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Information Design

It Depends

Rune Pettersson
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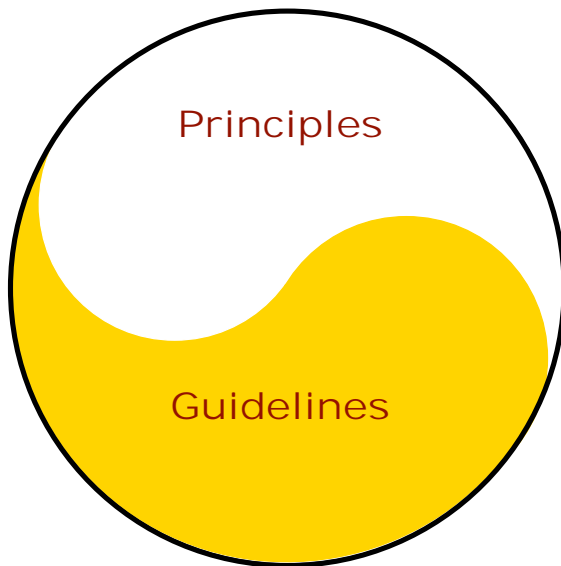
IIID Public Library

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It Depends

Principles

Guidelines

Rune Pettersson * Institute for infology

It Depends—Principles and Guidelines

Preface

Information design and message design are multi-disciplinary, multi-dimensional, and worldwide considerations. It is not possible to develop firm design rules telling exactly how to best design a message and develop good information materials. However, based on research it is possible to formulate principles and then develop a number of guidelines for the design of effective and efficient messages and information materials.

In my own work the goal has been to study the presentation of visual messages and combined verbal and visual messages in information and learning contexts in order to gain a better understanding of the conditions related to the design, use and interpretation of such messages. Most of my own work has been related to audience interpretation and perception of messages, visual literacy and the question of a visual language and its representations.

In this book I present four groups of message design principles: *Functional Principles, Administrative Principles, Aesthetic Principles*, and *Cognitive Principles.* 150 guidelines are based on a total of 16 message design principles and they may assist the information and message designer to design messages and information materials that are well suited for the intended receivers. However, the designer will always have to consider one of the main principles: "it depends." This fourth edition is only available online.

Rune Pettersson, Ph.D.
Retired Professor of Information Design

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Communication

Animals, people and technical systems communicate with the aid of simple signals. The signals may be aural or visual. They can also consist of odours or tactile contacts and therefore act on our sense of smell and touch rather than on our hearing and vision. There is often an interplay between different signals or stimuli which coalesce into a unified whole. Many information and communication theorists have devised models to explain the way the communication process or processes operates[1].
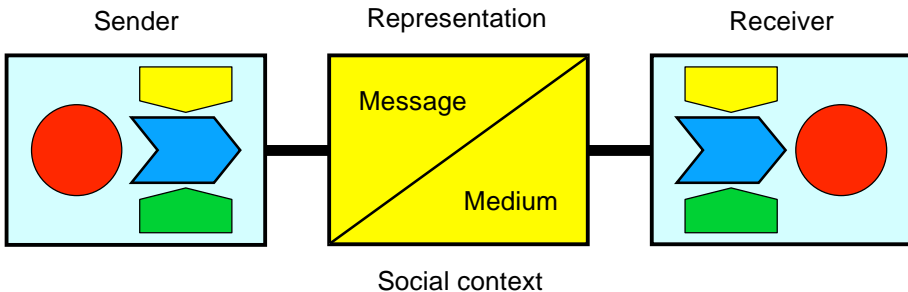
Several activities are involved when an intended message (left circle) is communicated from a sender, or information provider, to a receiver, and received as an internalized message (right circle). These processes are guided by principles (upper pentagons), performed with the help of tools (lower pentagons) and influenced by the social context. In this model the active receiver, or " interpreter", may actively reach out and grab the representation with its message.

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[1] Such as Lasswell, 1948; Shannon and Weaver, 1949; Schramm, 1954; Hall, 1980; Hagen, 1998; Morley, 1992.

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Communication between people has always been important. If communication is to be possible at all, signals in some form must be produced, transmitted, received, and deciphered. The sender successfully transfers the message to the receivers with the help of a medium. A medium with a message constitutes a representation. In this book the main emphasis is on the design of information and learning materials.

In the production and distribution of a verbal and visual message, the sender will use creative processes, production processes, and distribution processes. Generally speaking, a sender may be an advertiser, an artist, a businessperson, an instructor, a subject matter expert, a teacher, a writer, a film or television producer, or anyone who wants to convey an intended message to one or more receivers or information providers.

The receiver is usually not a passive part in communication. In fact several different activities are involved when an intended message is communicated from a sender to a receiver, interpreted and understood. When a message evokes feedback to the original sender, the receiver becomes a sender, and the sender becomes a receiver. These processes are performed with the help of various tools and influenced by the social context.

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Information

The term *information* is derived from the Latin noun *informatio,* which means a conception or an idea. Information has therefore long been synonymous with 1) "data, details, facts, and intelligence". However, the term information has acquired additional meanings. Today it may also refer to 2) "the import ascribed to specific data". Then information does not arise until a receiver interpret data, e.g. a text or a picture.

Furthermore the term *information* is also sometimes used for 3) "data processed in a computer", 4) "an internal structure which regulates processes", 5) "a formal written statement or accusation", 6) "the action of informing against a person", and 7) "the giving of a form or essential character to something; inspiration". Information is also 8) the term for a group of information materials in the category *Brief messages.*

The verb *inform* means to supply or convey information or to provide knowledge of something and is therefore a unidirectional process, e.g., from one person to another. In my view, to *communicate* entails interplay between two or more persons.

From a terminological point of view the concept *information* may be placed somewhere between *data* and *knowledge*. The three terms data, information and knowledge are frequently used for overlapping concepts. These concepts are ambiguously defined in the subject matter literature. It is not at all easy to draw any strict borderlines between these three concepts.

Often the term *data* refers to a collection of facts, specific details that are known. It may be results from experiments,

measurements and observations of a set of variables. Data may consist of numbers, words, or visuals, often stored in lists and tables, in computer systems or on paper. Data are often complex, unorganised and unstructured. The information designer has the ability to organise, structure and present data as *meaningful information* in a chart, in a table, in a text or on a map.

There are numerous competing and complex theories of *learning* and of *knowledge*. For our purpose knowledge may be defined as 1) having understanding and skills acquired by theoretical and practical understanding of a subject matter, and the ability to use it for a specific purpose, 2) awareness and recognition, and 3) the sum of what is known in a particular field. Learning and acquisition of knowledge involves complex cognitive processes, such as attention, perception and learning. These processes are influenced by our earlier experiences and our memories. Groups of brain cells are activated and associate to each other.

We may view information from various perspectives with respect to how we create, present, produce, distribute, search, sort, index, store, receive, process, value, respond to, make use of, and renew information. Often several groups of people with different skills are needed for these activities. Each person has a set of individual experiences and values that will influence their views of information.

Information can be moved from one place to another and stored in analogue or in digital form. Vickery and Vickery[2] pointed out that information is merchandise, however quite dif-

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[2] Vickery and Vickery, 1987, 27.

ferent from other kinds of commodities and wrote: "Informa-
tion is a peculiar commodity. When transferred from source to
recipient, or from seller to buyer, it remains available to both.
Unlike the sale of a material product, information transfer does
not give the recipient the right of exclusive use, ..."

Information is a richly varied concept covering many im-
portant disciplines or subjects and areas of knowledge. Infor-
mation concepts include copyright, information access, infor-
mation assurance, information competence, information disci-
plines, information ethics, information layout, information
quality, and information structure.

Most people are involved with communications and com-
munications systems in one way or another. Some of these sys-
tems have soft, human or linguistic dimensions, whereas others
possess hard, technological dimensions. Some subject fields
have been well established for many years. Others are new.
These fields can be regarded as independent scientific disci-
plines. In several instances, there is some overlapping because
certain sub-issues may be addressed in different disciplines,
even if the approaches may vary considerably.

Design

The term *design* represents the identifying of a problem and the intellectual creative effort of an originator, manifesting itself in drawings or plans that include schemes and specifications to solve the problem. However, the term *design* <u>also</u> represents the outcomes of each specific design process, such as products, services, processes, and systems.

People have been designing, planning and executing information sets, information materials, and messages in all times. The *design process* includes cognitive as well as practical aspects and activities. While a painter or a sculptor can choose any imaginable shape, a designer is limited by the function of the thing being designed[3]. Whereas art strives to express fundamental ideas and perspectives on the human condition, design is concerned with finding the representation best suited to the communication of some specific information[4].

Design areas

The concept *design areas* include many parts of human activities. Examples are apparel design, architectural design, ceramics design, communication design, costume design, craft design, document design, editorial design, engineering design, environmental design, exhibition design, fashion design, fine arts design, furniture design, glass design, graphic design, image design, industrial design, information design, instruction design,

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[3] Pye, 1964, 7.
[4] Mullet and Sano, 1995, p. 9.

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instructional message design, interaction design, interface design, interior design, it design, landscape design, light design, manufacturing design, mechanical design, message design, molecular design, ornamental design, package design, pattern design, persuasion design, poster design, presentation design, product design, service design, text design, textile design, type design and urban design. Many design areas are seen as academic design disciplines.

Some of these design areas partly overlap other disciplines, and there are probably even more design areas. Some design areas are old and some rather new. The concept of design language describes how interfaces communicate what objects are to users, what they might do, and how they should be used[5].

Design processes

Models for design processes include cognitive as well as practical activities and aspects. The (final) design represents the outcomes of each specific design process, such as processes, products, services, and systems. On a theoretical level the intention of an overall design process, including process activities, might be the same regardless of the specific design area.

Any design process includes the development from a concept or an idea to a final product. Steps in a design process may be called *design activities*, such as conceptual design, embodiment design, detail design, and design reviews.

[5] Head, 2000.

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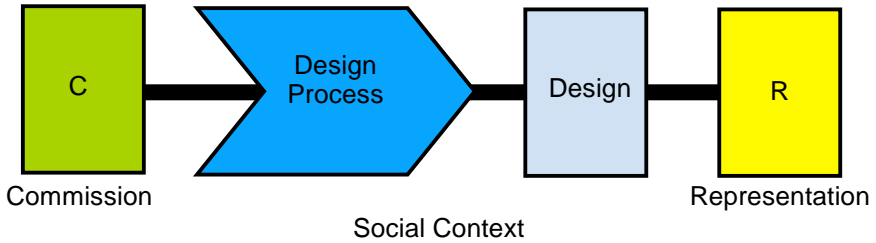
A design processes starts with a commission (C). The goal is to produce a final design, to be used as a master for production of a number of representations (R) or artefacts.

The design process includes cognitive as well as practical aspects and activities. Models for design processes include cognitive as well as practical activities and aspects. Shadrin discuss seven and Rowland ten design process activities, or design process steps[6]. Rowland has studied the process of design across a number of professions. According to him main principles of a *general process of design* include the following characteristics:

- Designing requires a balance of reason and intuition, an impetus to act, and an ability to reflect on actions taken.
- The design process is a learning process.
- Designing is a goal-directed process in which the goal is to conceive and realize some new thing.
- The design process is dependent on the designer and on what he or she designs.
- The new thing that results from designing has practical utility.

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[6] Shadrin, 1992, p. 29; Rowland, 1993

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- Design requires social interaction.
- Designing involves problem solving, but not all problem solving is designing.
- In designing, problem understanding and problem solving may be simultaneous or sequential processes.
- Designing involves technical skills and creativity and rational and intuitive thought processes.

The (final) design represents the outcomes of each specific design process, such as processes, products, services, and systems. On a theoretical level the intention of an overall design process, including a number of process activities, might be the same regardless of the specific design area.

My own studies of processes of *message design*[7] resulted in the following list with twelve design principles to be used in the production of information and instruction:

- Introduce novel or unexpected events at the start of instruction.
- Inform learners of expected outcomes.
- Recall relevant prerequisite information.
- Present only relevant information.
- Organise content and present "organisers".
- Progress from simple to complex.
- Provide prompts and cues.
- Vary the information presented.
- Present examples and non-examples.
- Provide appropriate practice.

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[7] Pettersson, 1993, p. 88

- Provide immediate feedback or knowledge of results.
- Review and repeat.

Smith and Ragan[8] argues that *instructional design* is a systematic and reflective process of translating principles of learning and instruction into plans for instructional materials, activities, information resources, and evaluation. Smith and Ragan noted that an instructional designer is somewhat like an engineer. Both plan their work based upon principles that have been successful in the past. Engineers use principles based on the laws of physics, and instructional designers use principles based on basic principles of instruction and learning. Both groups have a vast number of factors, which often interact, that they must consider. Their "model of instructional design" is based on three phases[9]: 1) analysis, 2) strategy, and 3) evaluation.

