

Gearing Communications to the Cognitive Needs of Students: findings from visual literacy research

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Abstract

Knowledge of graphic design, information design, visual communication, visual language, and visual literacy might be important for our ability to better produce effective messages — “messages that really work”. In this study eight groups of ID students ranked lists of “information design characteristics”, a total of 50 research findings. These masters students were asked to discuss and rank how they perceive the importance of research findings related to (1) sender processes, (2) text design, (3) image design, (4) graphic design, and (5) receiver processes.

Introduction

We need many information utility goods in order to perform our tasks at work. We also need an increasing amount of information materials during our leisure time, in order to be able to handle things like cameras, cars, CD-players, computers, computer software, etc. A well designed information material makes everyday life easier for people, and it grants good credibility to the senders or sources.

Information design may be described in the following way (Pettersson, 1998a, 2002): “In order to satisfy the information needs of the intended receivers information design comprises analysis, planning, presentation and understanding of a message – its content, language and form. Regardless of the selected medium, a well designed information set will satisfy aesthetic, economic, ergonomic, as well as subject matter requirements.”

Information design is a multi-disciplinary, multi-dimensional, and worldwide consideration with influences from areas such as language, art and aesthetics, information, communication, behaviour and cognition, business and law, as well as media production technologies. Information designers, technical writers and others who want to produce information sets and learning materials may all benefit from the results of research related to message design, text design, image design, graphic design, and cognition. These are all important areas of information design.

Message design. We are today living in mass-media societies. Every day we are bombarded with information. Visual messages in different forms are increasingly important. The study of presentation of verbo-visual messages is a multi-disciplinary, multi-dimensional and worldwide consideration.

Text design. There are many kinds of languages. Results from research explain some of the characteristics of verbal language, spoken as well as written. Combinations of different kinds of languages may be used in communication.

Image design. Results from research explain some of the characteristics of visual language. Its functions, levels of meaning, properties, and structure may be explained. Combinations of different kinds of languages are used in mass communication. Yet little is known about the effects of various linguistic combinations. Different linguistic combinations must be studied in detail before optimum combinations can be found for various purposes.

Graphic design. Although we may not think about it, the practice of graphic design is as old as recorded history. We see the results of graphic design every day. Often graphic design is thought of with regard to the print medium, but it is used in all media. Graphic design is the art and craft of bringing a functional, aesthetic, and organized structure to groups of diverse elements. These elements may be headings, texts, pictures, captions, tables, and even sounds and motion in motion pictures, on television, and computers.

Cognition. Results from research may explain some of the functions related to our senses, attention, perception, processing, mental images, and application of new knowledge. The goal of communication-oriented design of messages should always be *clarity of communication*. In information design the task of the sender or source is actually not completed until the receivers or interpreters have received and understood the intended message.

There are more areas of information design such as audio design, exhibition design, event design, light design, time design as well as modern web design. These areas are, however, not included in this study.

In this study some of our information design students are ranking findings from research.

Findings from Research

For many years I have “collected” research findings that I personally felt were important for the understanding of information design, visual communication, visual language, and visual literacy. This body of knowledge might

be important and interesting for our ability to better produce effective messages — “messages that really work”. Thus I have put together lists of “information design characteristics”, a total of 50. The research findings discussed in this study are listed below. Here they are sorted according to the final rank order that was the result of the study.

Sender Processes

1. Communication is not complete until the receivers understand the messages. Information materials shall be legible, readable and well worth reading for the intended audience (Pettersson, 1989).
2. Information is most useful to have exactly at the time when we need it (Pettersson, 1998b).
3. We have to adopt verbal as well as visual messages to suit each group of receivers. (Pettersson, 1998b)
4. The graphical message's *legibility* is determined by the technical design of the text and the pictures, that is, their *clarity*. Good legibility is always economically advantageous, whereas poor legibility is a costly business. (Pettersson, 1993)
5. Information materials which provides the wrong information may give a *negative result*, and the learner may end up *less competent* than before the learning experience. (Pettersson, 1993)
6. It is better not to have any pictures at all than employing pictures with poor quality (Pettersson, 1989).
7. The perception of linear representations requires slow, sequential, processing for comprehension of content. (Perfetti, 1977; Sinatra, 1986)
8. Image manipulation implies the improper control of people's perception of a given reality through the use of pictures. (Pettersson, 2002)
9. The classical “borders” between the media groups will dissolve. In the future most media will interact and partly overlap each other. (Pettersson, 1989).
10. Word identification is a multi-stage process. Visual-lexical analysis is carried out by the right brain hemisphere. Word naming and word meaning are processed by the left hemisphere. (Pirozzolo and Rayner, 1979)

Text Design

1. It may take only 2-3 seconds to recognize the content in an image (Paivio, 1979; Postman, 1979), but 20 – 30 seconds to read a verbal description of the same image (Lawson 1968; Ekwall, 1977) and 60 – 90 seconds to read it aloud (Sinatra, 1986). In verbal and visual languages prior experience and context are very important to the perception of contents.

