



The influence of special effects on the perception of printed products

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<p>Summary</p> <p>The influence of special effects on the perception and mental impressions associated with printed products was investigated in a psychometric study. A set of 60 print samples containing different types of printed special effects, such as varnishing and metallic effects, was subjectively assessed by 177 observers. The number of print samples and observers was increased from an earlier study, allowing more general conclusions to be drawn from the results.</p> <p>The shifts produced by the use special effects along perceptual dimensions termed Noteworthiness and Aesthetic Value were examined. These dimensions were found in the previous study to efficiently capture a considerable part of the influence of printed special effects on the subjective experience of printed products. The positions of the special effect print samples were compared on the psychometric scales of Noteworthiness and Aesthetic Value to the positions of the reference samples that had the same content but no special effects beyond conventional CMYK printing. A strong trend of increased Noteworthiness and Aesthetic Value in the special effect print samples, compared to the reference samples, was found.</p>	
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Preface

The project was carried out in the first part of 2009 in close cooperation between the VTT project team and the project partners: Lönnberg Painot, Map Suomi, Orange Advertising, and Hansaprint. The authors wish to thank the representatives of the companies for their efforts in the production of the print samples and in arranging the subjective assessments. In addition to VTT and the companies, the project received financing from the Graphic Industry Research Foundation. Additional subjective experiments were arranged in Germany by manroland.

Espoo 29.6.2009

Authors

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Appendix 1: Distribution of answers to selected background questions

1 Introduction and goal

The use of special effects in printed products is motivated by the assumption that the effects make the product stand out from the mass of ordinary printed products, making the product better at catching the attention of the consumer, more effective in shaping their mental impressions in order to deliver the desired message, and more memorable. However, while data related to effectiveness of individual marketing campaigns is often collected, research results supporting the assumptions concerning the influence of special effects in printed products on the consumer perception and experience have been lacking.

The work described in this report is a continuation of a project that concentrated on measuring the influence of the printed special effects on the subjective experience and mental impressions evoked by printed products. The psychometric scaling procedures used in this project were based on the results of the earlier study [Laine et al., 2008]. Compared to the earlier study, the subjective experiments were streamlined, concentrating on measuring only a few key perceptual dimensions that were identified as being central in describing the perceptual and experiential shifts resulting from the use of printed special effects. The use of this focused experimental setup allowed a considerably larger amount of print samples to be assessed by a considerably larger group of observers. Indeed, this was the main motivation for this study: to collect a larger set of subjective assessment data for a larger set of special effects print samples, in order to verify and possibly expand the findings of the earlier study, which had been carried out with a more limited set of print samples and observers.

Figure 1 indicates the scope of this (and the previous) study. The emphasis was on the shifts in the mental impressions caused by enhancing printed products with special effects. This enriched media experience is then expected to strengthen the message to be delivered (by an advertisement or product packaging, for instance), resulting in increased sales, either in short term, or in the longer term through stronger brand. Examination of the influence of the printed special effects on the buying decision was, however, outside the scope of this project.

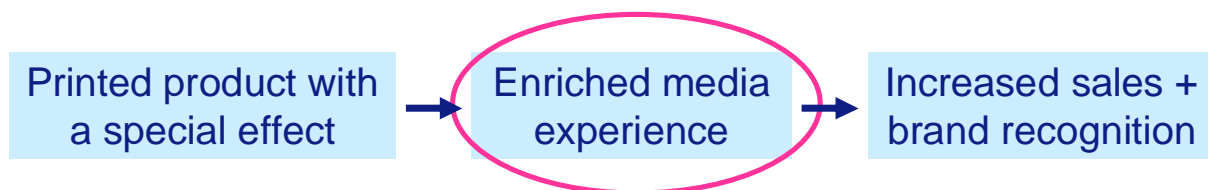


Figure 1. The expected result of using special effects in printed products

It should be further pointed out that this study did not aim to categorically define the contribution of a given type of special effect to the subjective experience, as it was clear that the sheer number of context-dependent, interacting factors varying from case to case (consumer expectations, message to be delivered, interpretation of the content by the consumer, etc.) would make this kind of effort futile. Instead, a set of experimental data was collected and analyzed in order to find significant trends in how the special effects influenced the subjective experience of printed products. The basic approach was to build certain numerical psychometric scales to describe the mental impressions evoked by the set of print samples subjectively assessed in the experiments. By comparing the positions of special effect print samples on the psychometric scales to those of reference samples printed without special effects, significant trends could be observed in how the special effects shifted the mental impressions associated with the print samples.

The print samples and experiments are described in chapter 2. The results of statistical analysis of the experimental data (subjective assessments of the print samples) are presented and discussed in chapter 3. Chapter 4 concludes the report.

2 Experiments

2.1 Print samples

A total of 60 different print samples were collected by the project partners for the subjective assessments described in section 2.1. 26 of these samples were standard CMYK print samples without special effects. They had the same content as the corresponding special effect print samples, and served as references for analyzing the perceptual shifts caused by the special effects. Metallic effects were used in 15 of the print samples. The class of metallic effects included metal-laminated paper, metallic inks, and metallic foil elements. Varnishing was used in 15 of the prints samples. Typically spot gloss or pearlescent varnishing was used to highlight certain objects in the printed image. In 10 samples a design paper with visible surface structure or special optical properties was used. The print sample set also had a single print sample in which a 3D effect had been created by printing on a lenticular sheet. The lenticular sheet delivers different views to the left and the right eye of the viewer, creating a strong illusion of depth in the image. Some of the samples had more than one special effect, both metallic and varnishing effects could be used in the same print sample, for example.

In contrast to the previous project in which several different special effect versions of the same content were made specifically for the psychometric experiments, most of the samples used here were taken from earlier production or demonstration samples that already were enhanced with special effects. The reference versions were produced by printing the same content without the special effect, in some cases mimicking the effect, as well as possible, with modified CMYK separations. Thus there were typically two versions with the same content, a special effect print sample and a standard CMYK print sample for reference.

The contents and special effects used in each print sample are listed in Table 1. The code numbers in the first column are used to indentify the samples when presenting the results in chapter 3.

Table 1. Code numbers and content descriptions of the print samples

Sample code	Description	Special effect
1	Chocolate box (promotional gift) cover	None
2	Chocolate box (promotional gift) cover	Design paper
3	Cereal advertisement	None
4	Cereal advertisement	Design paper
5	Car advertisement	None
6	Car advertisement	Design paper
7	Car advertisement	Design paper
8	Jewellery advertisement	None
9	Jewellery advertisement	Design paper
10	Jewellery advertisement	Design paper
11	Management consulting firm advertisement	None
12	Management consulting firm advertisement	Design paper
13	Management consulting firm advertisement	Design paper
14	Furnishing advertisement	None
15	Furnishing advertisement	Design paper
16	Furnishing advertisement	Design paper
17	Industrial component company brochure cover	None
18	Industrial component company brochure cover	Metallic - laminated paper
19	Telecommunications company customer event invitation	None
20	Telecommunications company customer event invitation	Varnish - spot gloss
21	Classical music instrument	Metallic - cold foil
22	Wrist-watch	Metallic - cold foil
23	Book cover	Metallic - hot foil
24	Tableware	None
25	Tableware	Varnish - spot UV
26	Clockwork toy	Lenticular 3D
27	Womens' clothing customer magazine	None
28	Womens' clothing customer magazine	Varnish - UV overprint
29	Tobacco company history	None
30	Tobacco company history	Varnish - spot gloss
31	Comic book cover	None
32	Comic book cover	Metallic - laminated paper
33	Design glass advertisement	None
34	Design glass advertisement	Varnish - spot gloss
35	Bag advertisement	None
36	Bag advertisement	Varnish - spot gloss
37	Annual report of a research center	None
38	Annual report of a research center	Varnish - spot gloss
39	Lipstick advertisement	None
40	Lipstick advertisement	Metallic - metallic ink
41	Motorboat advertisement	None
42	Motorboat advertisement	Metallic - laminated paper, Varnish - overprint
43	Motorcycle	None
44	Motorcycle	Metallic - laminated paper
45	Rifle advertisement	None
46	Rifle advertisement	Metallic - laminated paper
47	Customer magazine of a forest industry company	None
48	Customer magazine of a forest industry company	Varnish - spot gloss, Embossing
49	Motorcycle advertisement	None
50	Motorcycle advertisement	Varnish - spot pearlescent gloss, Metallic - foil
51	Washing machine advertisement	None
52	Washing machine advertisement	Varnish - spot gloss, Metallic - foil
53	Alcohol drink advertisement	None
54	Alcohol drink advertisement	Varnish - spot pearlescent gloss, Metallic - foil
55	Womens' bag advertisement	None
56	Womens' bag advertisement	Varnish - spot gloss, Metallic - foil
57	Wrist-watch advertisement	None
58	Wrist-watch advertisement	Varnish - spot pearlescent gloss, Metallic - foil
59	Printing press advertisement	None
60	Printing press advertisement	Varnish - spot gloss, Metallic - foil

2.2 Subjective assessments

The set of print samples were assessed by a total of 177 observers. Although the majority of the observers (145) were Finnish, a total of 10 nationalities were represented. The second largest group, 21 observers, were from Germany. The other countries among the ten were represented by 1 to 3 observers each.