The first phase includes analysis of the learning context, analysis of the learners, analysis of the learning task, and writing of test items. The second phase includes development of organizational strategies, development of delivery strategies, development of management strategies, and production of the actual instruction. The third phase includes assessments and formative evaluation, which may lead to revision of the instruction. Many times steps may occur concurrently. Smith and Ragan[10] provides seven critical assumptions underlying instructional design for instructional designers to follow in order to be able to

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[8] Smith and Ragan, 1999, p. 2
[9] Smith and Ragan, 1999, p. 7
[10] Smith and Ragan, 1999, p. 18

produce "good instruction". The *instructional design assumptions* are:

- To design instruction, the designer must have a clear idea of what the learner should learn as a result of the instruction.
- The "best" instruction is that which is effective (facilitates learners' acquisition of the identified knowledge and skills), efficient (requires the least possible amount of time necessary for learners to achieve the goals), and appealing (motivates and interests learners, encouraging them to persevere in the learning task).
- Students may learn from many different media; a "live teacher" is not always essential for instruction.
- There are principles of instruction that apply across all age groups and all content areas. For example, students must participate actively, interacting mentally as well as physically with material to be learned.
- Evaluation should include the evaluation of the instruction as well as the evaluation of the learner's performance. Information from the evaluation of instruction should be used to revise the instruction in order to make it more efficient, effective, and appealing.
- When the purpose of assessment is to determine whether learners have achieved learning goals, the learners should be evaluated in terms of how nearly they achieve those instructional goals rather than how they "stack up" against their fellow students.
- There should be congruence among goals, learning activities, and assessment. Along with learner's characteristics and

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learning context, learning goals should be the driving force behind decisions about activities and assessment.

It is possible to edit the above instructional design assumptions and turn them into a list of seven *information design assumptions* or *message design assumptions*

- To design information set, the designer must have a clear idea of what the user should understand as a result of using the information set.
- The "best" information set is that which is effective (facilitates users' acquisition of the identified knowledge and skills), efficient (requires the least possible amount of time necessary for users to achieve the specified goals), and appealing (motivates and interests users, encouraging them to read, or listen to, the complete information set).
- Many different media may be used for distribution of specific information content. Different media have their specific advantages.
- There are principles of information design that apply across all age groups and all content areas. Users must be active rather than passive, interact mentally as well as physically with the information material.
- Evaluation of information should include the evaluation of the information set as well as the evaluation of the user's performance. Facts from these evaluations should be used to revise the information set in order to make it more efficient, effective, and appealing.

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- When the purpose of assessment is to determine whether users have achieved the goals, the users should be evaluated in terms of how nearly they achieve those goals.
- There should be congruence among goals, reading, and assessment. Along with user's characteristics and context, information goals should be the driving force behind decisions about activities and assessment.

Models for design processes include cognitive as well as practical activities and aspects. My "message design and information design model" include the following four process activities: analysis and synopsis, production of draft, production of script, and production of original and master. Each activity includes a design sub-process, activity documentation, and a review process. Main message design tools will include text (printed and spoken), symbols, pictures (drawings and photos), typography and layout, light and light effects, sound and sound effects.
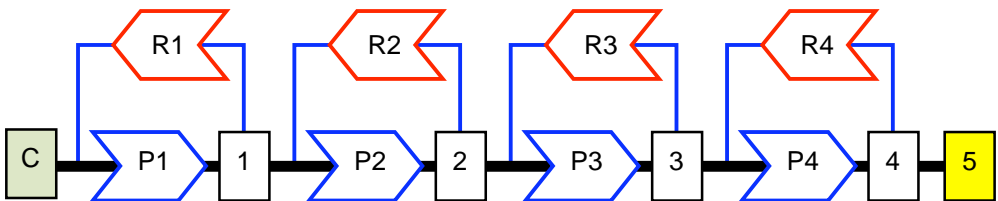
The creative message and information design processes include four different production (P) and review activities (R). The production activities are analysis and synopsis (P1) and synopsis (1), production (P2) of draft (2), production (P3) of script (3), and production (P4) of original (4) and master (5). C = commission.

An originator, like an author, a designer, an illustrator and a painter, may want to tell somebody something. Then he or she has got an "intended message" as well as one or more mental images to communicate. By creating a number of physical outlines or sketches the originator is able to explain and demonstrate her or his mental images. These outlines include "preliminary messages" and they seldom reach any large audience. The mental and creative process, and the physical and practical work make it possible for an illustrator and a painter to make an original drawing or an original painting. This finished original has got a "designed message." Each person looking at the final design will create an individual "interpretation of the message."

Several authors have pointed out "form follows function". Thus the content of the message is more important than the actual execution of the message. Therefore, we should always begin by defining what any message is supposed to show. What is the problem we want to solve? The information in each message will have to be structured and adapted to the needs of the target group, the intended readers or listeners. An intended message may consist of specific ideas, thoughts, data, information, or some subject matter facts.

Today's design motto is very much: "function can take any form." According to Mijksenaar[11] this phrase is an adaptation of the famous: "form follows function" which can be traced back to the American sculptor Horatio Greenough, who had used it in his text *Form and Function*, written in 1851. However,

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[11] Mijksenaar, 1997, p. 15

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Mijksenaar and Westendorp[12] conclude: "architects, engineers and designers rarely follow this rule." Several authors have tried to develop firm rules on how to design information materials. This is, however, not possible[13].
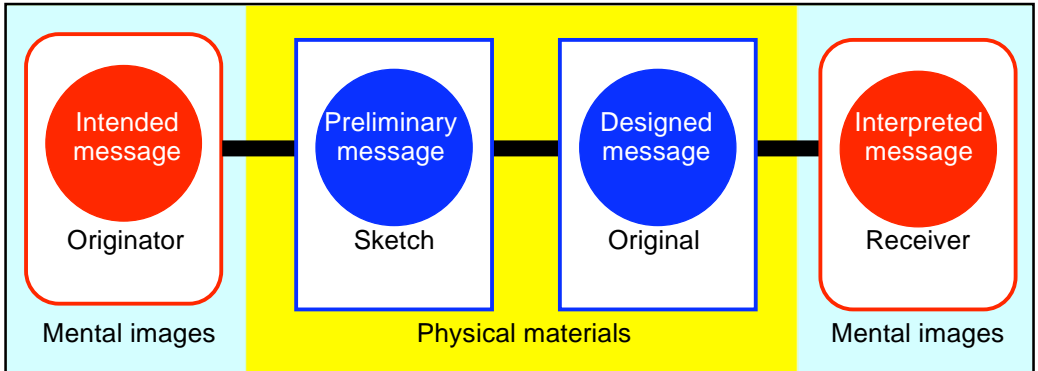
An originator has got an "intended message." He or she creates a "preliminary message" and a "designed message." Each person looking at the final design will create an "interpreted message."

[12] Mijksenaar and Westendorp, 1999, p. 34
[13] See the section *Information Ethics* for an exception from the "rule of no rules."

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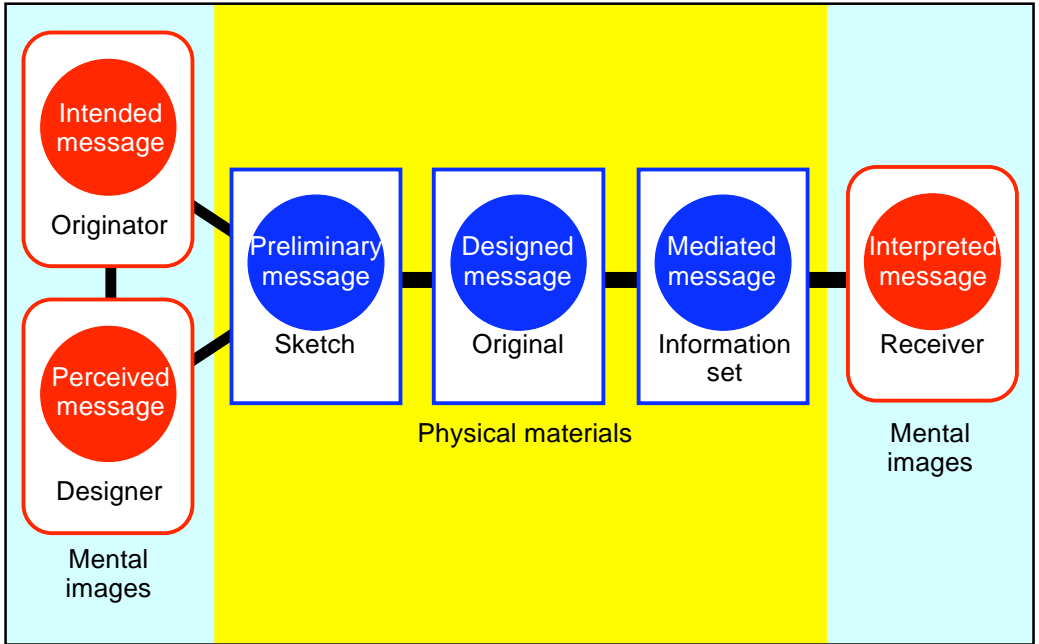
An originator has got an "intended message." An information designer assists him or her. During this process the designer creates a "perceived message" and a number of sketches. After some discussion they agree on a "preliminary message." The original include a "designed message." After production "mediated messages" will be distributed. Each person looking at the final design will create an "interpreted message."

The purpose of an intended message may be advertising of a product or a service, providing a business proposal; providing education, entertainment, information, instruction, learning, training, establishing a change of behaviour, making a decision,

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performing an action of any kind, or any combination of these and many other examples. There are many groups of receivers. The receiver of an intended message may be business partners, colleagues, dentists, employees, course participants, ministers, students, teachers, veterinary surgeons, retired professors, teenage girls, teenage boys, or a "general" audience – just to mention a few. There are of course many more groups of receivers. It is obvious that a person may belong to several groups of receivers, or "target groups". There are always individual differences among members of any group.

Design science

Design science is a large field of academic research, education and training. There are common problem areas regardless of what we design. In a common terminology the top level may be named "Families." Next level may be called "Genera." The third level is "Species" (or disciplines). Each subject matter consists of a number of courses. In five design families the classification depend on the purpose with the design. We can design artefacts, different messages, performances, systems and processes, and our own environments. These design families are called artefact design, message design, performance design, systems design or systems development, and environment design. All are hold together with design philosophy, the sixth design family.

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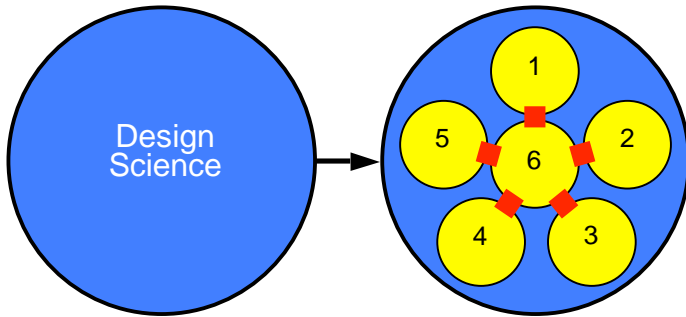
Design science (left) includes six design families (right): artefact design (1), message design (2), performance design (3), systems design (4), environment design (5), and design philosophy (6).

A group of design disciplines all deal with the design of messages. The main components in message design are *words, visuals and forms*. These main components may be used in many different ways to produce, transmit and interpret messages of various kinds in different communication situations. Depending on the different objectives of the messages we can see different "message design genera." These groups are graphic design, information design, instruction design, mass design, and persuasion design.

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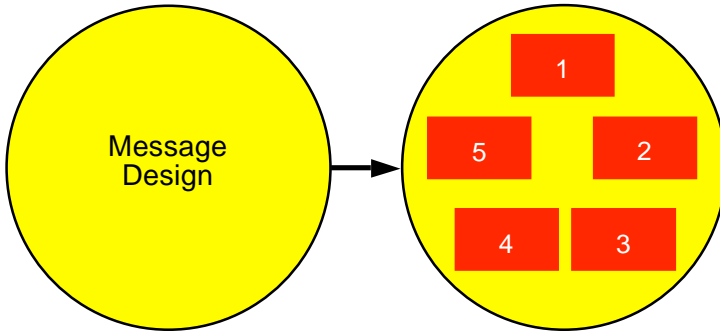
The message design family (left) includes five design genera (right): graphic design (1), information design (2), instruction design (3), mass design (4), and persuasion design (5).
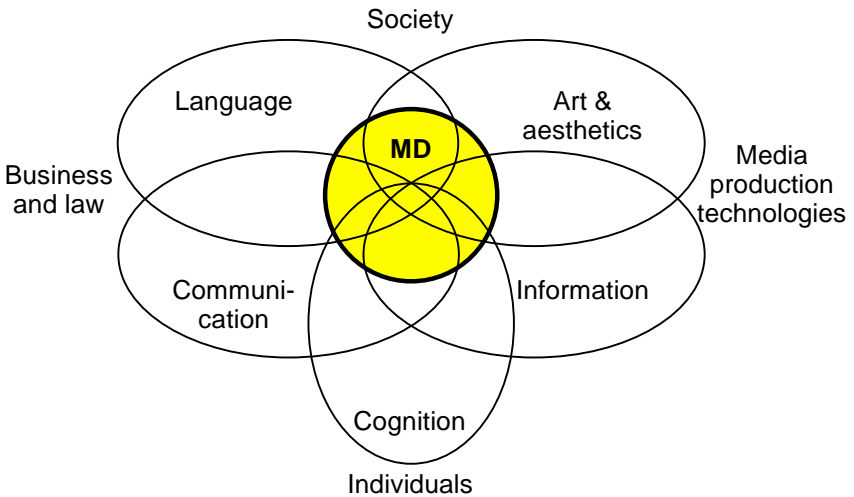
Message design (MD) is interdisciplinary and encompasses influences and facts from more than fifty established academic disciplines and areas of research.

