called sentence stems) which they then complete in ways that are meaningful to them [7, 8, 9, 10].

There are three aspects to emphasize in relation to sentence completion technique. First of all, when a person fills in the usual questionnaire, she/he thinks that the person who will read the questionnaire will involuntarily evaluate her/him and the instinct makes her/him look not for the honest answers, but for the ones she/he considers the most appropriate. Second, when a person assesses product aesthetics using a Likert scale, she/he inevitably activates the left hemisphere of the brain, which is not desirable, considering that only the right hemisphere is genuinely capable of evaluating beauty. Third, a person who completes an open sentence has the freedom to write any words without self-censorship, because she/he knows that there is no "correct" words to write and, moreover, the creativity of the left hemisphere is active.

The sentence completion technique has important strengths. The respondent uses his own words to describe her/his emotions, feelings, and interests, thus providing more precise, spontaneous and honest answers than those obtained through the traditional questionnaire and interview [9]. Moreover, the respondent becomes aware of her/his hidden emotions and attitudes [2]. Another important advantage of sentence completion is time saving. If an interview lasts on average around an hour, a sentence completion test requires between 5 – 15 minutes. In addition, the audio recording of the interview must be transcribed, which is time-consuming. And the interpretation of the obtained information takes longer in the interview case than in the sentence completion case [10]. Moreover, sentence completion allowed the identification of differences between groups of users [9].

Although it was invented for applications in psychology, sentence completion is today criticized for the doctor's subjectivity in interpretation of results [11]. Sentence completion is ignored by neuropsychologists in evaluation of personality [12]. European psychologists rarely or never use sentence completion [13, 14, 15, 16, 17]. It is the same with American educational psychologists [17, 18, 19, 20].

But sentence completion, through its ability to bypass or circumvent the conscious defences of respondents, has been successfully used in consumer research, marketing and consumer psychology, and business research [21, 22, 23]. The examples of using sentence completion outside of psychology are numerous: evaluation of the user experience of a smartphone [10]; checking consumer interest in local food products [24]; restaurant services [25]; the reasons why people smoke [3]; analysis of the factors that influence the conferring of symbolic meaning [9]; parents' values and attitudes towards the necessity of children's exercise [10]; cross-cultural study of happiness [26]; career assessment [27]; learning foreign languages [28]; linguistics [29, 30].

A promising field for the application of sentence completion is product design. The approach is different from that of pure psychology, i.e. the respondent's attention should be focused on the product. It has proven to be useful for capturing user experience [4], because the contemplation and use of the product is not a momentary experience, which afterwards disappears, but an experience strongly conditioned by prior situations. It was also found that the understanding of needs depends on the identification of the user's values and factors that determine the quality of life [31]. Possible application

directions of sentence completion are: the reasons why a person chooses to buy or use a product or eliciting opinion about what signifies valuable experience and meaning for people [4].

In product development, sentence completion is not well-known and is rarely used, even if it offers a promising approach to understanding the motivations, needs, attitudes, feelings and experiences of future users. Although some research has been done on the application of sentence completion in product design, a detailed methodology for applying sentence completion has not been formulated.

Concluding, the sentence completion can be applied in industrial design and visual issues. For example, a sensitive aspect is visual pollution [32, 33, 34]. Visual pollution manifests itself through graffiti and other agents. Among the general public, opinions are divided: some consider graffiti to be a gross violation of property rights and a graphic offense to passers-by, while others positively interpret graffiti as an expression of alternative visual arts. A shy person who does not like graffiti would be reluctant to express her/his opinion directly in order not to appear unsophisticated, but her/his hidden attitude would be detected through sentence completion. Regarding strictly industrial design, one could study the golden ratio issue [35, 36] through sentence completion and detect the proper value for the considered market segment.

2. Method

So, the purpose of this research was twofold: a) to check if the technique produces useful results when applied in the field of industrial design; b) to develop a specific structure for the sentence completion test for product aesthetics.