All the samples were attached to gray cardboard backing that extended beyond the borders of the print sample. Each observer assessed a subset of 28 randomly selected print samples in random order, one sample at a time. The observers were allowed to hold the samples in their hands, but were instructed to touch only the cardboard backing, not the sample itself.

Before assessing the samples the observers completed a background questionnaire. In addition to basic demographic data, the questionnaire included a short section concentrating on media use.

The observers were asked to indicate their level of agreement with seven statements concerning the perceived properties of each sample by making a mark on a visual ruler such as the one shown in Figure 2.

This sample is interesting.

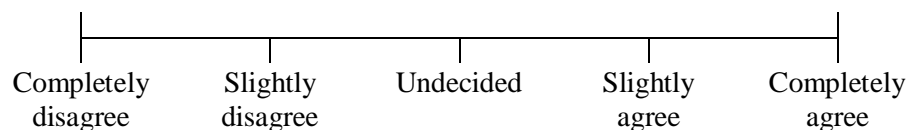


Figure 2. The visual ruler used in assessing the print samples

The seven statements were:

1. This sample is stylish.
2. This sample is interesting.
3. This sample is beautiful.
4. This sample catches one's attention.
5. This sample is pleasant to look at.
6. This sample is memorable.
7. The visual appearance of this sample supports the content.

The agreement levels were converted to integer numbers from 0 (corresponding to the left end of the ruler, "Completely disagree") to 100 (corresponding to the right end of the ruler, "Completely agree"). This data was analyzed to form numerical scales representing the perceptual differences between the print samples, as described in the following chapter. The first six statements were used to form ratings for "Noteworthiness" and "Aesthetic Value", as described below.

3 Results and discussion

The results of the previous project suggested that the influence of the printed special effects on the perception of printed products was mainly reflected on two perceptual dimensions. These dimensions were termed Noteworthiness and Aesthetic value. Statements 2 (This sample is interesting), 4 (This sample catches one's attention), and 6 (This sample is memorable) in the previous chapter were intended to measure the Noteworthiness of the print samples. Likewise, statements 1 (This sample is stylish), 3 (This sample is beautiful), and 5 (This sample is pleasant to look at) were intended to measure the Aesthetic Value of the samples.

Multivariate data analysis method known as principal component analysis (PCA) was used to verify that the six attributes indeed measured these two approximately independent underlying dimensions, as was assumed based on the results of the earlier study. Examination of Figure 3 confirms that this was the case. Vectors corresponding to the attributes "Interesting", "Memorable", and "Catches attention" all point in the same general direction, indicating high correlation between these variables. This is also the case for attributes "Pleasant to look at", "Beautiful", and "Stylish". Furthermore, the fact that the angle between the vectors of these two groups of attributes is approximately 90 degrees indicates low correlation between the groups and suggests that the two underlying attributes indeed correspond to two separate aspects in perceiving the special effects in printed products, as expected.

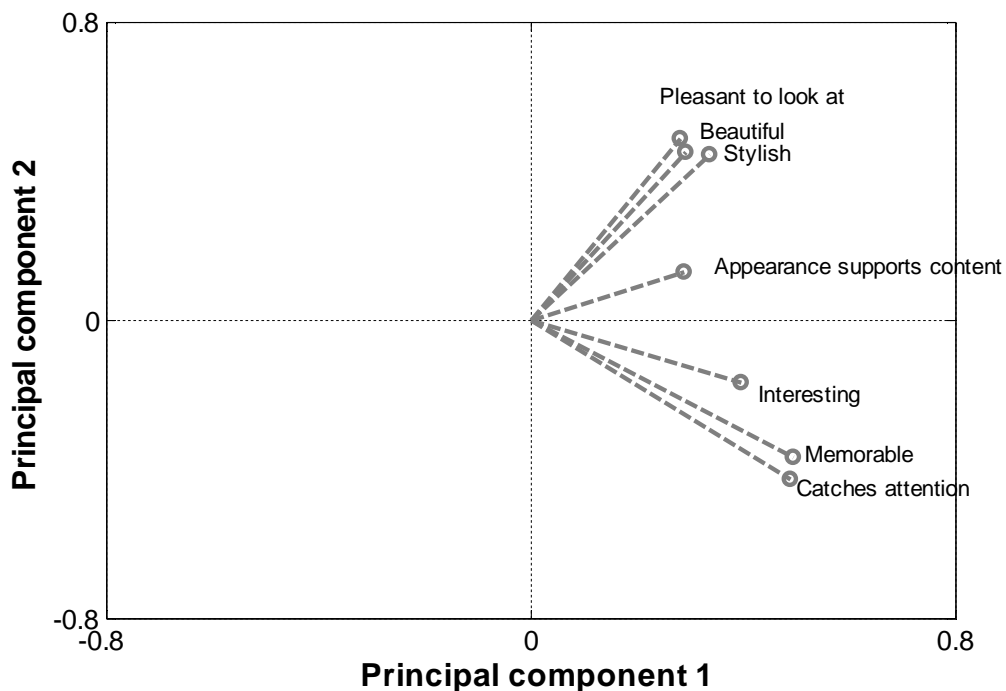


Figure 3. The seven original attributes in the space of principal components 1 and 2

Rotating the vectors counter-clockwise roughly 40 degrees would put the vectors in positions that closely correspond to their locations in the earlier study. This would align the horizontal axis with the dimension of Noteworthiness, and the vertical axis with Aesthetic Value.

The seventh variable, corresponding to the statement “Appearance supports content” was included in the assessments in order to identify possible cases where the use of special effects was perceived to be in disharmony with the message of the content. This variable is seen to have some positive correlation with both Noteworthiness and Aesthetic Value.

Instead of actually rotating the axes in the principal component space of the above diagram (which would not have affected the interpretation of the results), Noteworthiness was calculated in a more straightforward manner as the average of the ratings on the “Interesting”, “Memorable”, and “Catches attention” rulers. Aesthetic Value was similarly calculated as the average of “Pleasant to look at”, “Beautiful”, and “Stylish”.

Figure 4 summarizes the overall results of the study, showing the locations of all 60 print samples in the Noteworthiness-Aesthetic Value diagram (values averaged over all 177 observers). After looking at the overall view, more specific results will be presented.