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Message design (MD) is an interdisciplinary field of knowledge. It encompasses influences and facts from more than fifty established disciplines and areas of research. The main areas of research may be divided into the following six groups with "base disciplines."

1. *Language disciplines* such as drama, graphic design, linguistics, rhetoric, semiology/semiotics, verbal languages, visual languages and visual literacy. (Graphic design is often seen as an art subject. However, from a message design perspective the language aspects of graphic design are more important than the art aspects.)
2. *Art and aesthetic disciplines* such as aesthetics, computer graphics, film and cinema, iconography, iconology, illustration, photography.
3. *Information disciplines* such as computer science, information processing, and library and information science.
4. *Communication disciplines* such as communication theory, education technology, information design, information technology, information theory, instructional design, instructional message design, instructional technology, journalism, media studies, persuasive design, planned communication, television and video.
5. *Behavioural and cognitive disciplines* such as cognitive science, didactics, information ergonomics, pedagogy, psychology, sociology and their subareas. The study of attention, perception, cognitive skills and memory are especially important. Some aspects deal with individuals, and some with the societies in which we live.

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6. *Business and media production technology disciplines* such as business economics and management, information economics, information management, law, technologies for production and distribution of different media.

This "message design model" is a theoretical model showing that different disciplines influence and contribute to the area of message design. Please note that the ovals in the illustration representing the various groups of disciplines are not meant to be sharp and distinct. The borders between the groups are rather blurred, unclear, and indistinct. Furthermore, the model is not intended to show any exact relationships between the different groups of the base disciplines.

All message design disciplines have got a theoretical as well as a practical component and message designers need to have theoretical knowledge as well as practical skills. In order to perform sound reflections and make a qualified reflection regarding theory and practice, we need concepts both to structure our thoughts, and to describe them verbally.

Information Design

Information design can be hard to define, and it often goes by other names. I will only mention a few definitions here. Hurlburt[14] noted: "Terms like information design, visual communication, and even graphic design are so broad in their connotations that it is impossible to use them accurately to describe specific functions. The term information design is often used to cover all of the areas of two-dimensional design that are non-persuasive."

Easterby and Zwaga[15] provided a definition when they edited the proceedings from the *NATO Conference on Visual Presentation of Information* in 1978. In the preface[16] they write: "information presentation involves a wide range of professional interest groups concerned with its development and use." Marsh[17] discussed *communication design* for "messages that work" and made a clear distinction between artistic and design approaches. He commented that an artistic approach strives for *perfection*, while a design approach strives for *workability* in a cost-effective context. By careful planning the design approach minimizes need for rewriting and editing. The approaches result in vastly different final products, each with its own use.

In 1993 Wileman[18] noted: "Communication can be judged successful only when it conveys the information it sets out to

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14 Hurlburt, 1981, p. 22
15 Easterby and Zwaga, 1984
16 *Information Design*, p. xxi–xxii
17 Marsh, 1983
18 Wileman, 1993, p. 6

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convey. This is as true for visual modes as it is for verbal modes." Here "visual modes" include all kinds of visual language, and "verbal modes" include verbal language. Because the solution of any information design problem is determined by the interaction between the instrumental and user constraints Flach and Dominguez[19] preferred to talk about *"use-centred design."* According to them success of a specific design depends on the coordination of the two sets of constraints: information with the appropriate means for action, and the means for action with the appropriate information. At the same time Mullet and Sano[20] remarked that: "The goal of *communication-oriented design* is to develop a message that can be accurately transmitted and correctly interpreted, and which will produce the desired behavioural outcome after it has been understood by its recipient."

Mok[21] provided the following short definition of the concept information design: "*Information design* is the arrangement of organization models to provide context and meaning for the information." According to Bull[22] *communication design* examines the role of the designer as a strategic architect/visual translator in producing visual language systems that focus on appropriateness, meaning, and the end user. In my view *information design* of today has its origin and its roots in graphic design, education and teaching, and architecture and engineering, or

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[19] Flach and Dominguez, 1995
[20] Mullet and Sano, 1995, p. 2
[21] Mok, 1996, p. 108
[22] Bull, 1999

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rather construction and production. In all these three broad areas of knowledge people have recognised the need for clear, distinct and trustworthy presentation and interpretation of verbal as well as visual information. I have described information design in the following way[23]:

> "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 material, with its message, will satisfy aesthetic, economic, ergonomic, as well as subject matter requirements."

In my view the main goal in information design is *clarity of communication*, even if we also expect presentations to be aesthetically pleasing, and in some cases also intellectually rewarding. To fulfil this main goal all messages must be accurately designed, produced and distributed, and later correctly interpreted and understood by most of the members of the intended audience. These different processes are guided by *principles*, performed with the help of *tools* and always influenced by the *social context*.

The *objective* refers to what the sender wishes to achieve with her/his message, i.e. the goal(s) the sender wishes to attain. The objective of information material is linked to some utilitarian aspect in which the receiver is supposed to understand how something works or how she or he should behave in a

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[23] Pettersson, 2002, p. 19

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given situation in order to avoid or resolve a problem. In message design, instructional design, instructional message design, as well as in information design it is important to define the purpose and the objective with the message, always keeping the intended receivers in mind[24].

In information design the main objective is to provide information materials needed by the interpreter in order to perform specific tasks. The information interpreters might be seen as "doers." They may develop new skills, understandings, and experiences[25].

As an area of knowledge information design rests on a foundation, which can be expressed in four basic statements: 1) ID is multi-disciplinary. 2) ID is multi-dimensional. 3) Theory and practice co-operate in ID. 4) There are no firm rules in ID.

Multi-Disciplinary

Information design is based on co-operation between people with quite different backgrounds, competences and experiences. Information design of today has its origin and its roots in *graphic design*, *education* and teaching, or rather *instruction,* and architecture and engineering, or rather *construction and*

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[24] e.g. Briggs and Wager, 1989; Fleming and Levie, 1993; Pettersson, 1993; Wileman, 1993; Pettersson, 2002; Lohr, 2003; Smith and Ragan, 2005; Lipton, 2007.
[25] See the section "The Message" in "Functional Principles – Defining the Problem – The Representation" for examples of verbs that denote observable behaviour.

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production. Here people have recognised the need for clear and distinct presentation and interpretation of information.

Information design is a *new academic discipline,* but it is not a new area of knowledge. Manuals and instructions have been preserved since the 15th century. Mijksenaar and Westendorp[26] mention a fencing manual by Hans Thalhoffer (1443). This manual includes visual instructions in wrestling and un-armed combat. From an instructional point of view, there was not much development in visual instructional language from the 15th until the 20th century. They concluded[27]:

> "The next major advance in visual instructions occurred during World War II, when the military used pictorial language to train soldiers. The Walt Disney Company, for instance, adapted its cartooning skills to create training documentation and films such as the movie employing Mickey Mouse to explain how to use a Browning.50 water-cooled machine gun. The defence industry in general also played a role in augmenting and applying visual instructional language during this period."

Since the introduction of the personal computer there has been a rapid development in the production of information materials. The availability of and need for information as the basis for decision-making is continually increasing. Now an increasing number of decisions are being made on the basis of pictorial

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[26] Mijksenaar and Westendorp, 1999, p. 21
[27] Mijksenaar and Westendorp, 1999, p. 22

representations[28]. Visual messages are a powerful form of communication[29]. Visual messages stimulate both our emotional and our intellectual responses and therefore make us think as well as feel. It can be concluded that *the ability to communicate visually is becoming more and more important.*
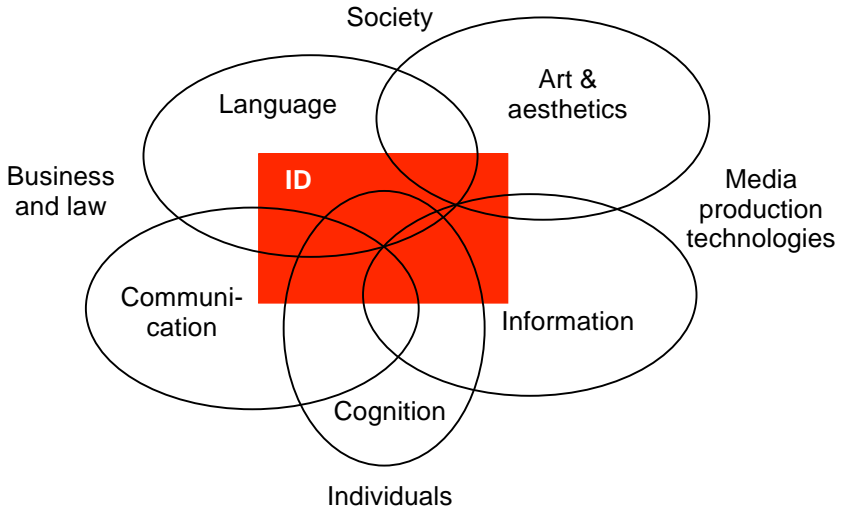
A model of information design (ID). The ovals representing the various groups of disciplines are not meant to be sharp and distinct.

At present the genus information design includes three academic disciplines. They are named *Communication design*, *Information design*, and *Presentation design*. In the future it is

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[28] Nielsen, 2004
[29] Lester, 1995, p. 73

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quite possible that some universities will introduce very similar design subject matters and use other names.

In all parts of message design it is important to make a clear distinction between the actual content, the message itself, and the representation of that message. This representation is often called *information material* or *information set*. It is intended for a specific target group. It is devised in a specific fashion. It has a specific purpose and is distributed with the aid of a medium. Information materials can be structured in a three-dimensional model, i.e. an *information box*, for each subject field. This box describes the relationship between objectives (x), media (y) and target groups (z). A number of such boxes can be devised. There is one box for technical information providers, one for the information-provider disseminating social information or tourist information etc. Each box covers hundreds of conceivable types of information materials, all with specific subject content.

> ### *Seven groups of information materials*
>
> 1. Advertising and propaganda
> 2. Informative entertainment
> 3. Brief messages
>   Simple instructions
>   Prohibitions
>   Information
>   Warnings
> 4. Administrative documentation
>   Working materials
>   Administrative messages
>   Business documents
>
> 5. Factual information
>   Facts
>   Descriptions
>   Reports
> 6. Instructions
>   Operating instructions
>   Production and maintenance
>   documentation
>   Good advice
>   Interfaces
>   Recipes
>   Guidance
> 7. Teaching aids

Multi-Dimensional

In his book *Envisioning Information* Tufte[30] argues that the principles of information design are universal. Like mathematics information design principles are not tied to the unique features of a particular language, nor are they tied to a particular culture. Information design is a worldwide consideration. Information design is multi-dimensional.

Different media are able to represent reality with a varying degree of facility owing to differences in their structure, the kind of representation involved, and the content in each specific case. A verbal presentation is an example of a "one-dimensional" representation. The words in a verbal message "flow" in

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[30] Tufte, 1990, p. 10

a relatively fixed and often unambiguous form along a time axis. Drawings and photographs are "two-dimensional" representations. Interpretation of image content is less constrained than interpretation of a verbal message. However, a still picture may always be interpreted in more than one way. Furthermore dioramas, models, sculptures and stereo pictures have a third "dimension." Current laser techniques make it possible to create three-dimensional images, holograms, enabling viewers to actually see "behind" the image objects.

Having a "one-dimensional" and a "two-dimensional" representation at the same time, or even one or more "one-dimensional", "two-dimensional", and "three-dimensional" representations, at the same time, is possible, even commonplace. We may also add "access time" as another dimension. In the future, media might also be able to represent smell and taste, which would add still other dimensions.

Movies as well as TV- and radio-programs are presented from the beginning all the way to the end. In fact movies used to conclude with the text "THE END." The directors and the producers are in complete control of the order and of the way the information is presented to us. This is a directed experience. As viewers we are restricted to choose between watching and not watching the program. We can associate freely, and different people often make different interpretations of the same program.

Different media are also related to one another in regard to their level of structural complexity. The simplest form of a "one-dimensional" representation is a simple acoustic signal, such as

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a baby's cry. A higher degree of complexity is found in texts and music. Music is always structurally more complex than text but can, of course, sometimes be "simple" in content. The greater the degree of structural complexity, the closer the representation approaches reality at a given time, in a given place, and in a given context. Marsh[31] however, uses another terminology. He points out that audible dimensions include: frequency, amplitude, complexity, duration, and localization. With this view in mind all representations could be considered as "multi-dimensional."

Theory and Practice Co-operate

Theory may be defined as a number of assumptions or statements that conceptualises diverse phenomena, and systematises our knowledge about them. A theory illustrates how and why something is. *Practice* is performance or execution, as opposed to theory; custom or habit; systematic exercise for instruction; training; exercise of a profession.

Simlinger[32] argues that information design is complementary to information technology in the same way as architecture, or rather "architectural design" is complementary to building technology. Architecture has a practical as well as a theoretical component. This is also true for information design as well as for several other disciplines, such as dance, economics, education, engineering, the fine arts, journalism, medicine, music and

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[31] Marsh, 1983
[32] Simlinger, 1999

theatre. Like the two faces of a coin, *infology* and *infography* are the two main components of message design[33] and also the two main parts of information design.