2. When illustrations provide text-redundant information, learning information in the text that is also shown in pictures will be facilitated. (Levie and Lentz, 1982; Melin, 1999).
3. There is no direct correspondence between groups of letters, words, and reality. Each meaning is defined and must be learned. (Elkind, 1975)
4. When illustrations are not relevant to prose content they can have a negative effect. (Levie and Lentz, 1982; Melin, 1999)
5. Perception of verbal content is apparently easier when a text is read than heard. Thus it is easier to assimilate and profit from a rich language by reading than by listening (Pettersson, 1986).
6. People usually have no difficulty in reading the jargon used in professional or technical languages but understanding the concepts the words represent may be difficult for a non-specialist (Melin, 1986b).
7. The more abstract a word is the harder it is to relate it to any specific activity (Melin, 1986a).
8. Verbal languages have varying levels of meaning (Eco, 1971): (i) phonemes (without meaning); (ii) morphemes (with meaning); (iii) syntagms, sub-meanings; (iv) complete meanings.
9. The end of a sentence should be determined by syntax rather than by a set width of a line. (Hartley, 1980; Bork, 1982)
10. A written text can convey information, contain analyses and describe feelings and facts. (Melin, 1986a)

Image Design

1. Content is more important than execution, context, and format. Pictures have a strong emotional impact. (Pettersson; 1987, 1989)
2. Seeing is believing. Most people believe that pictures tell the truth. (Lefferts, 1982)
3. The same visuals are not equally effective for learners in different grade levels, and for learners with different prior knowledge. (Dwyer, 1972)
4. Persuasion tends to be accomplished in both children and adolescents almost exclusively through imagery. (Barry, 1998)
5. The effectiveness of a visual depends on the medium, on the type of information, and also on the amount of time learners are permitted to interact with the material. (Dwyer, 1972)
6. All types of visuals are not equally effective. Line drawings are most effective in formats where the learner's study time is limited. More realistic versions of art work, however, may be more effective in

formats where unlimited study time is allowed. (Dwyer, 1972)

7. Visual languages attempt equivalence with reality. Visuals are iconic. They normally resemble the thing they represent. Meaning is apparent on a basic level, but the visual language must be learned for true comprehension. (Pettersson, 1989)
8. The same intended theme or subject can be expressed through many different pictures. (Pettersson, 1986)
9. Perception of two- or three-dimensional representations entails fast, parallel, simultaneous, and holistic processing. (Gazzaniga, 1967; Sperry, 1973, 1982)
10. Visual languages have analogue coding employing combinations of basic graphic elements (dots, lines, areas, and volumes) for depicting reality. A given set of basic elements can be combined to form completely different images. (Pettersson, 1987)

Graphic Design

1. Dissatisfaction with the execution of a message may cause dissatisfaction with the content of the message. (Pettersson, 1989).
2. Most pictures are capable of several interpretations until anchored to one by a caption. (Barthes, 1977)
3. Learners are most able to build connections between verbal and visual representations when text and illustrations are actively held in memory at the same time. This can happen when text and illustrations are presented in close connection on the same page in a book, or when learners have sufficient experience to generate their own mental images as they read the text. (Mayer et al., 1995)
4. It is more likely that graphically complex texts will be read than “plain” texts. (Melin, 1999)
5. Readers often react in a positive way to graphically complex texts. Texts with good typography will be noticed. (Melin, 1999)
6. The decision of which font or which fonts to use should rest largely on the purpose and audience of the document (Benson, 1985).
7. It takes less time to read a graphically complex text than a “plain” text. (Melin, 1999)
8. If pictures are not adequately discussed and explained, they will probably not be properly understood. (Zimmermann and Perkin, 1982)
9. Lenze (1991) noted that private documents may invite the use of ornate and stylish looking fonts. Professional documents, however, require maximum legibility (Tinker, 1963; Benson, 1985; Pettersson, 1989).

10. Text which should be read in a continuous manner should be set between nine and twelve Pica points (Tinker, 1963; Haber and Haber 1981; Benson, 1985; Braden, 1983, 1985).

Receiver Processes

1. Memory for pictures is superior to memory for words (Paivio, 1983; Branch and Bloom, 1995). This is called the “pictorial superiority effect”.
2. Visual languaging abilities develop prior to, and serve as the foundation for, verbal language development. (Reynolds-Myers, 1985; Moriarty, 1994)
3. Images and visual language speak directly to us in the same way experience speaks to us: holistically and emotionally. (Barry, 1998)
4. Memory for a picture-word combination is superior to memory for words alone or pictures alone. (Adams and Chambers 1962; Haber and Myers, 1982)
5. Development of visual languaging abilities is dependent upon learner interaction with objects, images, and body language. (Reynolds-Myers, 1985).
6. Both students and teachers have to learn how to read, how to create and how to use visuals. (Pettersson, 1990)
7. Because children developmentally cannot or do not pay attention to factual information in advertising – but rather to peripheral cues such as colour and imagery – they tend to process advertising not through logical assessment, but through their emotions. (Barry, 1998)
8. Comprehensive school students have a very poor pictorial capability. They are poor at reading and understanding pictures. They are also poor at expressing themselves with pictures. (Backman, Berg and Sigurdson, 1988; Eklund, 1990)
9. People who have not learned to read or write do not necessarily look at pictures in the order intended. It often proves helpful, as messages are being tested, to ask several groups of people to arrange the individual message into a sequence that seems most logical to them. (Zimmermann and Perkin, 1982)
10. The pattern for eye movements and fixations depends on what we wish to see, or are told to see in a picture. (Yarbus, 1967)

What do our masters level information design students think about these research findings? Is it possible for them to rank the importance of the findings? Which findings are considered to be the most and the least important? Some are probably seen as more important than others. Based on such assessments it might also be possible to develop

some of the items on these lists into practical guidelines that may be of interest for those producing materials for information and learning. There may, however, exist a large number of other research findings than those I have selected for this specific study.