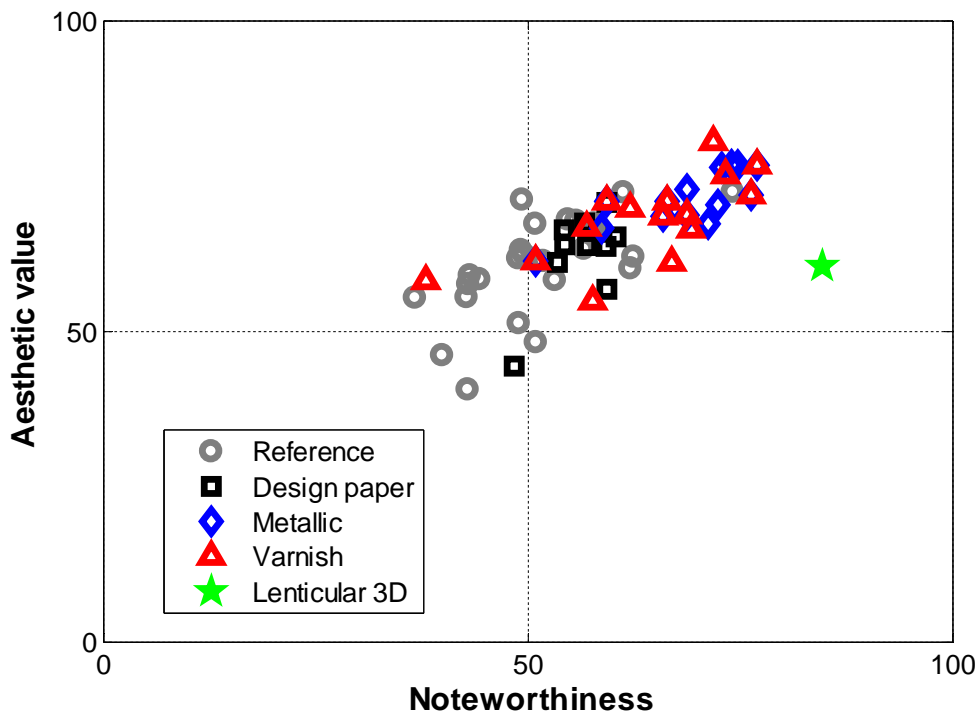


Figure 4. Noteworthiness and Aesthetic Value of all print samples, averaged over all observers

The gray circles in Figure 4 correspond to the reference print samples that had the same content as some of the special effect samples but without any special effects above conventional CMYK printing. These reference samples form a cluster roughly in the middle of the diagram. The distribution of these points results from the perceived differences in the Noteworthiness and Aesthetic Value of the content of the samples. Without yet looking specifically at the reference and special effect samples of identical content, it can be seen that generally the special effect sample clusters occupy areas to the top right of the reference samples, indicating increased Noteworthiness and Aesthetic Value in the special effect samples.

While in Figure 4 the full scale of Noteworthiness and Aesthetic Value from 0 to 100 is shown, Figure 5 shows the same diagram with the axes extending from 30 to 90. The sample code numbers are also included, allowing individual samples to be identified (refer to Table 1 for descriptions of the samples). This same range from 30 to 90, encompassing the locations of all the samples, is used in all the following diagrams for easier comparisons.

While no general conclusions can be drawn from the position of a single sample, it is interesting to note that sample 26, the only sample with a 3D effect created by lenticular printing, is considerably separated from the cluster of the other samples by its significantly higher Noteworthiness.

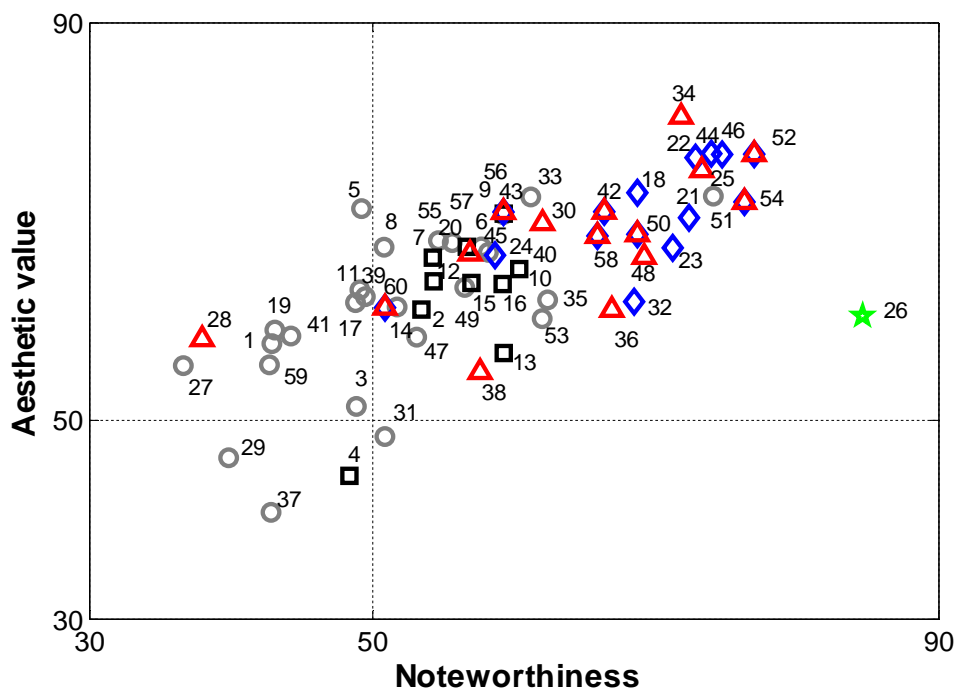


Figure 5. Noteworthiness and Aesthetic Value of all samples, averaged over all observers

Looking more closely at the perceptual shifts produced by a certain type of special effect, Figure 6 shows locations of the print samples with metallic effects (whether produced by laminated paper, metallic inks, or foil) and the corresponding reference print samples with the same content but no special effects. The arrows point from the reference sample to the corresponding metallic-effect sample, indicating the perceived shift in Noteworthiness and Aesthetic Value in that case. A trend is evident in the perceived shifts: the arrows point toward the top right corner, indicating increases in both Noteworthiness and Aesthetic Value. In all cases an increase in both of these dimensions was achieved with metallic effects. The shifts can generally be said to be statistically significant. The confidence intervals for the mean values of both Noteworthiness and Aesthetic Value (not shown in the figures), averaged over all observers, are in the range from 2.1 to 4.7 scale units, for all samples.

The results for the varnish samples, plotted in Figure 7, are very similar to those of the samples with metallic effects. Again increases in both Noteworthiness and Aesthetic Value were generally achieved compared to the reference samples, apart from a few cases in which only the Noteworthiness was significantly increased, Aesthetic Value having remained

practically at the same level as that of the reference sample. The increases in Noteworthiness tended to be larger, but only slightly, than increases in Aesthetic Value for the other samples also, as was the case with the samples with metallic effects.

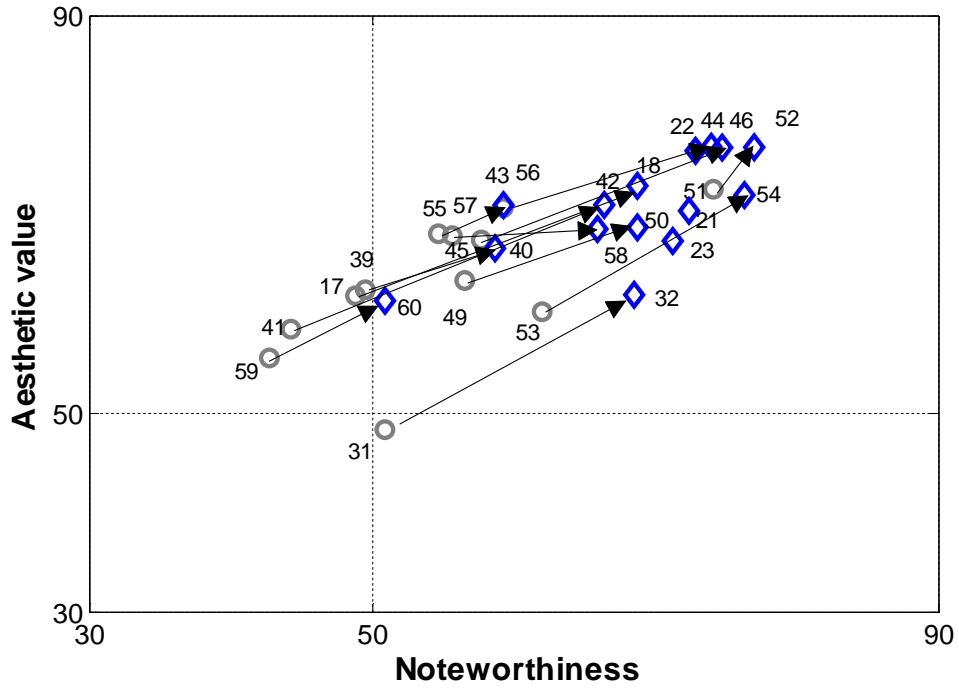


Figure 6. Noteworthiness and Aesthetic Value of samples with a metallic special effect and the corresponding reference samples, averaged over all observers