It was imagined the situation in which an industrial designer had to conceive a kitchen scale and wanted to find out information from the market segment more than she/he would receive using only the questionnaire technique. It was decided that the respondents should be helped in completing the sentences by seeing a kitchen scale with a special design. After examining several products, the scale displayed in Figure 1 was selected.



Fig. 1: Sphere Kitchen Scale (by Roberto Pezzetta)

The author and two colleagues in the same field generated a number of 25 question stems during a brainstorming session. The question stems were related to cooking, kitchen scales in general, and the kitchen scale presented in Figure 1. After generating the question stems, the three researchers established the criteria for assessing question stems: relevance, clarity and potential to provide useful information. Then, they evaluated the generated question stems according to the criteria, and those that did not correspond were eliminated. For example, "The color of the kitchen scale seems to me" was considered irrelevant, because the respondent would have reacted to the colour red in general and not to the colour of the kitchen scale itself.

In the end, only 8 question stems remained. Thus, the test consists of:

- S1. Cooking seems to me
- S2. Precision in cooking is
- S3. The typical user of a kitchen scale is a[n]
- S4. Considering kitchen scale as a human being, the relationship between the scale and the cook would be

- S5. What I like about the kitchen scale in the picture is the
- S6. The scale in the picture makes me think of
- S7. Compared to other kitchen scales, this scale is
- S8. This scale fits in a kitchen

3. Experimental results

The research was carried-out with 343 participants (207 women and 136 men; mean age = 22.6). All participants were students enrolled at a large technical university in Romania. The participants were not financially rewarded for their participation in this research. Each research session had the following structure: 1. The author made an introduction in which he presented the purpose and the methodology of the research. 2. Participants saw the kitchen scale on a computer screen and completed the sentences using a survey administration software. The author ensured that the same type of computer screen was used during the whole experiment. The process of completing sentences was done in Romanian.

After the last session, the results were translated into English, afterwards they were analysed, and it was found that only 16.6% of the sentences were completed with more than one word. Then, the attention was focused on each sentence stem and basic qualitative content analysis was applied, respectively the sentence fragments were grouped according to their meaning. Whenever possible, words were replaced with the most frequently synonym used by participants; similar for phrases.

The frequency of responses was calculated for each word or phrase using a spreadsheet software and it is presented in Table 1.

Table 1. Frequency of responses.

Sentence Stem	Response	Frequency [%]
Cooking seems to me	relaxing	28.86
	interesting	11.95
	necessary	10.20
	pleasant	6.12
	fun	4.08
Precision in cooking is	important	39.36
	high	34.40
	average	13.41
	low	7.00
	essential	4.08
The typical user of a kitchen scale is a[n].....	housekeeper	29.74
	average man	22.45
	cook	18.37
	young person	11.66
	sophisticated person	7.58
	control freak	7.29
Considering kitchen scale as a human being, the relationship between the scale and the cook would be	friendship	70.55
	teamwork	8.16
	harmonious	5.83
What I like about the kitchen scale in the picture is the	shape	32.36
	colour	30.61
	design	11.08
	innovation	3.21
	aesthetics	2.62

Sentence Stem	Response	Frequency [%]
The scale in the picture makes me think of	children ball	17.78
	egg	5.83
	Christmas globe	4.96
	crystal ball	3.79
	apple	2.62
Compared to other kitchen scales, this scale is	different [and striking]	10.79
	modern	10.79
	interesting	7.87
	small	6.12
	beautiful	5.54
	innovative	5.54
This kitchen scale fits in a kitchen	modern	65.31
	small	5.83
	average	4.66
	new	3.21

The research purpose was not to obtain information about the design of kitchen scales, nor to evaluate the scale in Figure 1, but to verify the usefulness of the information and the revelation of unexpected elements. As can easily be seen in Table 1, the verification confirmed the targeted aspects.