Research Method

In a distance learning course in “Information Design” our masters level students in Sweden participated in this “ranking study” during the spring of 2002, and masters level students in the USA during the fall of 2002. This masters level course is administrated by the Department of Innovation, Design and Product Development at Mälardalen University in Sweden and by the Distance Learning Graduate Program at Appalachian State University in the USA. In each case the students worked in groups of four to six persons. The groups were asked to discuss and rank how they perceive the importance of the research findings presented in the previous section. In the field study each of the five sets of research findings were sorted and presented in a random order.

If all groups deliver exactly the same rank order for a group of ten research findings this will be seen in a diagram as bars with an even and exact distribution, from rank one to ten (Figure 1). This pattern shows “total agreement” and total consensus between the different groups.

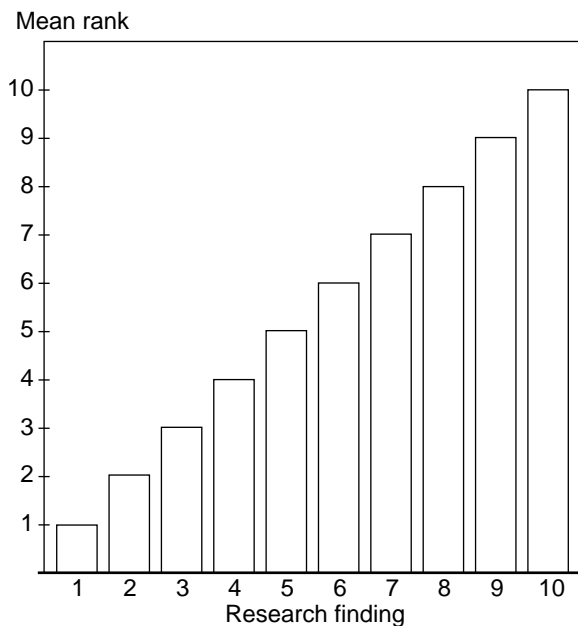


Figure 1. If all groups deliver exactly the same rank order of a group of ten research findings this will be seen in a diagram like this one. Please note that a high rank is shown in this diagram as a short bar. This diagram

represents “total agreement” between the groups.

The opposite is a situation when all groups have different opinions regarding the rank order. In this case all the ten bars will have the same size, and they will all stop at the mean rank level of five. This pattern shows a “total disagreement” and a total lack of consensus between the groups (Figure 2).

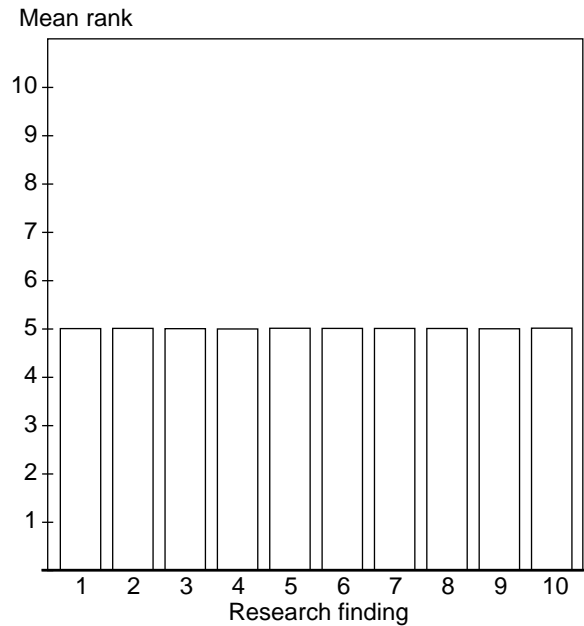


Figure 2. If all groups have different opinions regarding the rank order all findings will have the same mean rank. Thus all bars will be equal in size. This diagram represents “total disagreement” between the groups.

Data and Results

The 36 Swedish students worked in six study groups. The ten North American students worked in two study groups. Thus a total of 46 subjects have been involved in the ranking processes. The results are presented in the following five figures as well as in an Appendix with five tables.

Practically all of the groups reported that it was a difficult task to rank these research findings. They felt that all of the findings were “important”. However, after vivid discussions in the groups they somehow managed to reach an agreement on a rank order for each set of ten research findings.

In a statistical analysis the agreements between the rankings made by the groups of students were estimated with Cronbachs alpha. For the set of research findings presented in the following five figures and in the tables

in the appendix (Table 1 – 5) alpha levels of .94, .88, .77, .64, and .64 respectively was obtained. Thus the inter-scoring reliability was extremely high for findings regarding “sender processes” (Figure 3). The inter-scoring reliability was high for findings regarding text design and image design (Figures 4 and 5). Finally the inter-scoring reliability was quite low for findings regarding graphic design and receiver processes (Figures 6 and 7).