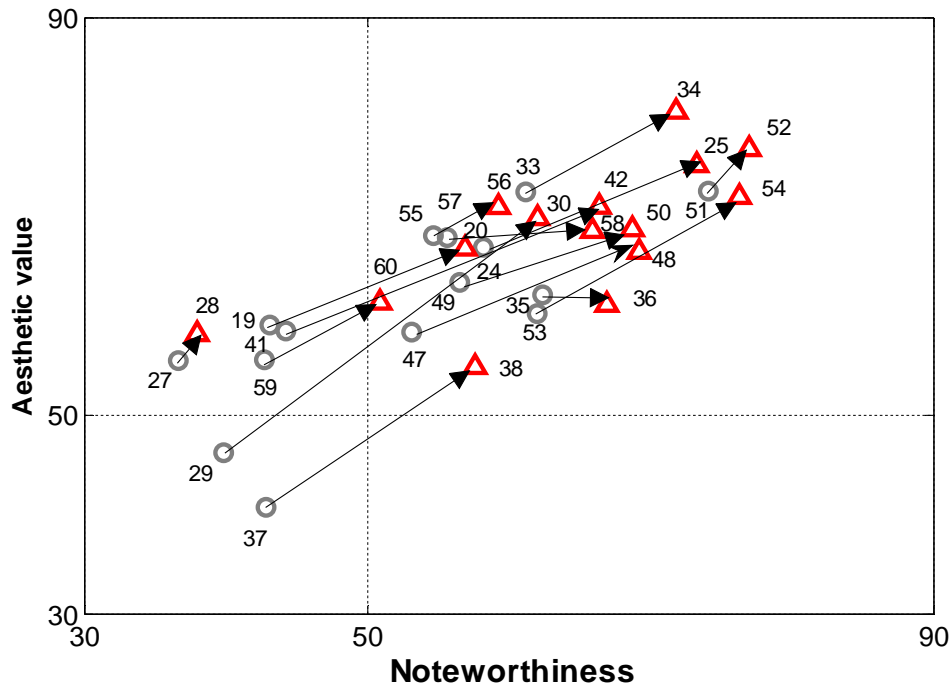


Figure 7. Noteworthiness and Aesthetic Value of samples with a varnish special effect and the corresponding reference samples, averaged over all observers

The design paper print samples were more experimental in nature than the other samples. A set of contents from previous productions, originally printed on a conventional paper, were printed on a set of design papers with special surface properties for the purposes of these experiments. The varying suitability of the given design paper to each content appears to be evident in the results for the design papers, plotted in Figure 8. The graph indicates that increases in Noteworthiness were achieved for most samples, compared to samples of the same content printed on normal paper. However, there were both increases and decreases in the Aesthetic Value. Indeed, for the same content, Aesthetic Value was in some cases increased when a certain design paper was used, but decreased with another kind of design paper (arrows pointing towards both top right and bottom right from the reference sample; see samples 8, 9, and 10, for instance).

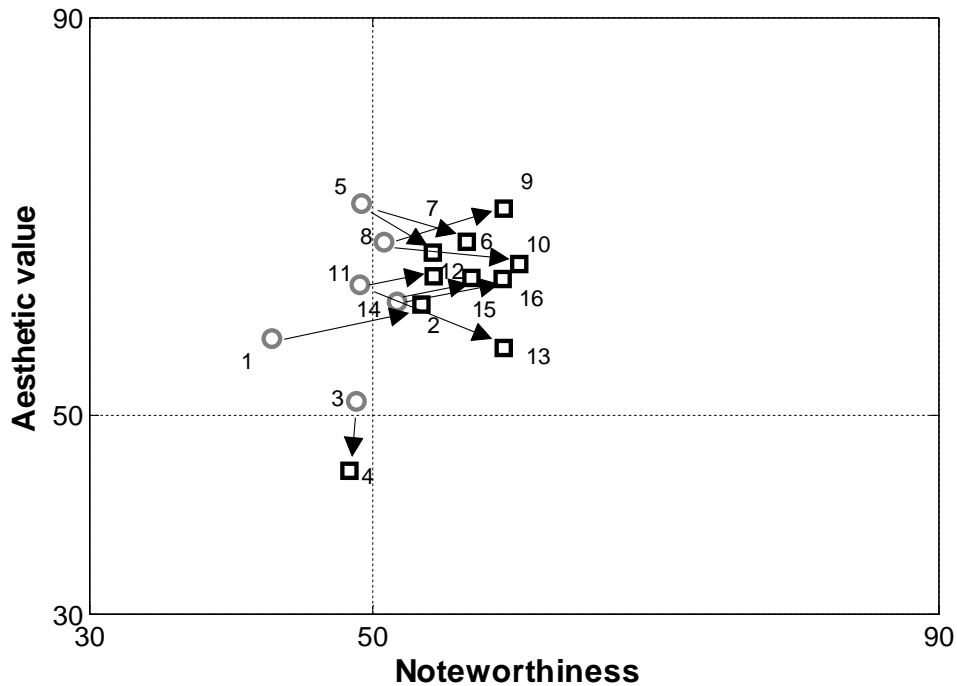


Figure 8. Noteworthiness and Aesthetic Value of design paper samples and the corresponding reference samples, averaged over all observers

The results for the design papers resemble the results of the previous study, in which the special effect print samples were also for the most part made by adding different types of special effects to existing content [Laine et al., 2008]. In those results the trend of increases in Noteworthiness was evident, with both increases and decreases in Aesthetic Value. This was interpreted as having resulted from the success (or lack of it) with which a special effect had been designed and implemented, and the suitability (or lack of it) of a given special effect to certain content. It was further speculated that with more carefully designed special effects increases in Aesthetic Value as well as Noteworthiness could be usually achieved.

The results of this study support the above assumptions: a strong trend of increases in both Noteworthiness and Aesthetic Value was evident with the carefully designed metallic and varnish special effect samples (Figures 6 and 7).

For the purposes of comparison to the results of the previous study, note that samples 37 and 38 (the cover of annual report without special effects and the same cover with spot gloss varnishing, respectively) of this study were also included in the previous study (identified by sample labels Report and ReportGloss in that report).

The observers, prior to assessing the print samples, also answered a brief background questionnaire. Basic demographic information was collected, along with questions on media-use habits.

An interesting approach would be to cluster observers sharing similar attitudes towards printed special effects by statistical analysis of the assessment data. The identified observer clusters could then be profiled based on the background data. This kind of analysis was beyond the scope of this project, however.

The results for some basic demographic groups were examined, however. These are presented in the Figures 9 to 22 for the metallic and varnish samples. When examining these results, it should be noted that because the number of observers in each group is considerably lower than the total number of observers, there is more uncertainty in the sample mean locations for the observer groups. Note also that the observers were not completely randomly selected, and cannot be assumed to fully represent the general population.

Results for female and male observers are first compared (Figures 9 to 12). The number of female observers was 75, and the number of male observers was 97. While there were some significant differences for individual samples in the assessments made by women and men, the results of the both sexes share the similar trend of increasing Noteworthiness and Aesthetic Value for the metallic and varnish samples.

The differences are more pronounced when comparing observers aged 20 to 39 (120 observers) to observers aged 40 to 63 (53 observers), as seen in Figures 13 to 16. The older observers ranked many special effect samples considerably lower than the younger observers. However, there were still a considerable number of special effect samples that were highly ranked by the older observers also.

Finally, the observers were roughly divided into three groups based on the relation of their work to visual media. The division was based on the background question asking “Is your job (or your studies, if you are a student) related to visual media? (You can choose more than one option)” The observers that stated that their job involved making decisions of buying advertisement agency services and making media choices, or buying of print jobs were assigned to a group labelled “Buyers” (51 observers). The observers that were not included in “Buyers” but stated that their job involved visual creative work, or was related to making of printed products, or was related to research and development in the field of print quality or image quality, or was related to making of media products and services other than printed products were assigned to the group “Makers” (69 observers). Finally, the observers whose job was not closely related to visual media or at least not directly concerned with the production of visual media were assigned to the group “Consumers” (45 observers). The results for these three groups are plotted in Figures 17 to 22. While the same trend of increased Noteworthiness and Aesthetic Value can be found in the results of these three groups, the results of the “Buyers” for certain samples, with significant decreases in Aesthetic Value, suggest more critical assessments. It should also be noted that many of the “Buyers” were in the age group from 40 to 63 years, which explains the somewhat similar results for these two observer groups.