Infology is the theoretical component of information design, is the science of verbal and visual presentation and interpretation of messages. On the basis of man's prerequisites, infology encompasses studies of the way a combined verbal and visual representation should be designed and produced in order to achieve optimum communication between a sender and a group of receivers. Infology models contain both theoretical (descriptive) elements as well as normative (prescriptive) elements. Producers of information and learning materials can facilitate communication, and the learning processes of the receivers. Complicated language, in both texts and pictures, will impair the understanding of the message. Active voice, attention, clarity, comprehensibility, consistency, emphasis, information ethics, legibility, memory, perception, precision, processing, quality, readability, reading value, simplicity, structure, and unity are all key concepts in information design.

Infography is the practical component of information design, is the actual, practical work with design and execution of structured combinations of words, pictures, and graphic design. Therefore a designer of messages needs to have good skills in writing comprehensible, clear and consistent texts, in creating clear illustrations, and in creating a clear, transparent typography and layout that will aid attention, perception, interpretation, understanding and learning for the intended receiver. The

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[33] Pettersson, 1989, p. x, 206; 1993, p. 173; and Pettersson, 2002, p. 20

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task of designing complete information materials may often be far too overwhelming for one single individual. For that reason a team of people, with skills in different areas, are often working close together.
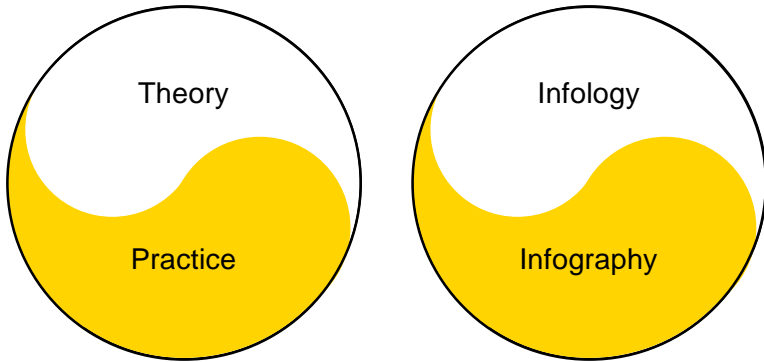
Infology is the theoretical and infography is the practical component of information design.

Any graphic message should be legible, readable, and well worth reading for the intended audience and any audio message should be audible, distinct, and well worth listening to. Every information designer needs to have theoretical knowledge as well as practical skills. In order to perform sound reflections and make a qualified reflection regarding theory and practice, we need concepts both to structure our thoughts, and to describe them verbally[34].

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[34] Nordegren, 2004, p. 23–24

There Are No Firm Rules in I D

A number of authors in various design areas have noted that it is not possible to provide any firm design rules. Several say: "It Depends." Lohr[35] presented an "It Depends Rule." She writes: "Design decisions do not take a cookbook approach. Too many factors influence design. That is why it is considered an art as well as a science." She further writes: "What should you do? It depends ... on the learner, the content, the task, the environment, other elements in the visual, and your level of skill." Maybe the situation for information design can be summed up in the expression: "it depends." In each specific case the information designer must be able to analyse and understand the problem, and find one – or more – practical design solutions.

Message Design Principles

All information materials must be legible and readable. They should also be well worth reading for members of the intended audience. The information designer should not view communication as complete until the intended audience can understand the messages. A number of authors have offered design principles, a kind of "fundamental truths" in different areas of design, such as *data graphics*[36] *general design*[37], *message design*[38], *instructional design*[39], *instructional message design*[40], *informa-*

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[35] Lohr, 2003, p. 81
[36] Tufte, 1983, p. 105
[37] Tufte, 1983; Shadrin, 1992; Rowland, 1993
[38] Pettersson, 1993, 1997; Wileman, 1993
[39] Lohr, 2003; Smith and Ragan, 1999, 2005

tion design[41]. Some of these message design principles are rather broad and general, while others are quite specific. However, all message design principles should contribute to the design of effective and efficient messages, information materials, and learning materials. These principles can be seen as a set of guidelines for the message design process.
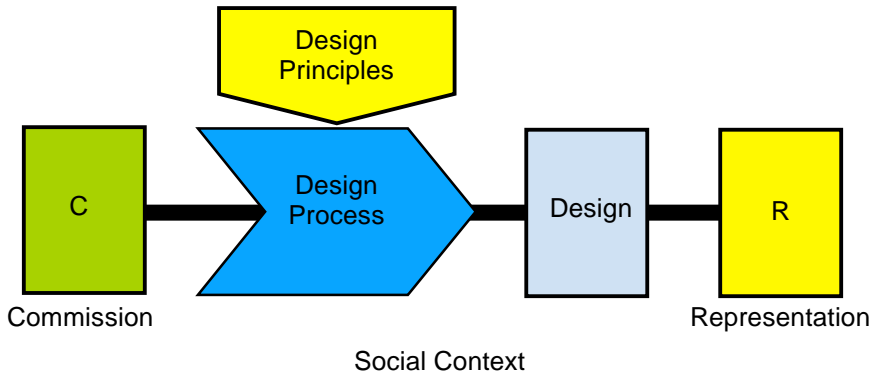
Design processes are guided by design principles.

Incorrect information in newspapers deceives thousands of readers, and incorrectness on television may influence millions of viewers. Tufte offers six design principles[42] that will result in graphical integrity in the display of quantitative information:

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[40] Fleming and Levie, 1993
[41] Pettersson, 2002, 2007; Lipton, 2007
[42] Tufte, 1983, p. 77

- The representation of numbers, as physically measured on the surface of the graphic itself, should be directly proportional to the numerical quantities represented.
- Clear, detailed, and thorough labelling should be used to defeat graphical distortion and ambiguity. Write out explanations of the data on the graphic itself. Label important events in the data.
- Show data variation, not design variation.
- In time-series displays of money, deflated and standardized units of monetary measurements are nearly always better than nominal units.
- The number of information-carrying (variable) dimensions depicted should not exceed the number of dimensions in the data.
- Graphics must not quote data out of context.

Good designs are intriguing and curiosity provoking, drawing the viewer into the wonder of the data. Tufte noted[43] that graphical competence demands three quite different skills: 1) the substantive, 2) the statistical, and 3) the artistic. Yet most graphical work today, particularly in news publications, is under the direction of a single expertise—the artistic. Allowing artist—illustrators to control the design and content of statistical graphics is almost like allowing typographers to control the content, style, and editing of prose. Substantive and quantitative expertise must also participate in the design of data graphics, at least if statistical integrity and graphical sophistication are to be

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[43] Tufte, 1983, p. 87

achieved. Fleming and Levie[44] provided the following twelve general design principles for *instructional message design*:

- Introduce novel or unexpected events at the start of instruction.
- Inform learners of expected outcomes.
- Recall relevant prerequisite information.
- Present only relevant information.
- Organise content and present "organisers."
- Progress from simple to complex.
- Provide prompts and cues.
- Vary the information presented.
- Present examples and non-examples.
- Provide appropriate practice.
- Provide immediate feedback or knowledge of results.
- Review and repeat.

In the 1990s I discussed eight *functional message design principles* for the presentation of clear messages in any medium [45]. These design principles were:

- Facilitating learning.
- Providing a clear structure of the message.
- Providing clarity.
- Providing simplicity.
- Providing unity.
- Securing a high quality of the message.

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[44] Fleming and Levie, 1993, p. x
[45] Pettersson, 1997, p. 110–118

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- Limiting the total costs.
- Respect copyright

A few years later I added two *aesthetic message design principles* to the list: 9) information aesthetics, and 10) harmony and proportion.

Lohr[46] offers three principles that can be used in *instructional design* and *instructional message design* to create more easily understood pictures. The principles are: 1) figure/ground, 2) hierarchy, and 3) gestalt. The figure/ground principle refers to the mind's tendency to organize into figure and ground categories. To facilitate this process the information designer should make the most important information really noticeable. The principle of hierarchy is based on the mind's tendency to process and remember "chunks" of information that in turn are arranged hierarchically. To facilitate this process the information designer should shape information structures to show subordinate, super-ordinate, and coordinate relationships. The gestalt principle encompasses figure/ground and hierarchy principles. Gestalt theory is based on the belief that the whole is greater than the sum of its parts. The information designer should combine text and visuals to present messages. Simplicity is an organisation and grouping of data and detail that make the information clear and meaningful. Lipton[47] provides eight principles for *information design*:

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[46] Lohr, 1993, p. 41–44
[47] Lipton, 2007, p. 9

- Consistency (is there a design style sheet at work—for example, does one headline look like another?)
- Proximity (does the amount of space between elements reflect the relationship between the elements?)
- Chunking (are related elements grouped and separated from others to make them digestible, instead of dauntingly unbroken?)
- Alignment (does every element line up with some other one?)
- Hierarchy (does the most important information look most important—placed at the top, bigger, bolder, or emphasized in some other way?)
- Structure (is the information presented in a sequence that will make sense to the audience?)
- Balance and eye flow (is there a clear starting place, and do the type and layout choices support the movement of your eye through the material?)
- Clarity (is the writing clear and concise, free of unnecessary jargon or undefined terms, and at the right level for the audience?)

Using a large number of visual examples Malamed[48] offers designers six principles for creating graphics and *visual language* that people may understand. These principles are:

- Organize for perception. ("By understanding how viewers initially analyze an image, designers can structure and organize graphic so it complements human perception."[49])

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[48] Malamed, 2009.
[49] Malamed, 2009, p. 45.

- Direct the eyes. ("A designer or illustrator can assist this process by purposefully guiding the viewer's eyes through the structure of a graphic."[50])
- Reduce realism. ("There are times when the ideal expression of a message can be achieved through visual shorthand. An effective way to do this is to reduce the realistic qualities embedded in a graphic."[51])
- Make the abstract concrete. ("Visual thinking is an integral aspect of cognition, an d the visualizing of abstract concepts helps us understand the world and communicate about it."[52])
- Clarify complexity. (Information is complex when it is voluminous, dense, and lacking in structure.[53])
- Charge it up. (The common assumption that art evokes emotion is reliably supported through brain research. When viewers look at both pleasant and unpleasant pictures, they consistently demonstrate an emotional reaction indicated by pronounced brain activity that does not occur when they look at neutral pictures."[54])

In this book I will present some additional *information design principles* for the presentation of clear verbal and visual messages in any medium. These principles are put in four groups: 1) Functional principles, 2) Administrative principles, 3) Aesthetic principles, and 4) Cognitive principles.

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[50] Malamed, 2009, p. 71.
[51] Malamed, 2009, p. 103.
[52] Malamed, 2009, p. 129.
[53] Malamed, 2009, p. 169.
[54] Malamed, 2009, p. 203.

Harmony	Information access	Information costs	Information ethics
Aesthetic proportion	Facilitating attention	Facilitating perception	Securing quality
Defining the problems	Facilitating processing	Facilitating memory	Providing emphasis
Providing structure	Providing clarity	Providing simplicity	Providing unity

The four groups of message design principles are aesthetic principles (top left), administrative principles (top right), cognitive principles (middle), and functional principles (bottom).

Message Design Tools

The design process and sub-processes are performed with message design tools that are suitable for the type of representation that is selected during an early phase of the work. Main message design tools include text (printed and spoken), symbols, pictures (drawings and photographs), typography and layout,

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sound and sound effects. These tools have different properties that offer and restrict the foundations for communication.

Social Context
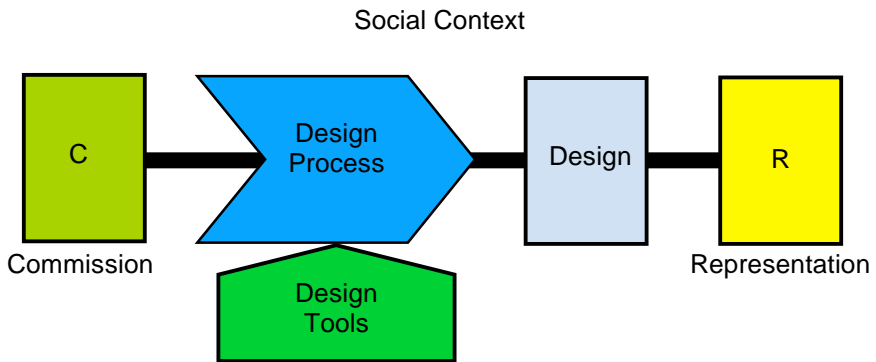
Design processes are performed with the help of design tools.

Representations

For Wileman[55] all kinds of representations of an object are symbols. He argues that there are three major ways to represent objects, from concrete to abstract representations. The first group, *pictorial symbols*, includes photographs and illustrations or drawings. Viewers should be able to translate a pictorial symbol to a real-world example. The second group, *graphic symbols*, has image-related graphics, concept-related graphics, and arbitrary graphics. Image-related graphics are silhouettes or profiles of the object. Concept-related graphics look like the object but have less detail than image-related graphics. Arbitrary graphics are abstract symbols for objects, constructed out of the designer's imagination. The third group, *verbal symbols*,

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[55] Wileman , 1993, p. 17

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is divided into two sub-groups, verbal descriptions and nouns or labels. Only people who comprehend the language used to describe the objects can understand verbal symbols.