In another statistical analysis the Spearman's rho between the rankings made by the groups of students was calculated for each set of research findings. Those correlation coefficients were analysed with a repeated measures analysis of variance (ANOVA) with each set of research findings as the within-subject factor. The ANOVA showed that the level of agreement between the rankings made by the groups of students depended on type of the research findings $F(2.83, 76.44) = 15.759, p < .001$ (Greenhouse-Geisser adjusted degrees of freedom). Post-hoc tests (Scheffé) revealed that the correlations between the rankings made by the groups of students for sender processes (Figure 3) was significantly larger than those for image design, text design and graphic design (Figures 4, 5 and 6). The correlations between the rankings made by the groups of students for text design (Figure 4) was significantly larger than those for graphic design and receiver processes (Figure 6 and 7).

Sender Processes

Several groups have reported that it is a hard task to rank the importance of research findings without a specific context or a certain and common perspective on the area. The sender processes are multi-dimensional. This dictates that a multitude of factors must be taken into consideration for ranking. However, despite these considerations and these problems individuals and groups actually have been able to do the ranking of research findings regarding the sender processes. Here subjects really agree. It is remarkable to note that the ranking of the importance of the research findings between these groups have very little variance. This is true for the Swedish groups as well as for the two groups from the USA. Rank 1 is significantly better than ranks 3 – 10. Rank 4 is better than ranks 7 – 10, and ranks 5 – 6 are better than rank 10. The results are shown in Figure 3 and in Table 1.

Rank 1. “Communication is not complete until the receivers understand the messages. Information materials shall be legible, readable and well worth reading for the intended audience (Pettersson, 1989).”

Rank 2. “Information is most useful to have exactly at the time when we need it (Pettersson, 1998b).”

Rank 3. “We have to adopt verbal as well as visual

messages to suit each group of receivers. (Pettersson, 1998b)”

Rank 4. “The graphical message's *legibility* is determined by the technical design of the text and the pictures, that is, their *clarity*. Good legibility is always economically advantageous, whereas poor legibility is a costly business. (Pettersson, 1993)”

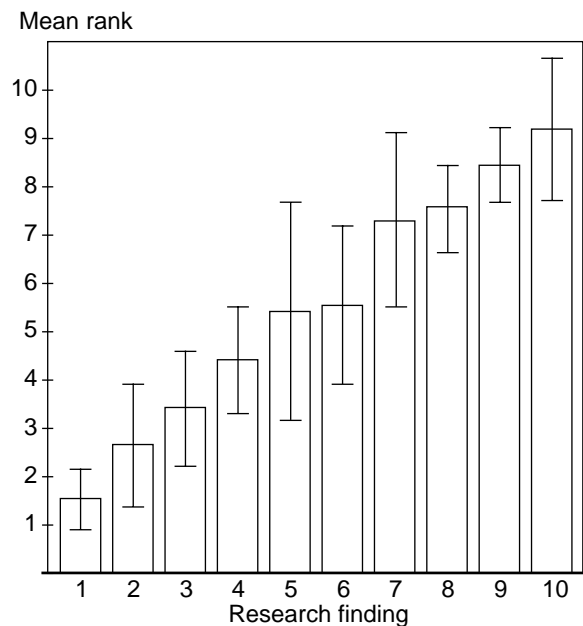


Figure 3. Sender processes. Here rank 1 is significantly better than ranks 3 – 10. Rank 4 is significantly better than ranks 7 – 10, and ranks 5 – 6 are significantly better than rank 10. This area of knowledge is mainly characterised by strong agreements between the groups.

Text Design

The opinions on the research findings on text design form three groups. There is a strong agreement between all groups in this study with respect to the two most important research findings, ranks 1 and 2. Rank 1 is significantly better than ranks 2 – 10, and rank 2 is better than groups 6 – 10. The results are shown in Figure 4 and Table 2.

Rank 1. “It may take only 2-3 seconds to recognize the content in an image (Paivio, 1979; Postman, 1979), but 20-30 seconds to read a verbal description of the same image (Lawson 1968; Ekwall, 1977) and 60-90 seconds to read it aloud (Sinatra, 1986). In verbal and visual languages prior experience and context are very important to the perception of contents.”

Rank 2. “When illustrations provide text-redundant information, learning information in the text that is also

shown in pictures will be facilitated. (Levie and Lentz, 1982; Melin, 1999).”