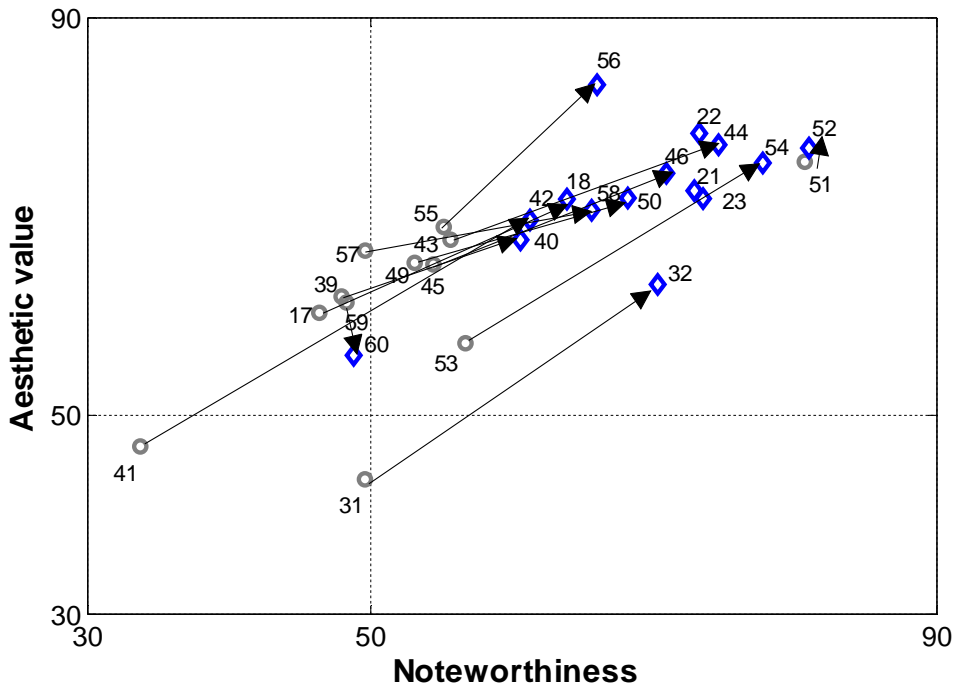


Figure 9. Noteworthiness and Aesthetic Value of samples with a metallic special effect and the corresponding reference samples, averaged over female observers

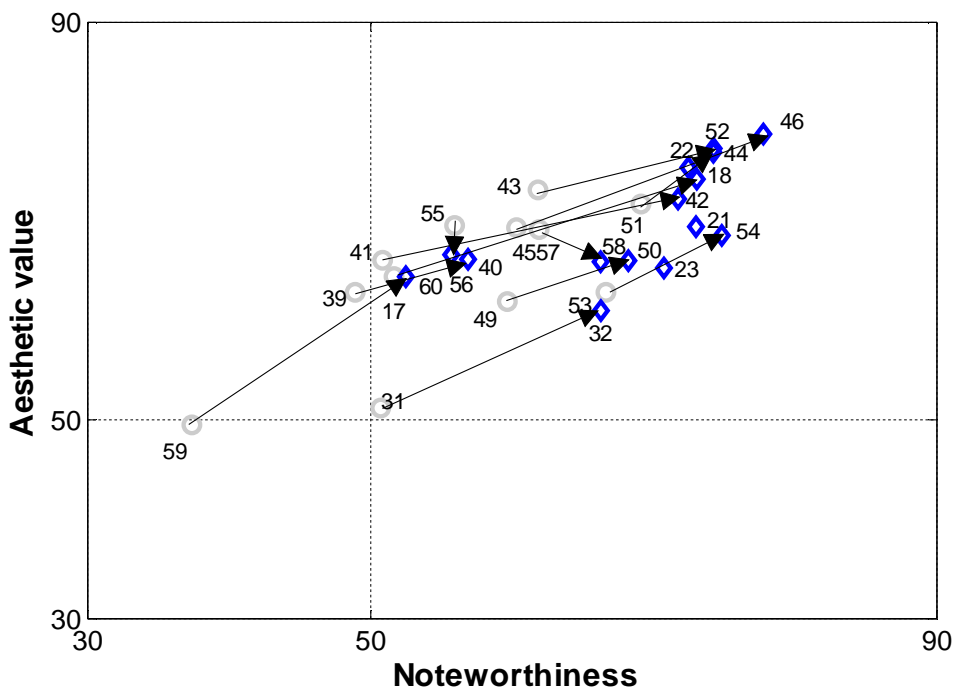


Figure 10. Noteworthiness and Aesthetic Value of samples with a metallic special effect and the corresponding reference samples, averaged over male observers

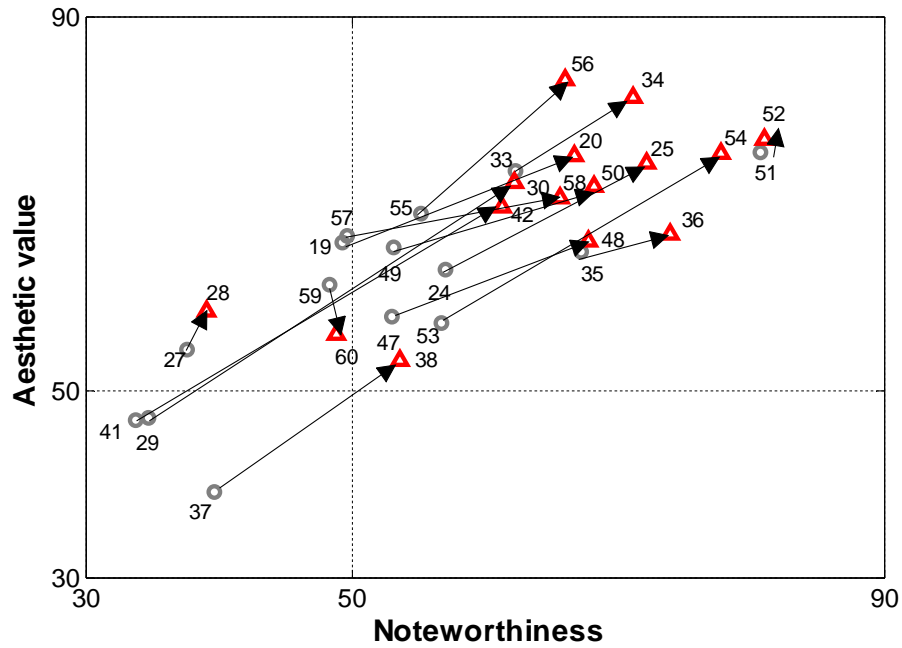


Figure 11. Noteworthiness and Aesthetic Value of samples with a varnish special effect and the corresponding reference samples, averaged over female observers

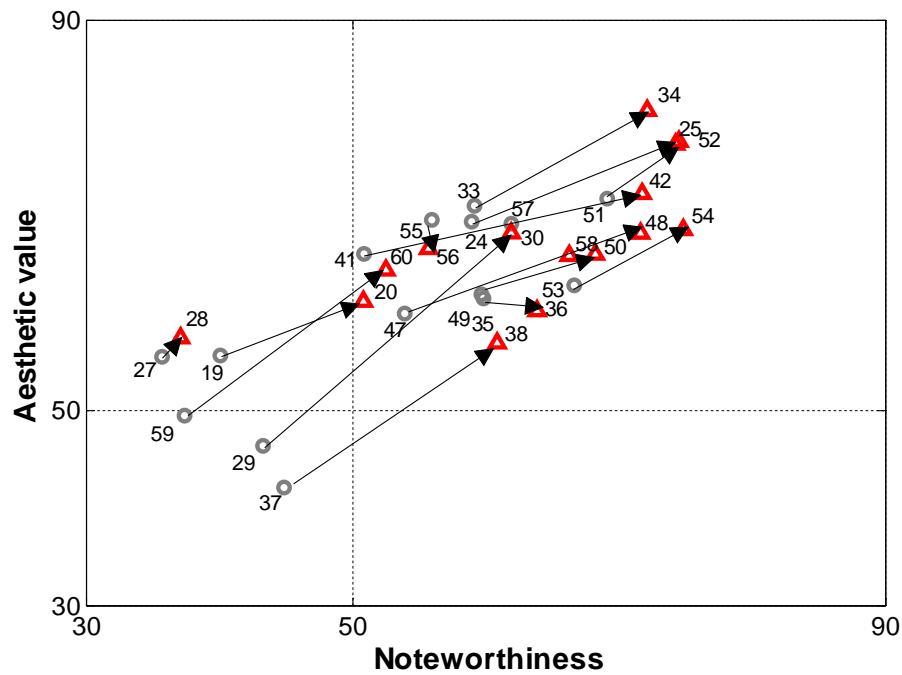


Figure 12. Noteworthiness and Aesthetic Value of samples with a varnish special effect and the corresponding reference samples, averaged over male observers