However, in my view there seems to be no major difference in "abstractness" between abstract arbitrary graphic symbols and verbal symbols. Thus, I prefer to distinguish between two main categories of representations: (I) figurative representations, and (II) non-figurative representations. Figurative representations include two groups, visuals and graphic symbols. Visuals include three-dimensional images, photographs, realistic drawings, and schematic drawings. Graphic symbols include pictorial symbols, abstract symbols, and arbitrary symbols. Non-figurative representations or verbal symbols include verbal descriptions, nouns or labels, and letters and characters.

Figurative representations	*Non-Figurative representations*

1. Visuals
    Three-dimensional images
    Photographs
    Drawings
    Schematic pictures
	1 Verbal symbols
	    Verbal descriptions
	    Nouns or labels
	    Letters or characters

2. Graphic symbols
    Pictorial symbols
    Abstract symbols
    Arbitrary symbols
	2. Non-visual and non-verbal representations
	    (Sounds)
	    Odours and scents

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Languages

Any system used as a means of communications between people can be regarded as a language. While linguistic scientists distinguish between spoken and written language, graphic designers distinguish between verbal and pictorial language. From a design point of view, written, printed, or displayed texts or verbal graphic language are important components of visible language. However, if the linguistic representation (e.g., the medium and its content) is placed at the forefront, another approach is natural. Linguistic differentiation may be based on the form of the messages: words, sounds, images, and other forms. Thus verbal language has spoken (aural), written (visual), and tactile categories. Audial language comprises sound effects, music, and paralinguistic sounds (all aural). Visual language has symbols, pictures, and paralinguistic visual expressions (all visual). Other languages may be based on smell, on taste and on touch.

Languages differ in their ability to express concepts with precision and with flexibility. Only people who have the appropriate knowledge can understand a language. Physics, chemistry, and mathematics, for example, employ non-ambiguous symbol and equation languages. Normal prose is often open to multiple interpretations, i.e., it is ambiguous. Fiction and poetry in particular offer abundant opportunities for individual interpretations. Pictures are normally ambiguous too.

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Some Properties of Verbal Language

Verbal languages have digital coding[56] using combinations of letters (including numerals) to represent content. There is no direct correspondence between groups of letters, words, and reality. Each meaning is defined and must be learned. The properties of letters are limited. A letter has a given position in an alphabet. It has a name. It is represented by one or more sounds and is used in a specific context. Verbal languages have varying levels of meaning[57]: (i) phonemes (without meaning), (ii) morphemes (with meaning), (iii) syntagms, sub-meanings, and (iv) complete meanings.

Semantic codes, grammar, and syntax must be exactly defined[58]. A written text works well when the content of the message is analytical, detailed, logical, narrative, theoretical, and sequential[59]. The text can describe facts as well as feelings as long as the language is comprehensible for the intended audience. People usually have no difficulty in reading the jargon used in professional or technical languages but understanding the concepts that the words represent may be difficult for a non-specialist[60]. The more abstract a word is the harder it is to relate it to any specific activity. The use of visuals does not always automatically improve the achievements of the learners. For some objectives text is enough[61].

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56 Elkind, 1975
57 Eco, 1971
58 Chomsky, 1959
59 Melin, 1986a
60 Melin, 1986b
61 Dwyer, 1972

Some Properties of Visual Language

Visual languages have analogue coding employing combinations of basic graphic elements (dots, lines, areas, and volumes). A given set of basic elements can be combined to form different images. Visual languages attempt equivalence with reality. Visuals are iconic and normally resemble the thing they represent. Meaning is apparent on a basic level, but the visual language must be learned for true comprehension. Visual messages are superior to verbal messages when content is emotional, holistic, immediate, spatial and visual[62]. Images and visual language speak directly to us in the same way experience speaks to us: holistically and emotionally[63]. Factors in visual language are related to criteria such as the content and execution of a visual, its context and format, and the subsequent perception, learning, and memory. Content is more important than execution, context, and format. Pictures have a strong emotional impact.

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[64]. 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 artwork, however, may be more effective in formats where unlimited study time is allowed. The realism continuum is not an effective predictor of learning efficiency for all types of

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[62] Lent, 1980; Zimmermann and Perkin, 1982; Colle and Glass, 1986; Van Aswegen and Steyn, 1987; Boeren, 1994; Brouwer, 1995; and Hugo, 1996
[63] Barry, 1998
[64] Dwyer, 1972

educational objectives. An increase in the amount of realistic detail will not produce a corresponding increase in learning. No pictorial image gains the status of a "statement", unless an explicit reference is made to what it is supposed to represent[65].

Some Properties of Combined Verbal and Visual Language
Texts and pictures represent completely different languages that complement each other when they are used at the same time[66]. Both text and images can be designed, presented, perceived and interpreted in many different ways. The possibilities for using typography and layout, and for combining texts and pictures are virtually unlimited. The interplay between text, picture, and graphic form needs to be studied thoroughly before optimal combinations can be found. There are always several opportunities to convey a message.

Readers often react in a positive way to graphically complex texts. Texts with good typography will be noticed[67]. Dissatisfaction with the execution of a message may cause dissatisfaction with the content of the message. It is more likely that graphically complex texts will be read than "plain" texts. It also takes less time to read a graphically complex text than a "plain" text.

Pictures that will be used for information purposes should always be supplied with legends. This is the only way to assure that information conveyed by these pictures is clear and unambiguous. Even simple pictures need plain legends for the contents and presentation to be conveyable in verbal form. Legends

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[65] Gombrich, 1969
[66] Pettersson, 1985; Melin, 1999b
[67] Melin, 1999

should be written with great care. They heavily influence our interpretation of image content. To a large degree readers see what they are told to see in an image. To get maximum impact from a visual, the writer or the presenter should introduce the visuals before presenting it. We create a "pre-understanding" of how a picture may be interpreted, based on the context in which the picture is shown[68].

Despite all efforts during the past decades visual literacy has not been able to attract enough interest from society and enough interest from those responsible for the school curricula around the world. An important reason for this may be a general lack of focus. In my view we need to consider combined verbal and visual representations, not only text and not only visuals when we study communication and communication related issues. This is where message design, and its different sub-areas, may play an important role for visual literacists.

Some Properties of Colour as Language
Colour is regularly used in printed materials, not only in illustrations, but also in the text itself. Colour can be used to clarify the structure of the text and to make learning easier. Certain parts of the text may be printed with colours or printed on top of backgrounds in different colours. Black type has good contrast to many light background colours. The legibility will always be affected when there is insufficient contrast between the type and the background.

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[68] Pettersson, 1989

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There are many situations where colour and typographic elements can be used for decoration. However, a decorative use of colour or typography should never be mixed with an intended use to provide a clear structure, simplicity and hierarchy. It must always be clear, and easy to understand for the receiver when colour and typography is used for decoration and when the use is meant to have some cognitive importance. There are strong cultural differences in interpreting the meanings of colour.

Colour blindness, or better still "anomalies of colour vision", is a condition in which certain colour distinctions cannot be made. Anomalies of colour vision is much more commonly observed among men than among women, with estimates ranging as high as 10% of the male population[69]. Only 1% of the female population has anomalous colour vision. The failure to distinguish between red and green is most common. Both hues are perceived as grey. Common colours in graphic symbols are pure yellow, red, blue, green, white and black, or combinations of these. Unfortunately, red and green are often used as discriminating colours in symbols and in warning signs. Since many colour-blind people perceive red and green as grey, colour can only be used to code the information redundantly. Colour may be combined with shape, and position, or with both, which is often seen in traffic signs.

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[69] Hartley, 1987; Ware, 2004

Some Properties of Symbols as Language
In his discussion on "*Presentation media for product interaction*" Westendorp[70] noted that *instructive elements* in or near a drawing have evolved rapidly into a special "instructive language." Instructive elements: "are purely symbolic: there are no physical hands, reference letters, numbers and lines, arrows, crosses, dotted lines, exclamation marks, circles, zoom-lines or greyed-out or colored areas on the products." Apart from arrows, lines and pointing hands most instructive elements were introduced after World War II. Some instructive elements are "statements" comparable with individual words[71] or even sentences. A good symbol is designed so it can be used in many different situations and in many contexts[72]. A good symbol is simple, clear, has optimal size, good contrast in form, dimension, and colour. There are, however, cultural as well as individual differences in interpreting the meanings of symbols.

Graphical symbols may be intended to convey generalities of the same order of abstractness as verbal terms. In some cases we can see graphical symbols as visual terms. Graphical symbols may be used to create an overview, identify information, illustrate position, illustrate size relationships, navigate in databases, provide a holistic perspective, recognize information, and represent an organization, a service, or a product. Graphical symbols may supply information and supply instructions.

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[70] Westendorp, 2002, p. 48
[71] Westendorp and Van der Vaarde, 2001; Pettersson, 1999
[72] Pettersson, 1999

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Functional Principles

The design process is influenced by message design principles, and is performed with message design tools suitable for the type of representation that is selected during an early phase of the work. These principles can be seen as a set of guidelines for design of information and learning materials.
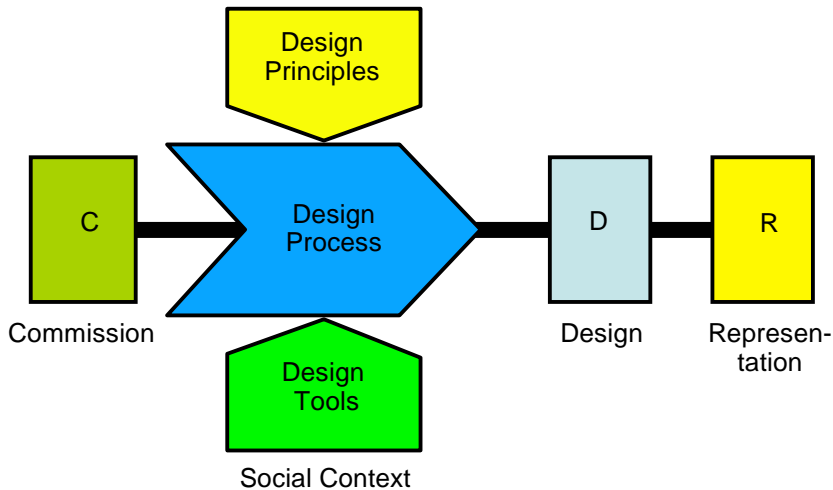
There are many models for design processes. It starts with a commission (C). The goal is to produce a final design (D), to be used as a master for production of a number of representations (R) or artefacts. Design processes are guided by design principles and performed with the help of design tools and always influenced by the social context.

This chapter includes a discussion on six "functional design principles." These principles are called: *Defining the Problem,*

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Providing Structure, Providing Clarity, Providing Simplicity, Providing Emphasis, and *Providing Unity.* Guidelines that are based on these principles will assist the information designer to design information materials that are well suited for the intended receivers.

Defining the Problem

During an introductory analysis and planning phase it is possible to organize the work, analyse the sender, analyse the intended receiver, analyse the intended message, and select a suitable medium. The message and the medium form the representation.

The Sender

A "sender" or "information provider" may be anyone who wants to convey a message to one or more receivers. Sometimes the sender will design messages and develop one or more information materials. However, quite often these tasks are entrusted and left to other people who may be more qualified. The first parts may be left to an information designer, who needs to:

- Define what the sender wants to achieve.
- Decide when this is to happen.
- Find out about the project budget, as well as all other requirements.

Within an organization it is usually necessary for the sender to employ a total view of information and communication. Infor-

mation should be related to the overall activity goals for the organization. Messages in different media should be designed to work together.

The Representation

A representation is a *medium* with a specific *message*. In this document the term "information material" is frequently used for pamphlets, posters, and reports, just to mention a few examples. Sometimes a representation is called "information set," or "learning material," or simply "material." Based on how verbal information is presented to the receivers, there are three main types of representations[73].

- We read the printed words in lexi-visual representations, such as messages printed in a book, or messages displayed on a computer screen.
- We listen to the spoken words in audio-visual representations, such as oral presentations with slides or overhead transparencies, and in television programmes.
- We read printed words and listen to spoken words in a combination of lexi-visual and audio-visual representations in multi-visual representations, such as interactive multimedia systems.

Together with the medium the message is the link between the sender or the designer and the intended receiver. The sender designs the message and sends it off, or makes it available. The

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[73] Pettersson, 1993

receiver receives the message, and may try to interpret and understand it.

The systems of rules that govern spoken and written languages are similar in many ways. In contrast to spoken and written languages, pictures have no general and distinguishing elements that are not bearers of information. Visual languages attempt equivalence with reality. They are iconic and normally resemble the things they represent. Language and cultural differences could impact the effectiveness of visuals[74]. Therefore it is important to select pictures with great care.

The Message

In information design the main objective is to provide information materials, including the intended messages, needed by the receivers in order to perform specific tasks[75]. The receivers may be seen as "doers." They may develop new skills, understanding and experience. Therefore the information designer must:

- Define the purpose and the objective of the message, always keeping the intended receivers in mind.
- Collect and review necessary facts for later use in the design process.
- Consider the use of words, images, and graphic form.