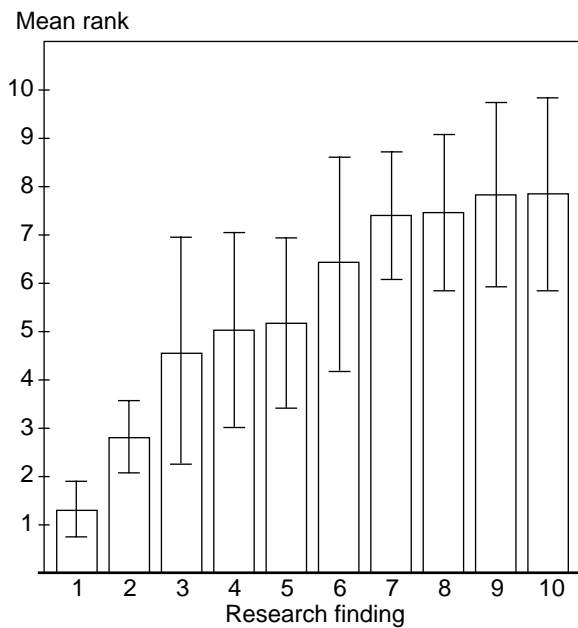


Figure 4. Text design. Rank 1 is significantly better than ranks 2 – 10, and rank 2 is significantly better than groups 6 - 10. There are disagreements between the groups for the remaining eight findings.

As we can see in the figure above, there is not much of a difference between the groups with respect to their opinions of the importance of the remaining and least important research findings. It may be concluded that the subjects in this study to a large extent disagree on the importance of research findings related to text design.

Image Design

This area of knowledge is mainly characterised by disagreements between the groups. The opinions on the research findings on image design form three groups. There is a strong agreement between all groups with respect to the most important research findings. Rank 1 is significantly better than ranks 6 – 10. Rank 2 is significantly better than rank 10. The results are shown in Figure 5 and in Table 3.

Rank 1. “Content is more important than execution, context, and format. Pictures have a strong emotional impact. (Pettersson; 1987, 1989).”

Rank 2. “Seeing is believing. Most people believe that pictures tell the truth. (Lefferts, 1982)”

As we can see in figure 5 there is not much of a difference between the groups with respect to their opinions of the

importance of the other findings. These findings are the least important. This distribution is rather similar to that of text design. It may be concluded that the subjects in this study to a large extent disagree on the importance of the selected research findings related to image design.

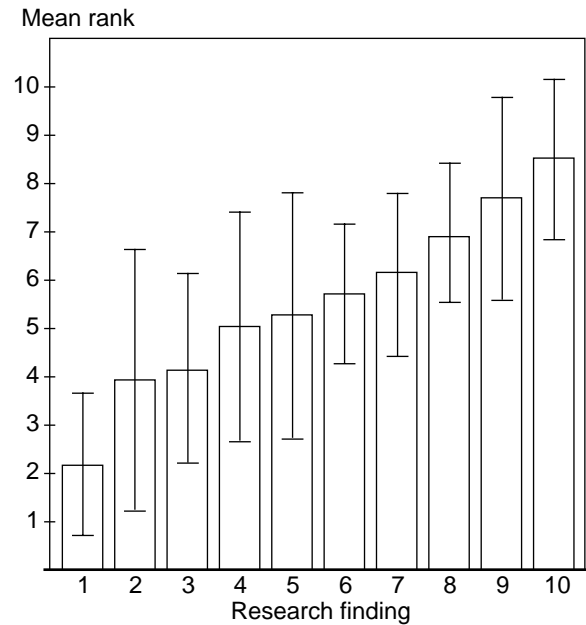


Figure 5. Image design. Rank 1 is significantly better than ranks 6 – 10. This area of knowledge is mainly characterised by disagreements between the groups.

Graphic Design

This area of knowledge is mainly characterised by strong disagreements between the groups of students. In this area the groups reported that their “opinions varied wildly” when they worked with this specific assignment. It seems that individual agendas, backgrounds, cultures, differences and experiences cause more disagreements than in the previous areas.

However, there is a strong agreement between all groups with respect to the most important research finding. The first rank is significantly better than ranks 5 – 10. The results are shown in Figure 6 on the next page and in Table 4 in the appendix.

Rank 1. “Dissatisfaction with the execution of a message may cause dissatisfaction with the content of the message. (Pettersson, 1989).”

With respect to the area of graphic design it may be concluded that the subjects in this study to a large extent disagree on the importance of the selected research findings.

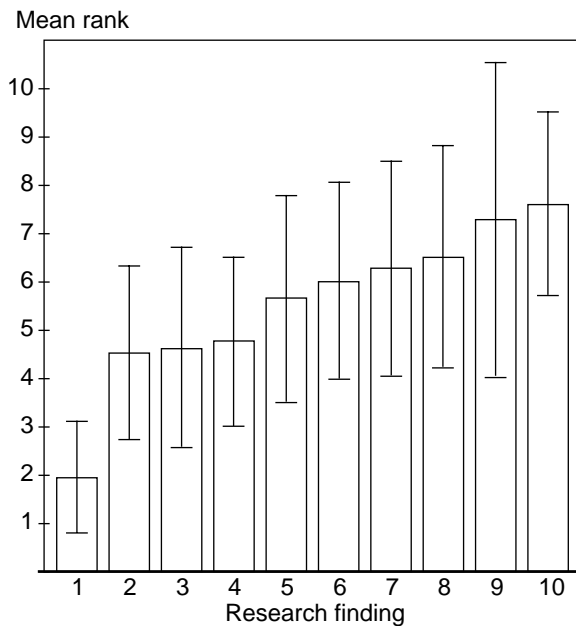


Figure 6. Graphic design. Here rank 1 is significantly better than ranks 5 – 10. This area of knowledge is mainly characterised by disagreements between the groups.