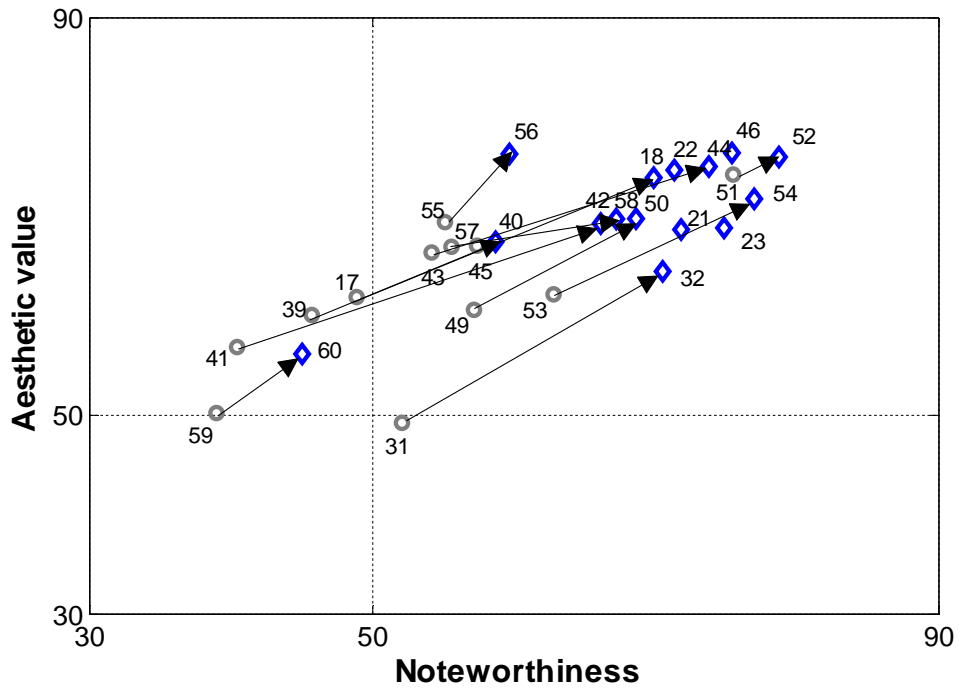


Figure 13. Noteworthiness and Aesthetic Value of samples with a metallic special effect and the corresponding reference samples, averaged over observers aged 20 to 39

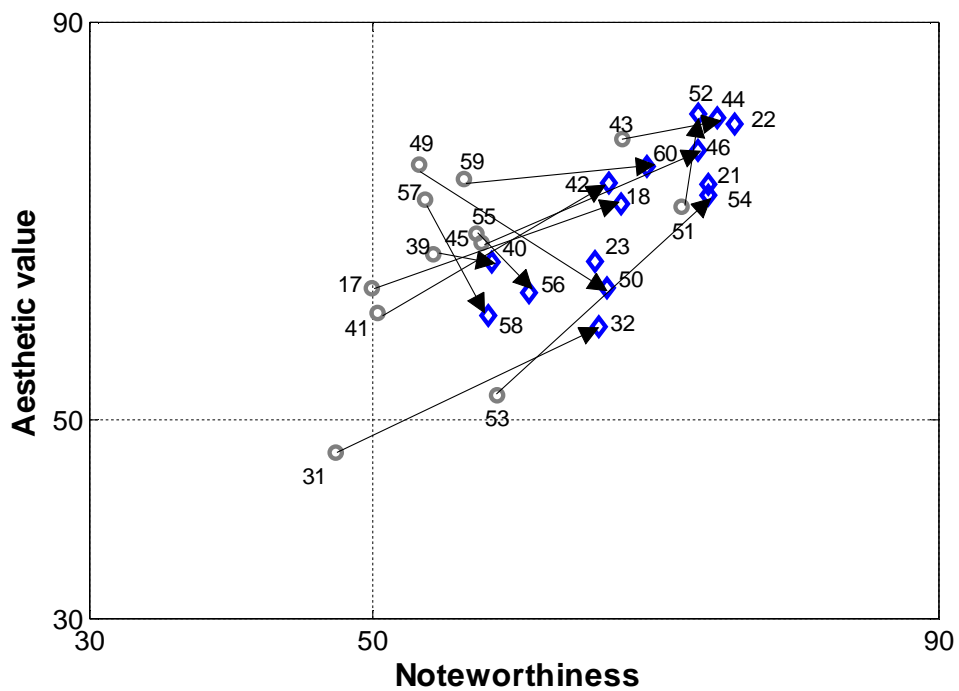


Figure 14. Noteworthiness and Aesthetic Value of samples with a metallic special effect and the corresponding reference samples, averaged over observers aged 40 to 63

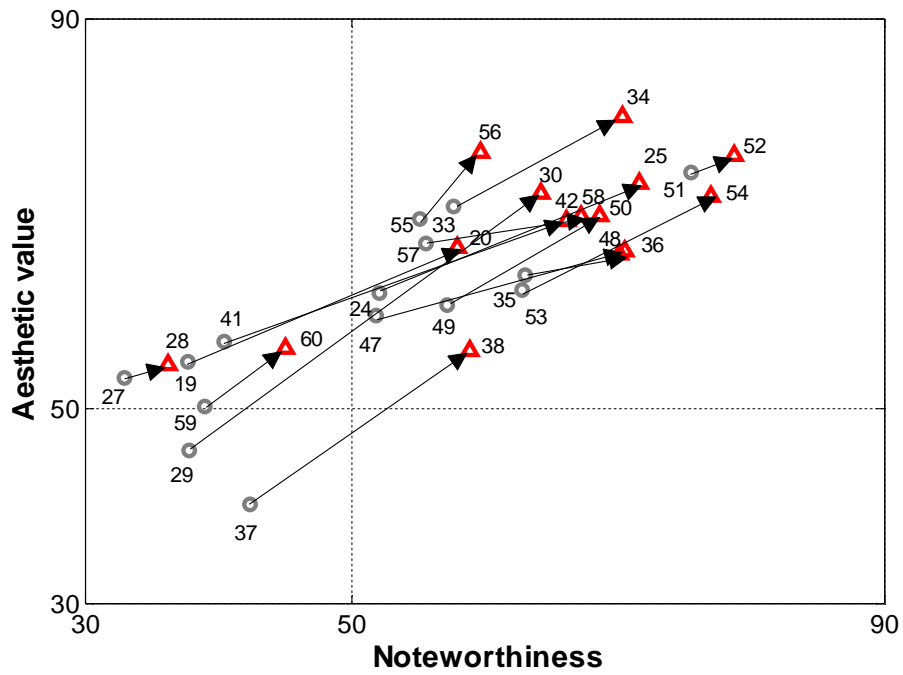


Figure 15. Noteworthiness and Aesthetic Value of samples with a varnish special effect and the corresponding reference samples, averaged over observers aged 20 to 39

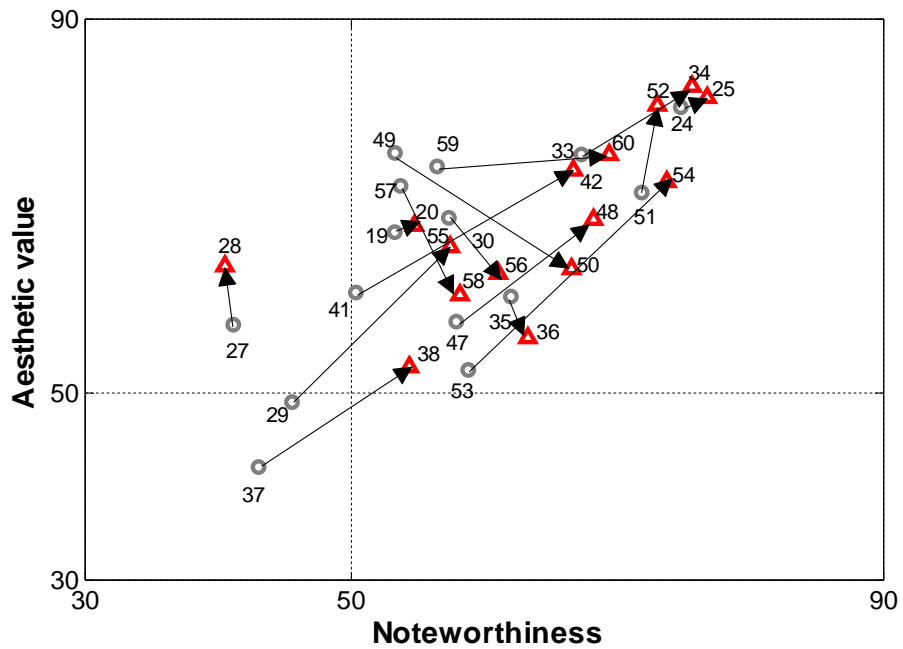


Figure 16. Noteworthiness and Aesthetic Value of samples with a varnish special effect and the corresponding reference samples, averaged over observers aged 40 to 63