Even the answers themselves and their frequency were useful and could be sources of inspiration for the industrial designer (as will be indicated in the "Discussion"), the decision was made that the content analysis should be carried out in depth with the help of a specialized software (KH Decoder). This software allows the calculation of numerous indicators and also generates charts. Given that designers appreciate information in a visual format, three chart formats were selected and separate charts were generated for the responses to each of the eight statements. The following figures display examples for each chart format: Correspondence Analysis of Words (Fig. 2), Multi-dimensional Scaling (Fig. 3), and Co-occurrence Network of Words (Fig. 4) – the most inspiring one.



Fig. 2: Correspondence Analysis Chart for “Cooking seems to me”

The Correspondence Analysis Chart (Fig. 2) indicates that, in relation to cooking, the words placed around the origin (“necessary”, “art”, “fun”, “interesting”, etc.) are less distinct in participants’ opinion. Also, the words located far from origin are perceived more different and their character is emphasised (“boring” – negative and “fabulos” – positive). The Multi-dimensional Scaling (Fig. 3) indicates the frequency of words by the size of their corresponding circles. The clusters are revealing the correlation of significances. So, according to participants, the scale displayed in Fig. 1 fits in a “modern”, “small”, and “new” kitchen and less in a “young” and “luxurious” one, for example. Using connecting lines, the Co-occurrence Network of Words (Fig. 4) suggests, due to their association within the text completed by participants, that the kitchen scale (Fig. 1) is “different” and “striking” by “design”.

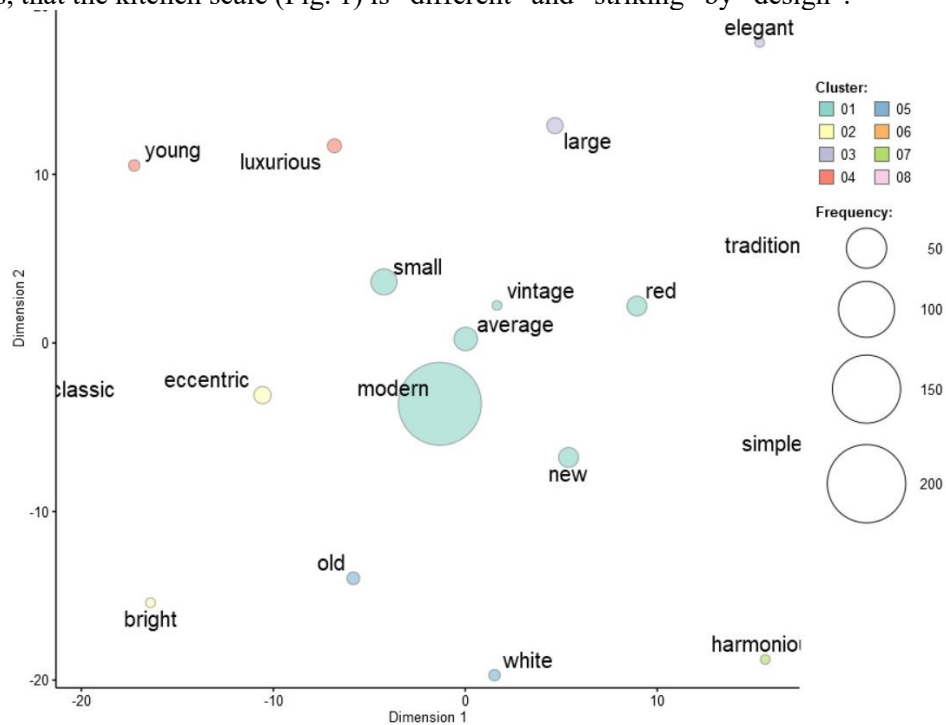


Fig. 3: Multi-dimensional Scaling Chart for “This kitchen scale fits in a kitchen”