Receiver Processes

As individuals we differ in the ways we perceive any given stimulus. This seems to be valid also when we are engaged in interpretation of research findings. Also this area of knowledge is mainly characterised by strong disagreements between the individuals and between the groups of students. Also in this area the groups reported that their “opinions varied wildly” when they worked with this specific assignment. It seems that individual agendas, backgrounds, cultures, differences and experiences cause many disagreements.

The opinions on the research findings on cognition and receiver processes may be seen to form two groups. There is agreement regarding the top two rankings of research findings, at the bottom of the diagram. Ranks 1 and 2 are significantly better than ranks 8 and 10.

Rank 1. “Memory for pictures is superior to memory for words (Paivio, 1983; Branch and Bloom, 1995). This is called the “pictorial superiority effect”.

Rank 2. “Visual languaging abilities develop prior to, and serve as the foundation for, verbal language development. (Reynolds-Myers, 1985; Moriarty, 1994)”.

It may be concluded that the subjects in this study to a large extent disagree on the importance of research findings related to receiver processes. The results are shown here in Figure 8 and in Table 5.

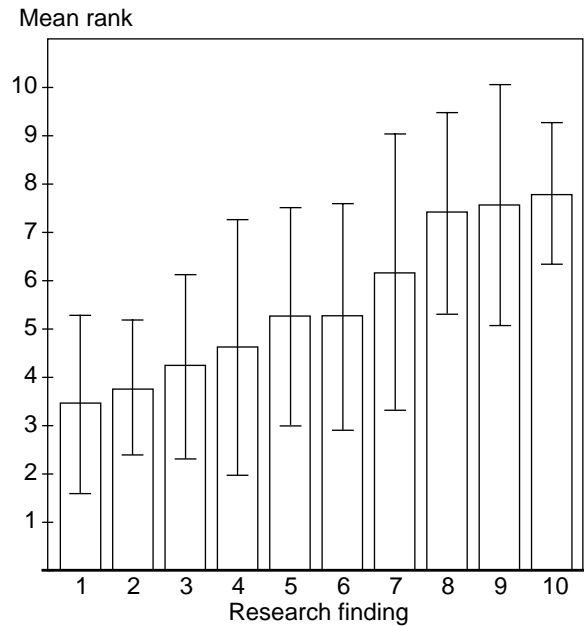


Figure 7. Receiver processes. Here ranks 1 and 2 are significantly better than ranks 8 and 10. This area of knowledge is mainly characterised by disagreements between the groups.

Guidelines for Designers

Based on the results of these rankings of research findings it may be possible to make a small and restricted easy to remember and easy to use “set of guidelines” that would help us to improve the quality of information materials that we need to produce for our information design students. At present we use the following guidelines in our own work.

Sender Processes

1. Define what any message is supposed to show, always keeping the audience in mind.
2. Analyse the intended message and create a synopsis, an overview of the forthcoming information or learning material.
3. Do not include too much realism in the representations because it may detract from the learning processes. A moderate amount of carefully selected realism often provides the best representation.

Text Design

1. Provide the time that is necessary for the audience. It may take quite a long time to perceive and interpret a verbal message. A message is only comprehensible if it can be grasped by the receiver without difficulty.

2. Ensure that the context of messages are seen and can convey a “pre-understanding” of the contents. Prior experience and context are important to the perception of contents.
3. Provide illustrations with text-redundant information in order to facilitate understanding and learning. Do not always assume that everyone is “literate”.

Image Design

1. Consider that pictures have a strong emotional impact. Image content is more important than its execution, context, and format.
2. Consider how an image may be perceived. Most people still believe that pictures “tell the truth”.
3. Define the objective for each visual. The same visuals are not equally effective for people with different prior knowledge. The context in which a message is presented impacts the perception of the message.

Graphic Design

1. Adjust the execution of a message to its content.
2. Design for clarity and optimum legibility. Keep the graphical form simple and direct. Use regular type for continuous text. Bold and italics may be used for emphasis and headings.
3. Present text and illustrations in close connection. Use legends to explain pictures.

Receiver Processes

1. Create *combined verbal and visual messages* when the message content is complex factual information. Visual language abilities develop prior to, and serve as the foundation for, verbal language development. Memory for pictures is superior to memory for words.
2. Create *verbal messages* when the message content is analytical, detailed, logical, narrative, theoretical, and sequential.
3. Create *visual messages* when the message content is emotional, holistic, immediate, spatial and visual. Images and visual language speak directly to the audience.

Despite the restricted number of subjects in this study it is quite possible that these guidelines will be valuable when any information designer has to produce information sets for other groups of receivers. Our long term goal is to be able to create information design guidelines of a “general nature” for broader audiences. Thus our studies will continue. Thus it is possible that some guidelines will be changed or replaced in the future.

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Appendix

The following five tables show the rankings of research findings by masters level students from Sweden (groups 1 – 6) and from USA (groups 7 – 8). A total of 46 persons took part in this study. In each table *mr* = mean rank.