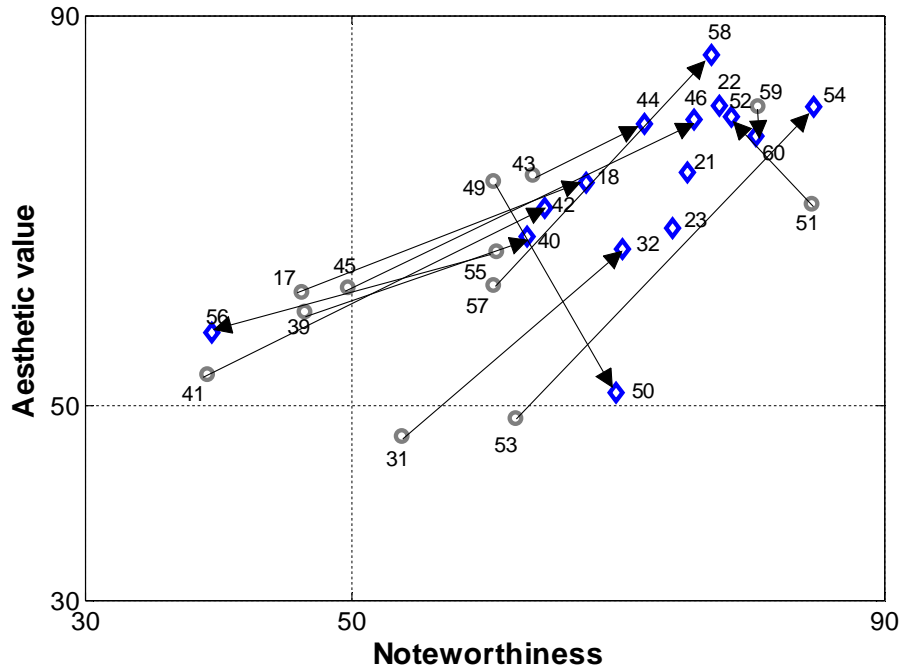


Figure 17. Noteworthiness and Aesthetic Value of samples with a metallic special effect and the corresponding reference samples, averaged over the observer group “Buyers”

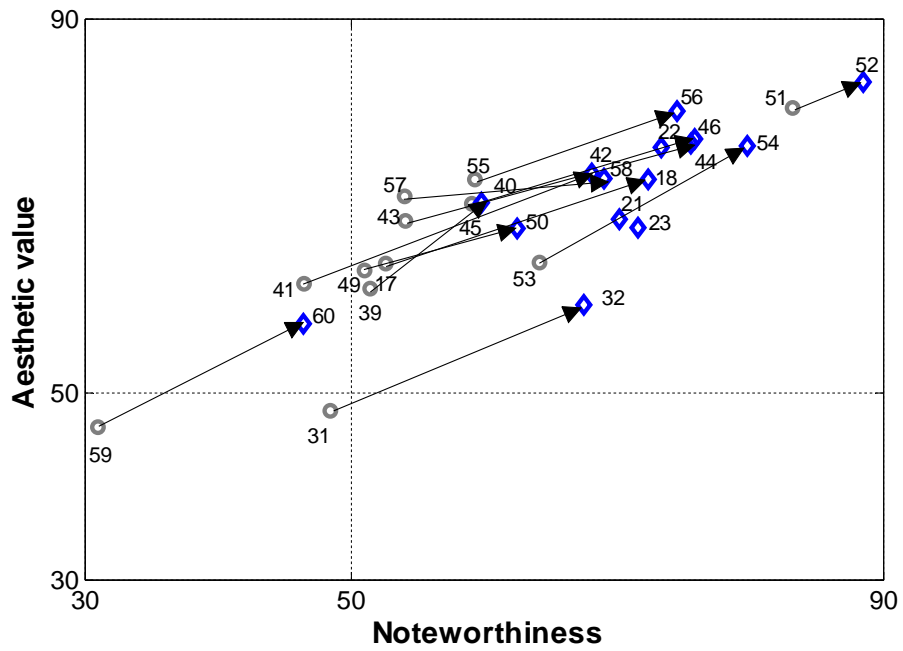


Figure 18. Noteworthiness and Aesthetic Value of samples with a metallic special effect and the corresponding reference samples, averaged over the observer group “Makers”

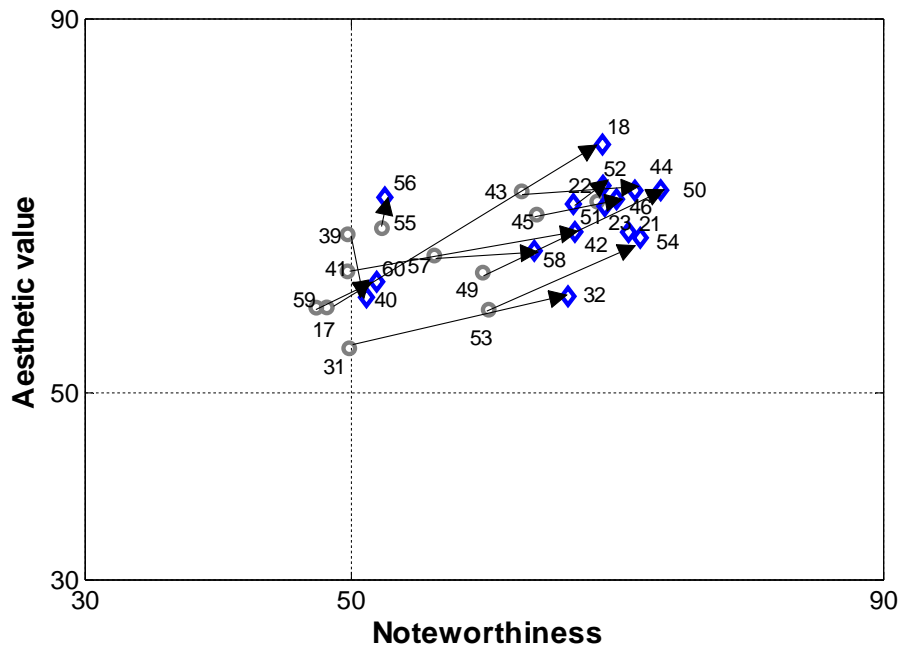


Figure 19. Noteworthiness and Aesthetic Value of samples with a metallic special effect and the corresponding reference samples, averaged over the observer group “Consumers”

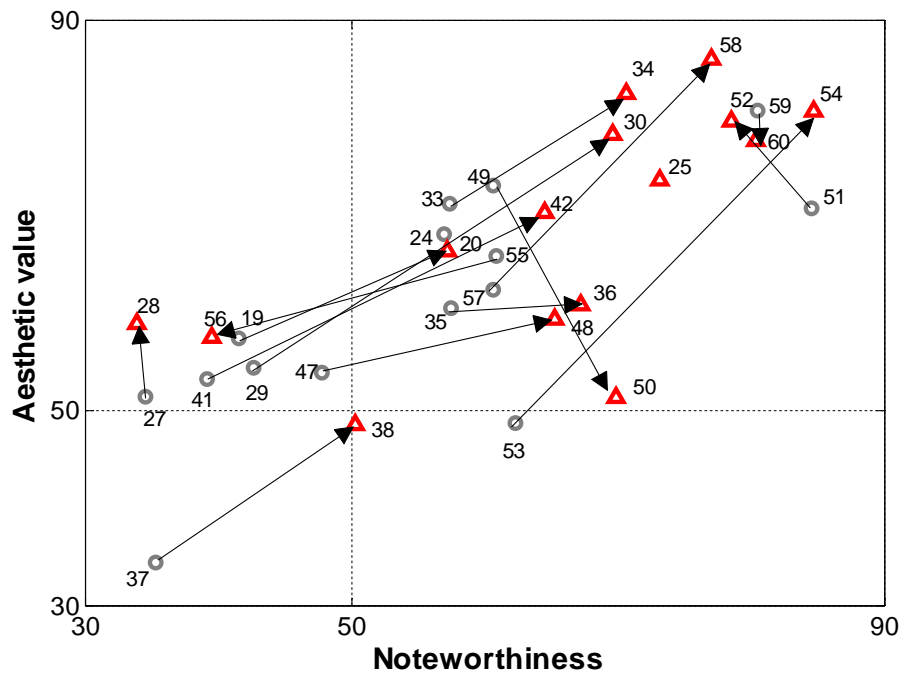


Figure 20. Noteworthiness and Aesthetic Value of samples with a varnish special effect and the corresponding reference samples, averaged over the observer group “Buyers”