It may be an advantage to use verbs like *apply*, *arrange*, *assemble*, *build*, *change*, *code*, *complete*, *compose*, *conduct*, *con-*

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[74] Kovalik, 2004

[75] Briggs and Wager, 1989; Fleming and Levie, 1993; Pettersson, 1993; Wileman, 1993; Pettersson, 2002; Lohr, 2003; Smith and Ragan, 2005; Lipton, 2007

struct, cut, demonstrate, develop, draw, explain, find, generate, get, identify, illustrate, install, label, locate, make, modify, name, operate, pack, paste, predict, prepare, produce, put, read, recognise, reconstruct, remove, revise, sort, specify, start, type, verify, and *write* in the writing of information design objectives it may These verbs all denote observable behaviour. A few examples of performance objectives in information design may be:

- For a computer interface: 95% of the users should be able to start a new application within five minutes.
- For an exhibition: 90% of adult visitors should be able to read the texts on labels used in the exhibition without any difficulty.
- For an instruction: 90% of the customers should be able to follow the instructions, put the different parts together, and build a complete set of furniture within 15 minutes.
- For a list: 90% of the users should be able to get correct information about flight departure and arrival times within two minutes.
- For a manual: 80% of the customers should be able to install the new computer software within 15 minutes.
- For a traffic information system: 100% of motorists should recognise the signs while they are passing during night.

Of course the actual numbers, with respect to percent and allowed time, have to be decided in each specific case. Avoid subjective objectives.

However, old traditions may be hard to change. In the 1970s many researchers showed that media provided clear mes-

sages about specific gender roles. This is in fact often still the case[76]. Contents in basic textbooks in the United States still show traditional gender roles regardless of the major changes that have appeared in public opinion.

The effectiveness of a message depends on the medium, on the type of information content, and also on the amount of time that receivers are permitted to interact with the information material. There are always several opportunities to convey a message. Marsh[77] provided the following eight guidelines for selecting a visual channel for a message:

• When messages are complex.
• When referability is important.
• When messages are long.
• When environment is noisy.
• When arrangement is complicated.
• When precise spatial discrimination is important.
• When simultaneous presentation is desired.
• When more dimensions are required.

Most people believe that pictures tell the truth[78]. At the same time familiarity with the depicted objects themselves is basic and crucial to understanding[79]. The more familiar a message is to its intended audience, the more readily it is perceived.

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[76] Hunter and Chick, 2005; Sosa and Kong, 2006
[77] Marsh 1983, p. 101
[78] Lefferts, 1982
[79] Zimmermann and Perkin, 1982

The Medium

Each medium has its own particular advantages and disadvantages. Audio, text, and visuals compete for our attention. It is always important to select the most suitable medium to carry the intended message. Therefore the information designer will have to:

• Select the most suitable medium for the message.
• Produce synopsis for text, pictures, and sound.
• Adopt the graphic design to the medium.

For many years the media situation was very stable, only expanding a little each year. In the 1950s we had live media, sound media, film media, broadcast media, models and exhibitions, graphical media and telecommunications media. In the 1970s video developed into a competitive medium. At the same time the classical "borders" between the media groups began to dissolve. In the 1980s several new technologies, most based on computers, and completely new media began developing.

In the 1960s Marshall McLuhan coined the expression "The Medium is the Message." This expression has given rise to considerable confusion. Now it is often said "The Message is the Medium." Technology is the servant, and the message, the idea, is the master. However, the medium is not the message. A medium is an aid used in the transfer of information from a sender to a receiver. The term aid is used here as a collective designation for the channel, or information carrier, and the processor/equipment required for encoding and decoding of the information.

The Receivers

The smaller a group of receivers is, the greater our ability is to describe it in a reasonable fashion. More individual characteristics are manifested in large groups. The more information we have on a particular group, the greater our ability is to address this group in such a way that our messages are understood. There are literally many thousands of possible groups of receivers. Therefore it is important for the information designer to:

- Carefully define the group of intended receivers.
- Collect data about age, culture, gender, and socio-economic factors.
- When possible, consider any feedback that may be expressed by any previous receivers.

The intended receivers of a message are sometimes referred to as "audiences," "information interpreters," or "demographic groups," sometimes as "target groups," or "target populations," and sometimes as "users" (Figure 8). In extreme instances, some intended groups of receivers only consist of one or two individuals. Other groups, like a "general audience," may at the same time include millions of people. However, most target groups are somewhere in between these extremes, but certainly a lot closer to the lower end of the continuum.

Receiver processes include search and selection of information, and mental processing of information. Principles related to receiver processes include attention, perception, learning, and memory. In perceiving a message the receiver uses sensory organs and the nervous system. When a message is internalized

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the receiver has got new emotions, new experiences, new feelings, and new knowledge. Often individuals will interpret the same representation in different ways. Here age and gender, cultural, economic, historical, political, religious, and social factors may be important. The internalized message will influence the interpretation and understanding of future and related messages. Tools related to receiver processes include catalogues, directories, databases, indexes, and libraries of different kinds.

The Context

Factors inside the medium provide the inner context. In a book it is the relationships between illustrations, headings, tables, texts and other elements of graphic design. Movies and television programs have images, music, sound effects, speech, and maybe texts. The information designer will have to:

- Define the internal context of the message.
- Define the external contexts of the message.
- Define how the context may influence the interpretation of the message.

When we view a film or a television program our attention is either on the image or on the sound. This is even more obvious when we look at a multi-image slide and film presentation. As soon as the film starts, our attention is directed towards the movement in the film from the surrounding stills. It is impossible for viewers not to be influenced by the film and the moving images. Some computer programs contain advanced animations

with interaction between text, images, and even sound. The inner context is an internal context.

When we read a book or view projected images the lighting in the room may exemplify the close context. The entire communication situation, i.e., the senders and the intentions of the message, the receivers and their circumstances all provide the social context. Each context will influence the interpretation of the message. The close context and the social context are both external contexts.

When students work together on assignments they take part in a cooperative learning process[80]. Other students, teachers, the actual building, books, libraries et cetera all provide important parts of the close context which is important for efficient learning. It was found that learners construct understanding by collaborating with classmates and interacting with the various tools, visuals, and information provided within a virtual reality environment[81].

Providing Structure

At the beginning of a book the list of contents provides the reader with an easy overview of the different parts of the book. The author develops the structure of the book. Later the editor, or the graphic designer, makes the structure clearly visible for the reader using typography and layout with distinct types of headings for each level. A clear and obvious structure will facili-

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[80] Kristiansen et al., 1994
[81] Donaldson and Acheson, 2006

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tate perception, interpretation, understanding, learning and memory of the information content. Therefore the information designer will have to:

- Develop a clear structure for the content.
- Limit the number of levels in the structure.
- Show the hierarchy and structure of the content in the graphic design.

Writing processes. The physical act of writing or drawing one's thoughts with the help of a pen and paper, or a keyboard, or a mouse and a computer, does not usually require a great deal of time. It may take more time to work out how the content of the message may be divided between verbal and visual representations than to actually formulate the contents. Writing processes are relatively independent of the language used.

Message contents. Before we can design information material it is important to decide which area and which sub-areas as well as which kind of relationships we wish to describe for the intended audience. Verbal messages work well when the content of the message is analytical, detailed, logical, narrative, theoretical, and sequential. Visual messages are preferred when content is emotional, holistic, immediate, spatial and visual. For complex messages combined verbal and visual representations may be the best choice.

Structure. It is important to arrange information from the most important to the least important[82]. The information de-

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[82] Lipton, 2007

signer should limit the content and elements in the design to what your audience needs and group related information to show that it is related. Elements should be aligned with others to help the audience navigate through them.

Level of detail. Subject matter experts often spend far too much time and effort describing very small, and for them, "interesting" details because they happen to have easy access to information about these details. However, these details may be of no interest at all to the audience. Before starting to draw or write, it is important to decide which level of detail we need to work on. It is often quite important to avoid too many details.

Number of levels. Readers have difficulty understanding the organisation and structure of text when there are more than three or four levels[83]. However, in scientific and technical documentation more levels may often be required.

Typographic variation. Layout and typographic variation provides a large number of possibilities to make the structure clear[84]. The graphical form should help the reader to benefit from the contents of a document. To this end, we can easily clarify the structure of a document with a distinct table of contents and explicit headings, shown in differentiated, consistent, and well-thought-out typography. Headings, introductions, the main body of the text, and picture captions should be presented in a *consistent way* throughout the entire document. The same

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[83] Three or fewer levels (Lang, 1987; Miles, 1987). No more than four levels (Misanchuk, 1992).
[84] Tinker, 1963, 1965; Benson, 1985

applies to series of related documents. On the other hand, different types of documents can be rendered in different graphical forms. It is an advantage to the reader to be able to recognize different kinds of documents on sight, for example, a factual study book, a yearbook, a glossary, an encyclopaedia, or an instructor's guide, on the basis of the different graphical forms. Graphical form must be adapted to the various needs and special requirements of each type of document.

Colour. Colour can be used to clarify the structure of a text. Certain parts of the text may be printed with colours or printed on top of backgrounds in different colours[85]. The use of colour should be *consistent*.

Headings. Headings should be used to make the subject matter readily apparent, and indicate the relative importance of different items in the document[86]. Space and the actual placement of a heading should be used to enhance the hierarchic structure[87]. Headings in different type versions aid comprehension of the text content[88].

Providing Clarity

The *legibility of a graphical message* is determined by the technical design of texts and pictures, that is, their *clarity*. The information designer will have to make the content stand out

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[85] Pettersson, 1989, 1993
[86] Jonassen, 1982; Mayer, 1993; Cisotto and Boscolo, 1995
[87] Jonassen, 1982
[88] Jonassen; 1982; Mayer, 1993

clearly from the background. In general information materials should be as clear, simple, unambiguous and transparent as possible. We should avoid unusual typefaces, as well as fonts that are too small or too large. We read words in a text as "pictures", not letter by letter. Typeface and font size must be adapted to meet the limitations of the medium and technical production. A message has good legibility if it is easy to read, and if the reader can easily see and distinguish all different parts of the message. Legibility can be measured rather objectively and its quality is assessable whether we understand the content of the message or not. Dissatisfaction with the execution of a message may also cause dissatisfaction with the content of the message. Therefore the information designer has to consider the legibility of text printed on paper, displayed and projected on screens, as well as legibility of pictures, legibility of layout, legibility of symbols, legibility of numerals, and legibility of colours.

Legibility of Text

The concept "legibility of text" refers to a text's external properties[89]. These are properties such as letter size, inter-line distance, line length, the distance between letters, the number of letters per line, the distance between words, headings, the subdivision into paragraphs, headings in the margin, the layout, colour of the printing ink and paper, the paper quality, etc. These different external properties have not been found to have a drastic effect on legibility as long as the text is presented

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[89] Pettersson, 1993; Williams and Tollet, 1998; Lipton, 2007

within the framework of variation normally found in contemporary books. Furthermore legibility refers to production and material quality, environmental conditions, room lighting and temperature, noise level, et cetera. Principles for legibility are presented in the following sub-sections: *Legibility of Print Media, Legibility of Text on Wall Charts, Legibility of Text on Computer Screens,* and *Legibility of Projected Texts.*

Legibility of Print Media

A printed text in books, handouts, reports and other printed documents must have good legibility. Therefore the information designer will have to:

- Use clear, direct, simple and transparent typography.
- Use a common typeface, between nine and twelve Pica points, for continuous text in a book, a pamphlet, or a report.
- Restrict the number typefaces and only use a few per information material.

Typefaces

During the little more than 500 years of western printing history, probably more than 60,000 typefaces have been designed[90]. Differences are often subtle. It is not always possible to see the differences without special training. A complete assortment of characters of the same style and size is called a "font of type." We read words in a text as patterns or even as a series of "word pictures," not letter by letter[91]. The distinctive

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[90] Mijksenaar, 1997
[91] Ingvar and Hallberg, 1989; Hallberg, 1992

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details and the explicit forms of words may facilitate word recognition. The unique properties of each instruction should be a guide to selection of a suitable typeface[92].

The *Roman type style* includes most of the typefaces in modern printing. These typefaces have serifs, finishing strokes at the ends of the letterforms. Serif typefaces are often considered to be easier to read than sans serif typefaces, except for small letter sizes[93]. Baskerville, Berling, Bookman, Garamond, New Century Schoolbook, Palatino, and Times New Roman can be used successfully for the body text in books, pamphlets and reports. Modern newspaper typefaces include Gulliver, Stone, Swift, and Utopia.

Roman type style (left) and Sans serif type style (right). In this example we can compare Garamond and Geneva of the same size.

A A

Sans serif typefaces have no serifs on the characters. They provide uniform weight when there are less-than-optimal reading conditions and are often used for headings, labels in pictures, legends and tables[94]. Helvetica typefaces may be the most widely used among the sans serif typefaces in the world today[95].