Table 1. Sender processes.

<i>Research findings</i>	<i>Ranks by groups</i>								
	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>	<i>mr</i>
Communication is not complete until the receivers understand the messages. Information materials shall be legible, readable and well worth reading for the intended audience (Pettersson, 1989).	1	1	1	2	1	2	3	1	1.5
Information is most useful to have exactly at the time when we need it (Pettersson, 1998b).	4	2	2	1	4	4	1	2	2.8
We have to adopt verbal as well as visual messages to suit each group of receivers. (Pettersson, 1998b)	3	3	6	3	2	5	2	3	3.4
The graphical message's <i>legibility</i> is determined by the technical design of the text and the pictures, that is, their <i>clarity</i> . Good legibility is always economically advantageous, whereas poor legibility is a costly business. (Pettersson, 1993)	5	6	3	6	3	3	5	4	4.4
Information materials which provides the wrong information may give a <i>negative result</i> , and the learner may end up <i>less competent</i> than before the learning experience. (Pettersson, 1993)	6	10	8	4	4	1	4	5	5.3
It is better not to have any pictures at all than employing pictures with poor quality (Pettersson, 1989).	2	5	5	5	9	6	6	6	5.5
The perception of linear representations requires slow, sequential, processing for comprehension of content. (Perfetti, 1977; Sinatra, 1986)	9	4	4	9	8	9	8	7	7.3
Image manipulation implies the improper control of people's perception of a given reality through the use of pictures. (Pettersson, 2002)	7	7	7	8	7	7	7	10	7.5
The classical "borders" between the media groups will dissolve. In the future most media will interact and partly overlap each other. (Pettersson, 1989).	8	8	9	7	10	8	9	8	8.4
Word identification is a multi-stage process. Visual-featural analysis is carried out by the right brain hemisphere. Word naming and word meaning are processed by the left hemisphere. (Pirozzolo and Rayner, 1979)	10	9	10	10	4	10	10	9	9.0

Table 2. Text design.

<i>Research findings</i>	<i>Ranks by groups</i>								
	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>	<i>mr</i>
It may take only 2-3 seconds to recognize the content in an image (Paivio, 1979; Postman, 1979), but 20 – 30 seconds to read a verbal description of the same image (Lawson 1968; Ekwall, 1977) and 60 – 90 seconds to read it aloud (Sinatra, 1986). In verbal and visual languages prior experience and context are very important to the perception of contents.	1	1	3	1	1	1	1	1	1.3
When illustrations provide text-redundant information, learning information in the text that is also shown in pictures will be facilitated. (Levie and Lentz, 1982; Melin, 1999).	4	3	2	3	2	4	2	2	2.8
There is no direct correspondence between groups of letters, words, and reality. Each meaning is defined and must be learned. (Elkind, 1975)	2	8	1	8	4	7	3	3	4.5
When illustrations are not relevant to prose content they can have a negative effect. (Levie and Lentz, 1982; Melin, 1999)	5	4	10	2	5	3	6	4,5	5.0
Perception of verbal content is apparently easier when a text is read than heard. Thus it is easier to assimilate and profit from a rich language by reading than by listening (Pettersson, 1986).	3	2	4	7	7	8	5	4,5	5.1
People usually have no difficulty in reading the jargon used in professional or technical languages but understanding the concepts the words represent may be difficult for a non-specialist (Melin, 1986b).	6	6	8	9	3	2	9	7,5	6.3
The more abstract a word is the harder it is to relate it to any specific activity (Melin, 1986a).	9	7	7	5	6	10	7	7,5	7.4
Verbal languages have varying levels of meaning (Eco, 1971): (i) phonemes (without meaning); (ii) morphemes (with meaning); (iii) syntagms, sub-meanings; (iv) complete meanings.	7	9	5	6	10	5	8	9	7.4
The end of a sentence should be determined by syntax rather than by a set width of a line. (Hartley, 1980; Bork, 1982)	8	10	6	4	8	6	10	10	7.8
A written text can convey information, contain analyses and describe feelings and facts. (Melin, 1986a)	10	5	9	10	9	9	4	6	7.8

Table 3. Image design

<i>Research findings</i>	<i>Ranks by groups</i>								
	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>	<i>mr</i>
Content is more important than execution, context, and format. Pictures have a strong emotional impact. (Pettersson; 1987, 1989)	1	1	1	2	1	3	2	6	2.1
Seeing is believing. Most people believe that pictures tell the truth. (Lefferts, 1982)	9	8.5	4	1	3	1	3.5	1	3.9
The same visuals are not equally effective for learners in different grade levels, and for learners with different prior knowledge. (Dwyer, 1972)	7	2	2	8	2	4	5	3	4.1
Persuasion tends to be accomplished in both children and adolescents almost exclusively through imagery. (Barry, 1998)	8	3	3	9	6	2	7	2	5.0
The effectiveness of a visual depends on the medium, on the type of information, and also on the amount of time learners are permitted to interact with the material. (Dwyer, 1972)	2	5	8.5	10	5	6	1	4	5.2
All types of visuals are not equally effective. Line drawings are most effective in formats where the learner's study time is limited. More realistic versions of art work, however, may be more effective in formats where unlimited study time is allowed. (Dwyer, 1972)	5	4	8.5	7	7	5	3.5	5	5.6
Visual languages attempt equivalence with reality. Visuals are iconic. They normally resemble the thing they represent. Meaning is apparent on a basic level, but the visual language must be learned for true comprehension. (Pettersson, 1989)	6	8.5	5	3	4	8	6	8.5	6.1
The same intended theme or subject can be expressed through many different pictures. (Pettersson, 1986)	4	6	6	6	9	7	8.5	9	6.9
Perception of two- or three-dimensional representations entails fast, parallel, simultaneous, and holistic processing. (Gazzaniga, 1967; Sperry, 1973, 1982)	3	8.5	8.5	5	10	9	10	7	7.6
Visual languages have analogue coding employing combinations of basic graphic elements (dots, lines, areas, and volumes) for depicting reality. A given set of basic elements can be combined to form completely different images. (Pettersson, 1987)	10	8.5	8.5	4	8	10	8.5	10	8.4