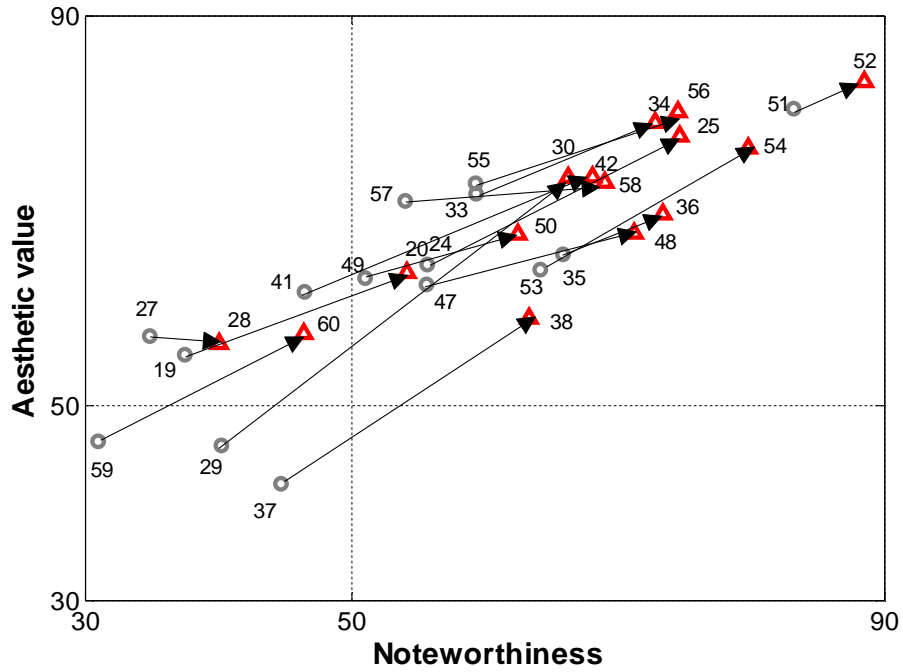


Figure 21. Noteworthiness and Aesthetic Value of samples with a varnish special effect and the corresponding reference samples, averaged over the observer group “Makers”

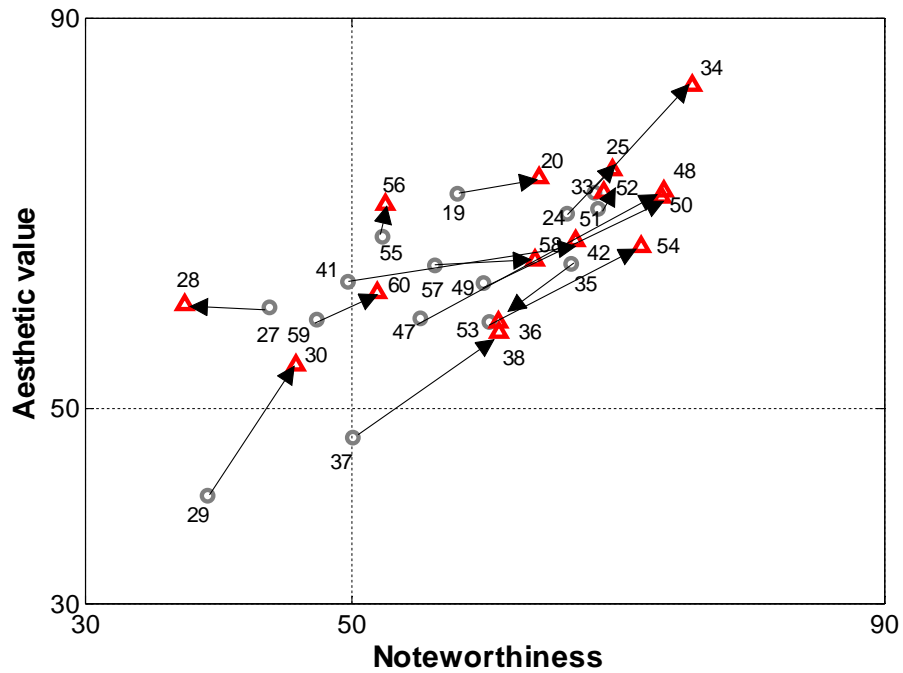


Figure 22. Noteworthiness and Aesthetic Value of samples with a metallic special effect and the corresponding reference samples, averaged over the observer group “Consumers”

4 Summary

The influence of special effects on the perception and mental impressions associated with printed products was investigated in a psychometric study. A set of 60 print samples containing different types of printed special effects, such as varnishing and metallic effects, was subjectively assessed by 177 observers. The number of print samples and observers was increased from an earlier study, allowing more general conclusions to be drawn from the results.

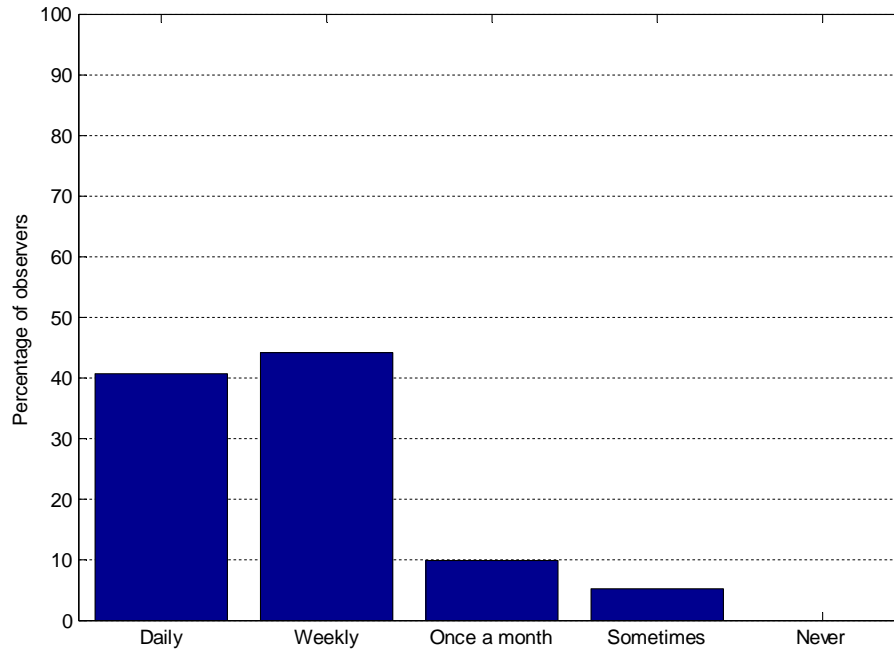
The shifts produced by the use special effects along perceptual dimensions termed Noteworthiness and Aesthetic Value were examined. These dimensions were found in the previous study to efficiently capture a considerable part of the influence of printed special effects on the subjective experience of printed products. The positions of the special effect print samples were compared on the psychometric scales of Noteworthiness and Aesthetic Value to the positions of the reference samples that had the same content but no special effects beyond conventional CMYK printing. A strong trend of increased Noteworthiness and Aesthetic Value in the special effect print samples, compared to the reference samples, was found.

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Appendix 1: Distribution of answers to selected background questions

Question 14: How often do you read printed marketing material or view printed catalogues?



Question 18: Do you pay attention to point-of-sale advertising (advertisements in a shop environment) or to the visual appearance of the product packages when making a decision to buy a product?