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[92] Black, 1990
[93] Braden, 1985; Benson, 1985. However, Williams and Tollet (1998) suggests using sans serif type to improve legibility.
[94] Benson, 1985; Pettersson, 1993; Lipton, 2007
[95] Collier and Cotton, 1989;

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introduction

Serifs on characters make it easier to follow horizontal text lines. This word is very hard to read.

introduction

The upper parts of letters shape images of words. This word is easy to read.

introduction

Serifs are terminal strokes, normally at the top and bottom of the main strokes of letters in a Roman type style. This is type-face is called Garamond.

Generally speaking *common typefaces* are easier to read than uncommon ones[96]. Private documents may invite the use of ornate and stylish looking fonts[97]. Professional documents, however, require maximum legibility[98]. The type designer Mat-

[96] Paterson and Tinker, 1932; Tinker, 1963, 1965; Benson, 1985
[97] Lenze, 1991
[98] Benson, 1985

thew Carter created the two typefaces *Georgia* and *Verdana* for the Microsoft Corporation. They were released in 1996.

Georgia is a transitional serif typeface specifically designed for clarity. It is similar to Times New Roman, but it is larger at the same point size. Georgia has a large x-height and open and wide characters. Thus Georgia has good legibility on computer screens, even at small sizes. Times New Roman is narrow with a more vertical axis. Serifs in Georgia are almost horizontal, more blunt and wide. The Georgia typeface is very common for running text in documents at the Internet.

Verdana is a humanist sans-serif typeface for computer screens. It was specifically designed for clarity. Verdana has no serifs, large x-height as well as open and wide characters. The spacing between characters is loose. In contrast to Helvetica similarly shaped characters have emphasized distinctions. Thus Verdana has good legibility on computer screens, even at small sizes. Verdana is very useful for titles, headings, legends, and tables of various kinds but it might be hard to read in running text.

Typeface	Digit 1	Lowercase l	Uppercase I
Helvetica	1	l	I
Verdana	1	l	I

Size of Type

Our perception of size is relative. Some type looks gigantic and some minuscule. It all depends on the design of the typeface, especially its height. Traditionally the vertical height of letters is

designated in typographical *points*. However the size of such a point is somewhat different in various parts of the world. There are three basic measurement systems used for typesetting.

- The *Pica system* is used in USA and Great Britain.
  Here 1 pica = 12 points = 12 pts = 1/6 inch = .1667 inch = 4.2333 mm.
  1 pt = .3528 mm

- The *Didot system* is used in most parts of Europe (except Great Britain and France).
  Here 1 cicero = 12 points = 12 p = .1780 inch = 4.511 mm.
  1 pt = .3759

- The *Mediaan system* is used in France.
  Here 12 points = .1649 inch = 4.205 mm.
  1 pt = .3504

This is the width of 100 *Pica* points
This is the width of 100 *Didot* points
This is the width of 100 *Mediaan* points

The differences may be significant in many situations. The most common programs for desktop publishing use the Pica system, giving points as "pts." Traditional hot metal type is cast in sizes ranging from 4 point to 144 point. Photo-typesetting machines and systems for desktop publishing can produce even larger characters. Sizes of type that are in common use are 6, 7, 8, 9, 10, 11, 12, 13, 14, 18, 24, 30, 36, 42, 48, 60, and 72 points. Characters should obviously neither be too small, nor too large.

In the first case we cannot read them at all. Legibility is very poor. In the latter case we can only have a few words on each line. To achieve optimum legibility it is known that letter size must be adjusted to the visual format and the reading distance.

Height and width vary in different typefaces of the same size. Garamond (left) has lower letters than Arial (right).). The differences in the shape and size of the characters will influence legibility.

Newspaper print is usually eight or nine points. Running text in a book, a pamphlet and report that should be read in a continuous manner should be set between nine and twelve Pica points[99]. Here 40–50 characters will result in a line that is 75–90 millimetre in length. The longer the line is, the larger the type size should be. The shorter the line is, the smaller the type size can be. The x-height is important. Typefaces with large x-heights manage well with smaller type sizes than typefaces with small x-heights.

In books, magazines, and newspapers larger type may be used for headings. Below are some examples of the word "information" in five size versions: Helvetica 18, 24, 28, 36 and 48 points type.

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[99] Braden, 1985; Benson, 1985

information 18

information 24

information 28

information 36

information 48

Which type sizes do you prefer for different headings in a book and in a technical report?

Stylistic Variation of Type
With respect to width and line thickness a character can be designed in different versions. A typeface may be available as light condensed, light, light expanded, bold condensed, bold, bold expanded, regular condensed, regular, regular expanded, extra bold condensed, extra bold, and extra bold expanded. With respect to inclination a typeface may be designed in italic letter style versions. A typeface may also be available as out-lined, in-lined, and shadowed. The "visual weight" varies. It may be compared with physical weight.

Regular type. A typeface is often available as regular, bold, italic, and bold and italic.

Italic type. A typeface is often available as regular, bold, italic, and bold and italic.

Bold type. A typeface is often available as regular, bold, italic, and bold and italic.

Bold and italic type. A typeface is often available as regular, bold, italic, and bold and italic.

Often text is printed with black ink. However text may also be printed in a number of colours. This is especially easy in documents for the Internet. The use of colour will influence impressions as well as legibility. White text on a black background should usually be larger than traditional black text on a white background. Fine lines in a Roman type style may sometimes almost "disappear." It is better to use a sans serif type when the text is white on a black background.

Regular type is easier to read than uncommon type. Boldface or italics should normally not be used for continuous text. Italic print is read more slowly than regular type and is also disliked by many readers[100].

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[100] Tinker, 1965

Make type big enough to stand out from the background and heavy enough to be visible[101]. Underlining in the middle of a sentence makes the lower line more difficult to read[102].

Line Length
It is easy to change the *length of lines*. The length of a line will affect reading speed[103]. The longer the lines the wider the vertical space between them needs to be[104]. Readers tend to dislike both very short and very long lines. Tinker[105] made extensive studies of typography. He worked with characters in sizes of nine to twelve Pica points and recommended ten to twelve words per line. This results in a line length of eight to ten centimetres. There are, however, several other recommendations of line length. Quite often the optimum line length seems to be about 1 1/2 alphabets – 42 characters[106].

The optimum line length is nine to eleven centimetres with optimum character size, ten to twelve points, at a normal reading distance. A text column may be widened up to 120–130 millimetres to accommodate more text, and still be easy to read for an experienced reader. It is quite clear that too wide lines impair reading.

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[101] Lipton, 2007
[102] Isaacs, 1987
[103] Duchnicky and Kolers, 1983
[104] Waller, 1987
[105] Tinker, 1963
[106] Pettersson, 1989; Walker, 1990. Other suggestions: 35–40 characters (West, 1987), 40–50 characters (Lipton, 2007), 50 characters (Parker, 1988), up to 60 characters (Zwaga, Boersma and Hoonhout, 1999), 60–65 characters (Miles, 1987).

Too short lines

Readers tend to dislike both very short and very long lines. Quite often the optimum line length seems to be about 1 1/2 alphabets — 42 characters.

Short lines

Readers tend to dislike both very short and very long lines. Quite often the optimum line length seems to be about 1 1/2 alphabets — 42 characters

Optimum line length

Readers tend to dislike both very short and very long lines. Quite often the optimum line length seems to be about 1 1/2 alphabets — 42 characters.

Long lines

Readers tend to dislike both very short and very long lines. Quite often the optimum line length seems to be about 1 1/2 alphabets — 42 characters

In my opinion the maximum line should not have much more than 60–70 characters. This is except for books intended for highly skilled readers. The optimum line length should be found for each individual purpose and each audience. Costs of-

ten force people to use more characters on each line, so that the total number of pages can be reduced.

Justified or Unjustified Text?

A text may be justified or unjustified. An unjustified text may be flushed left, centre justified or flushed right. There are some advantages and some disadvantages with each system. A number of authors argue that *justified text* is aesthetically pleasing and that it is easier for people to read lines of the same length than reading lines with markedly varying right-hand ends[107]. Readers may even feel that ragged right-hand lines in flushed left text make an ugly and repulsive text column. If justified text is set in lines too short, there will be "rivers of space" between words, or characters spaced out to fill the lines.

At the same time other authors argue that *flushed left text* is a much better choice[108]. The exact spacing between letters and between all the words in unjustified text retains the optimal spacing between letters and between words and so keeps the visual rhythm constant. This aids reading, especially for young, inexperienced and poor readers[109]. Results from reading experiments of justified and unjustified texts indicated a significant increase in reading time for the groups that read justified texts. There were, however, no differences in comprehension[110]. Whether a text is justified or unjustified causes no significant difference in search time and comprehension of the information

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[107] Lang, 1987; Lichty, 1994
[108] Hartley, 1994; Misanchuk, 1992
[109] Zachrisson, 1965; Gregory and Poulton, 1970
[110] Trollip and Sales, 1986

content for advanced readers[111]. Until recently most publishers regarded the use of anything other than justified text as unprofessional. Today, however, unjustified text is commonly used for running text in books, magazines, reports, and in some newspapers.

Flushed left text

A text may be justified or un-justified. An unjustified text may be flushed left, centre justified or flushed right. There are some advantages and some disadvantages with each system.

Justified text

A text may be justified or un-justified. An unjustified text may be flushed left, centre justified or flushed right. There are some advantages and some disadvantages with each system.

Centre justified text

A text may be justified or un-justified. An unjustified text may be flushed left, centre justified or flushed right. There are some advantages and some disadvantages with each system.

Flushed right text

A text may be justified or un-justified. An unjustified text may be flushed left, centre justified or flushed right. There are some advantages and some disadvantages with each system.

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[111] Hartley, 1987

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Centre justified texts are often used for menus, quite often used for poetry, and it is sometimes used for short legends. Centre justified texts are also used for tables of contents. In films and in television programs the participants are usually listed centre justified.

Flushed right texts can be used for legends that are positioned to the left of the pictures, and for tables of contents. This is, however, only possible when the line length is short. Regardless of justification system the ends of sentences should be determined by syntax rather than by an idea of a set width of line[112].

Interline Distance

The interline distance, interline spacing, line space, or vertical spacing is the vertical distance between the baselines in a text. A 10-point text may be set on a 12-point line in Times. This is written as 10/12, and read as "ten on twelve." The term "leading" refer to the extra space between the lines, the "line–to–line" spacing. In this example the interline distance is 12 points, and thus the leading is two points. Leading is important for legibility. The longer the lines, the larger the vertical distance should be. The reader needs to be able to find the start of the next line without any trouble. In general, the opinion is that as the line length increases, the need for more leading and larger type increases[113].

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[112] Hartley, 1980; Bork, 1982
[113] Pettersson, 1989; Misanchuk, 1992; Lipton, 2007

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Text leading should be open enough so the readers don't lose their place, straying into lines above or below them while trying to focus on one. For maximum legibility[114] of the running text in a book a leading should be between one to three points when text size and line length are optimal. Texts on wall charts, overhead transparencies, slides and computer screens need more space between the lines. Children and inexperienced readers need more leading than experienced readers. Typefaces with small x- heights manage well with less leading than type-faces with large x-heights. Generally speaking, one can use the type size plus 15–30% to determine this ratio.

Spacing
Space between words and between letters varies in each line. First the computer system adds "word spacing" and then, if the space between words becomes too excessive, the system will add "letter spacing." Visual design should be based on perceptual, rather than on physical phenomena. The distance between words shall be smaller than the distance between lines, and lar-ger than the distance between characters. Space between ele-ments should be used as a legibility tool[115]. Space between let-ters in text should not be too loose, or too tight. When a capital A and a capital V are set together there is too much space be-tween the letters. With *kerning* selected pairs of letters can be pushed together and overlap to create a better optical visual spacing between the letters. Kerning is important for headings

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[114] Tinker, 1963; Benson, 1985; Hartley, 1987; Kleper, 1987; Lichty, 1989; Pettersson, 1989, Lipton, 2007, p. 124
[115] Lipton, 2007, p. 122

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in books, handouts, pamphlets, reports and other printed documents, and also for texts on OH transparencies and wall charts. It isn't worthwhile kerning any type under 18 points[116].
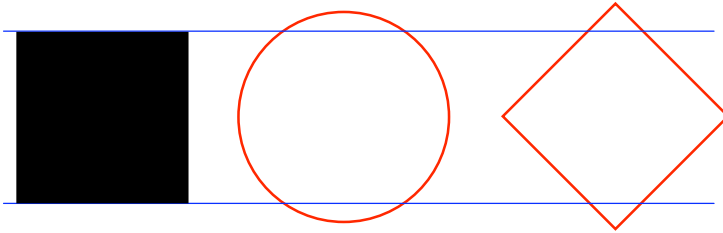
Rounded and acute shapes appear too low relative to a rectangular or square. They need to be extended in order to appear to be of equal height relative to a square.

Legibility of Text on Wall Charts
A wall chart must have good legibility. The information designer should:

- Set text bold and large enough, adjusted to the reading distance.
- Use lower case letters and avoid all-capital printing for running text.
- Restrict the number typefaces.

Posters and wall charts shall be read from some distance. Therefore text should be large enough[117], and bold enough[118].