Table 4. *Graphic design.*

<i>Research findings</i>	<i>Ranks by groups</i>								
	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>	<i>mr</i>
Dissatisfaction with the execution of a message may cause dissatisfaction with the content of the message. (Pettersson, 1989).	2	1	2	1	2.5	1	5	1	1.9
Most pictures are capable of several interpretations until anchored to one by a caption. (Barthes, 1977)	8	2	5	3	6	6	2	4	4.5
Learners are most able to build connections between verbal and visual representations when text and illustrations are actively held in memory at the same time. This can happen when text and illustrations are presented in close connection on the same page in a book, or when learners have sufficient experience to generate their own mental images as they read the text. (Mayer et al., 1995)	3	3	7	8	6	6	1	3	4.6
It is more likely that graphically complex texts will be read than "plain" texts. (Melin, 1999)	5	5.5	9	5	2.5	3	3	5	4.8
Readers often react in a positive way to graphically complex texts. Texts with good typography will be noticed. (Melin, 1999)	4	9	8	4	2.5	3	7.5	7	5.6
The decision of which font or which fonts to use should rest largely on the purpose and audience of the document (Benson, 1985).	7	5.5	3	2	9	8	7.5	6	6.0
It takes less time to read a graphically complex text than a "plain" text. (Melin, 1999)	6	5.5	10	6	2.5	3	9	8	6.3
If pictures are not adequately discussed and explained, they will probably not be properly understood. (Zimmermann and Perkin, 1982)	9	9	6	10	6	6	4	2	6.5
Lenze (1991) noted that private documents may invite the use of ornate and stylish looking fonts. Professional documents, however, require maximum legibility (Tinker, 1963; Benson, 1985; Pettersson, 1989).	1	9	1	9	9	10	10	9	7.3
Text which should be read in a continuous manner should be set between nine and twelve Pica points (Tinker, 1963; Haber and Haber 1981; Benson, 1985; Braden, 1983, 1985).	10	5.5	4	7	9	9	6	10	7.6

Table 5. Receiver processes

<i>Research findings</i>	<i>Ranks by groups</i>								
	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>	<i>mr</i>
Memory for pictures is superior to memory for words (Paivio, 1983; Branch and Bloom, 1995). This is called the “pictorial superiority effect”.	5	2	2	7.5	2	5	2	1	3.4
Visual languaging abilities develop prior to, and serve as the foundation for, verbal language development. (Reynolds-Myers, 1985; Moriarty, 1994)	2	3	3	5	6	3	6	2	3.8
Images and visual language speak directly to us in the same way experience speaks to us: holistically and emotionally. (Barry, 1998)	7	7	4	1.5	5	1	5	3	4.2
Memory for a picture-word combination is superior to memory for words alone or pictures alone. (Adams and Chambers 1962; Haber and Myers, 1982)	6	1	1	7.5	3	10	2	5	4.6
Development of visual languaging abilities is dependent upon learner interaction with objects, images, and body language. (Reynolds-Myers, 1985).	3	4	9	1.5	8	6	2	7	5.2
Both students and teachers have to learn how to read, how to create and how to use visuals. (Pettersson, 1990)	9	8	8	3.5	4	4	1	4	5.2
Because children developmentally cannot or do not pay attention to factual information in advertising – but rather to peripheral cues such as colour and imagery – they tend to process advertising not through logical assessment, but through their emotions. (Barry, 1998)	1	5	5	10	9	2	8	9	6.1
Comprehensive school students have a very poor pictorial capability. They are poor at reading and understanding pictures. They are also poor at expressing themselves with pictures. (Backman, Berg and Sigurdson, 1988; Eklund, 1990)	4	9	7	3.5	7	8	10	10	7.3
People who have not learned to read or write do not necessarily look at pictures in the order intended. It often proves helpful, as messages are being tested, to ask several groups of people to arrange the individual message into a sequence that seems most logical to them. (Zimmermann and Perkin, 1982)	10	10	6	9	1	7	9	8	7.5
The pattern for eye movements and fixations depends on what we wish to see, or are told to see in a picture. (Yarbus, 1967)	8	6	10	6	10	9	7	6	7.8