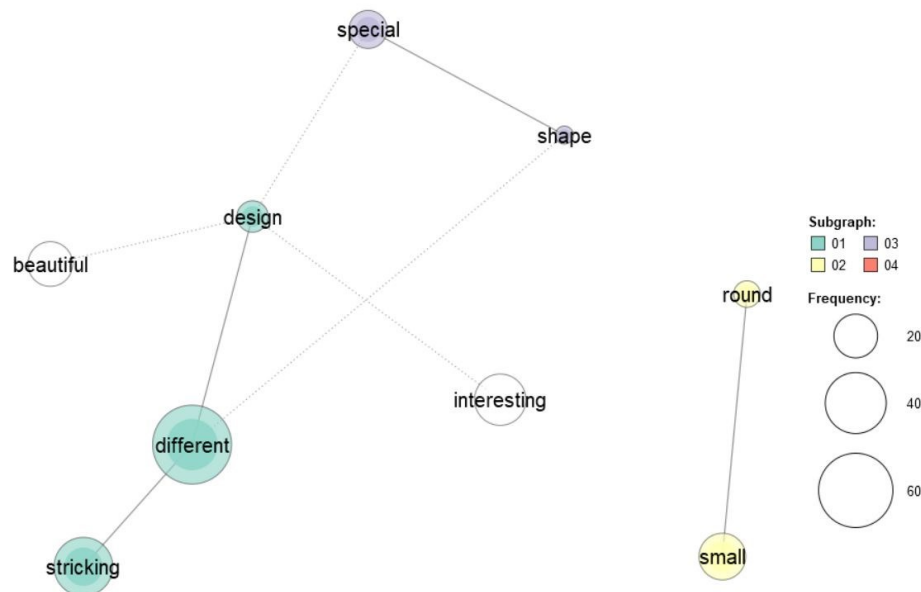


Fig. 4: Co-occurrence Network Chart for “Compared to other kitchen scales, this scale is”



Fig. 5: Tag Cloud for “Cooking seems to me”

Also, tag clouds were generated for all sentences, as recommended in the paper [9]. The facility provided by <https://worditout.com/> was used. Figure 5 shows an example.

4. Discussion

Analyzing the results of the experiment, it was observed: a concentration of responses towards certain aspects; the appearance of unexpected answers (like comparison of displayed kitchen scale to Christmas globe and crystal ball) that certainly may inspire designers; and the charts show the importance and correlations between the different aspects of each question.

The obtained results were presented to four practicing designers (two product designers and two interior designers) in separate informal interviews. All four appreciated the sentence completion technique as useful and easy to apply, even it was explained to them that generating sentence stems was more difficult than it seemed at first glance. Designers also considered that the graphic results obtained as charts or tag clouds can be powerful sources of inspiration. One of them even had the opinion that the graphic results were a kind of objectified mood board. Discussing in more detail about the practical results obtained for the kitchen scale, the designers indicated that they did not expect some aspects revealed by the technique. (That the user of a kitchen scale could be regarded as sophisticated person or even a control freak, for example.) The designers also suggested increasing the number of stimulus images from one to three.

In addition to the general recommendations for the development of the sentence completion test [3, 7, 8], it is proposed an original structure of the test for use in industrial design field to consist of:

1. General sentence about the activity performed with the product.
2. Sentence(s) about the particularities of the activity to be performed.
3. Sentence(s) about the typical user of the product.
4. Sentences about user-product relationship and interaction.
5. Sentences about the aesthetics of the product used as a stimulus.
6. Sentences about the connection of the stimulus product with the environment in which it will be placed.

After the sentence completion test has been developed, each sentence stem should be checked according to the following five criteria:

- Sentence stems are valid for every person from the considered market segment.
- Sentence stems are ambiguous and open enough to stimulate a large range of responses.
- Sentence stems are not leading to a “desired” response.
- Sentence stems are written in plain language avoiding technical jargon.
- Sentence stems are written in a casual manner to make respondent feel at large.

5. Conclusions

The research evaluated the usefulness of sentence completion as a research and inspirational tool for designers using the case of a kitchen scale. The results were compelling by themselves, but also were endorsed by four professional designers who appreciated the technique of sentence completion, but also the graphic results obtained by content analysis.

In the end, a structure for the sentence completion test specific for industrial design was proposed. The structure is accompanied by a checklist of five criteria to ensure the usefulness of the test.

To our knowledge, there were no other researches focused on the application of completion sentence technique to product aesthetics, and the promising results are similar to those obtained for capturing users' perceptions [4].

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