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[116] Hewson, 1988

[117] Ormrod, 1989; Pettersson, 1993; Wileman, 1993

[118] Mayer, 1993; Pettersson, 1993; Wileman, 1993, p. 79

Too small or too large lettering will impair reading. The text on a poster or a wall chart may often have to be ten times larger in size than a text in a book or on a print out. Text should be set in lower case letters, because all-capital printing has been shown to markedly reduce the speed of reading[119]. Since the texts on posters and wall charts should be short it may be a good idea to use a sans serif typeface like Arial, Helvetica or Verdana. If so the running text will need some extra space between the lines[120].

Legibility of Text on Screens

Compared with traditional graphic presentations, a presentation of information on visual displays such as television sets and computer terminals is very limited. Still, information may be presented in many different ways. The design may vary with respect to spatial organization like directive cues, colours, columns, headings, justification, lines, scrolling text, spacing, and twinkling characters or words. A text on a computer screen must have good legibility. The information designer should:

• Use typefaces designed for screen display.
• Use black text on a white or yellow background.
• Avoid the use of all capital letters.

The quality of visual displays is important for our perception. Colour as well as blank space are essentially free and might be used to increase legibility. Experiments with 11,000 judgments

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[119] Poulton and Brown, 1968; Henney, 1981
[120] Collier and Cotton, 1989

of perceived reading efforts of text on visual displays[121] showed that colours presented on colour displays are ranked in the same order as surface colours in traditional print media. Blue was most popular. The best combination is black text on a white or yellow background. Black was also the best background colour, because it has good contrast to most text colours. However, the background colour of a computer screen should be "fairly light" or "fairly dark," depending on the content[122]. The text displayed on a screen should have an opposite ("fairly dark" or "fairly light") colour.

The most important consideration when working with typography and colour for computer screens is to achieve an appropriate contrast between text and its background[123]. They wrote: "It has long been considered that black type on a white background is the most legible (combination). While this combination remains an excellent choice, other alternatives may offer equal if not improved legibility due to improved digital and printing technologies, and the fact that colour is a relative phenomenon. ... Generally, all legibility guidelines related to working with colour and type in print apply also to type appearing on a computer screen." It is also important to use typefaces specially designed for screen display, such as Trebuchet and Verdana[124], and also Georgia.

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[121] Pettersson et al., 1984a
[122] Bradshaw, 2000
[123] Carter, Day and Meggs, 2007, p. 80
[124] Hoffman, White and Aquino, 2005

Subjects generally prefer reading text on paper to reading electronic text on a screen[125]. In one experiment proofreading of text from print on paper was 20-30% faster than proofreading from computer screens[126]. Subjects dislike fast scrolling text on computer screens[127]. For maximum legibility on a computer screen double spaces should be used between lines in a continuous text[128]. Blinking and flashing text can be used as an accenting[129].

Legibility of Projected Texts

In verbal presentations, many of the overhead transparencies, slides, filmstrips, and projected computer presentations (such as PowerPoint) consist mainly, or sometimes only of text. Here lettering must be considered carefully in order to guarantee good legibility for all listeners. In preparing the material the information designer should:

- Use no more than six rows of six words in each image, set in a linear typeface, with characters large and bold enough.
- Maintain a good contrast between foreground and background.
- Avoid graduated and tonal background fills.

Before the presentation the presenter will need to reduce room illumination and clean slides, lenses, and screens. During the

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[125] Wright and Lickorish, 1983; Dillon and McKnight, 1990
[126] Gould and Grischkowsky, 1984
[127] Kolers, Duchnicky and Ferguson, 1981; Burg et al., 1982
[128] Kolers, Duchnicky and Fergusson, 1981; Grabinger, 1989
[129] Rambally and Rambally, 1987

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presentation it is important to really project the images in focus and on the screen, preferably horizontally. Also see the section "*Slides and PP."*

Legibility of Pictures

Pictures must have good legibility in all kinds of information and learning materials. The information designer should:

- Use picture elements that are bold and large enough.
- Use a style guide for picture elements in schematic pictures.
- Set words in images and pictures bold and large enough to read.

A "good" visual has a high level of picture quality. It is well worth reading and is executed so as to be legible and readable and be displayed in an optimum context in an appropriate format. The visual should convey information without ambiguity. It should be stylish and attractive, and is often, but not necessarily, also aesthetically pleasing. A schematic drawing has good legibility if it is easy to read, from the viewpoint that the reader should easily be able to see and distinguish all the different parts of the schematic picture.

A "poor" visual has a low level of picture quality. It displays poor legibility and poor reading value. It conveys information poorly, is seldom aesthetically pleasing, and often ambiguous. Graphics and schematic pictures can help readers see and comprehend complex patterns[130]. All kinds of visuals should contain

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[130] Horton, 1991

essential information and have a good contrast between figure and ground.

Legibility of Layout

An "informative layout" must have good legibility. Therefore the information designer should:

- Use standard page sizes with standard grids for pre-planning of pages.
- Use a clear and simple layout.
- Use arrows, bullets, lines, and symbols in various colours; also margin notes, repetition, and space to highlight relevant information.

The purpose of work with graphic design is to find a suitable presentation for the content with respect to the receiver, the subject matter, the medium, and the financial situation. A layout is the result of work with graphic design. Within a given area, such as a page in a book, a poster, a label, a computer screen, or a projected image the designer may alter the design of headings, margins, ornaments, pictures, space, symbols, and text. Deliberate typographic variation is used to present the content in the text in a clear way.

The observations on which the "Gestalt theory" is based form a basic part of the graphic designer's craft knowledge[131]. These principles might be seen as relatively inflexible "perceptual rules" that act as a fundamental constraint for the typogra-

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[131] Waller, 1987

pher alongside such conventional rules as the left-to-right direction of the writing system.

The page. For reports, and similar documents, it is reasonable to use one, two, or three columns on the page[132]. In multi-columnar layouts the narrow columns should have unjustified lines[133]. In a justified text the distances between the words are too long, creating white "rivers" of space in the text columns. Consistent use of columns will help to establish a regular pattern throughout a project[134]. There are many possibilities for placement of the page numbers. They should be clear and easy to find. Usually readers are likely to look for page numbers in the margin at the bottom of the page[135]. However, this should not to be considered a rule.

Headings attract the attention of the readers, make the subject matter readily apparent, and indicate the relative importance of items. In order to increase the contrast it is a good idea to use larger as well as bolder type when headings are printed in colour. Headings on different hierarchic levels will provide the readers with reference points and help them organize information cognitively for better retention and recall. Headings shall be placed above and close to the following text. This distance shall be smaller than the distance to the previous paragraph[136].

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[132] Hartley and Burnhill, 1977a, 1977b
[133] Davies, Barry, and Wiesenberg, 1986
[134] Lipton, 2007, p.120
[135] Lipton, 2007, p. 134
[136] Pettersson, 1993; Lipton, 2007

Legends. In information design the main function of legends (or captions as they also are called) is to help the reader select and read the intended content in the picture. We need to tell the readers what we want them to see and learn from the illustration[137]. Thus pictures in information materials should always have legends. This is the only way to assure that information conveyed by these pictures is clear and unambiguous.) Photographs nearly always need a partnership with words that will confirm, clarify and reinforce their messages[138].

Each picture should have a legend, unless two pictures or a series of pictures are closely together. A legend may be placed in many ways. The legend should always be located close to the picture. Readers usually expect to find the legends beneath the pictures. However, legends can also be placed above, to the left, or to the right, of the picture, but never inside the picture frame.

The legend and the picture should interact as parts of a whole. A legend can have a heading as an additional link between the picture and the legend. A good *legend title* provides a short summary of the combined information. The title of a legend should be short and distinct. The legend should have a different typographic size or even a different typeface so it can be easily distinguished from the main text. The legends should not be in negative form in a colour picture since the slightest misalignment in printing makes the legends extremely difficult to read. Never make the legend type larger than the main text. The title of the legend could be printed in boldface.

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[137] Pettersson, 1989, 1993; Winn, 1993
[138] McDougall, 1990, p. ix

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Space and margins. Space is an important tool in typography[139]: "It is space that separates letters from each other. It is space (with punctuation) that separates phrases, clauses and paragraphs from each other; and it is space (with headings and sub headings) that separates subsections and chapters from one another." Consistent spacing in a document will help the readers to:

- Increase the rate of reading because they are more able to see redundancies.
- Access the more personally relevant pieces of information.
- See the structure of the document.

The text-face is surrounded by margins: a header (or top margin) and footer (or bottom margin), an inner and an outer (or outside) margin. They provide space for comments, headings, illustrations, page numbers and personal notes. Margins also provide space to hold a document while reading it. Headings, margins and "empty" space can be used to aid communication when used in a consistent way[140]. A general guideline may be to make all margins one inch on a standard page[141]. However, margins vary a lot. In one study of right hand pages top margins

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[139] Hartley, 1985, p. 27
[140] Hartley and Burnhill, 1977a, 1977b.
[141] Bradshaw and Johari, 2000. According to Hartley (1985, 1994), Lichty (1989, 1994), Misanchuk (1992) margins should occupy 40–50% of a standard 8 1/2" x 11" page. Burns, Venit, and Hansen (1988) call for even larger margins.

varied between 14 – 35 millimetres[142]. The variation was 6 – 53 for the right margins, 14 – 34 for the bottom margins, and 8 – 28 millimetres for the left margins. The biggest variation was almost nine times. With very thick books, the part of the page that is bound will have a section that we cannot see. Thus, thick books need to have wide inner margins.
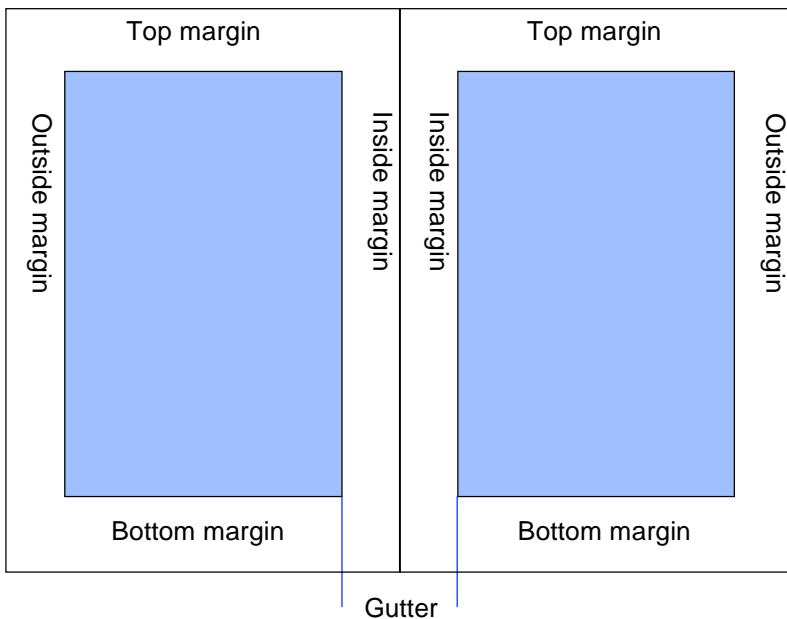
The classic model for page design creates very large margins.

Slides and PP. According to the standard for OH, overhead transparencies, SIS 62 23 01 SD A4L, the actual plastic film is 210 x 297 mm. The picture surface is 190 x 245 mm, which is a height-to-width ratio of 1:1.289. Administrative data are put in the 35 mm right margin. The top margin is 15 mm, bottom margin 5 mm and left margin 17 mm. In some organizations there is a need for more administrative data, such as logotype and/or name of the organisation, name of author, document name, security classification, revision, publication date and document number. These data are put in the bottom margin. Here the picture surface may be 170 x 270 mm, which is a height-to-width ratio of 1:1.588. In PowerPoint the height-to-width ratio is 1:1.328. The size of the image can be adjusted to the situation on the computer screen.
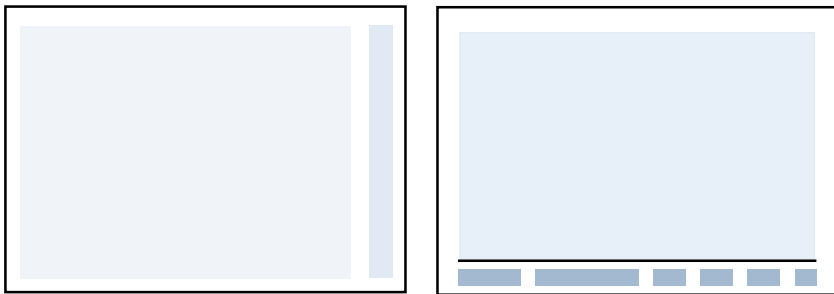
The layout to the left is the OH-standard SIS 622301 SD A4L. The layout to the right is used in some organizations. This layout can also be used for PP and other similar systems.

PowerPoint is a competent slide manager and projector[143]. But rather than supplementing a presentation, PowerPoint has become a substitute for it. People strongly overuse all kinds of PowerPoint-visuals in their presentations[144]. The use of word visuals in presentations has reached alarming proportions. The overuse of word visuals actually hinders audience comprehension of the message[145]. This is an acute problem in medical presentations.

Legibility of Symbols

The use of symbols has a long tradition and various symbols can be used to aid communication. The information designer should:

- Use distinct colours and simple graphical elements to design symbols that will function in any size.
- Design solid figures with a distinct contrast to the background.
- Use characters and graphical elements that are bold, distinct and large enough.

A clear and stable figure to ground articulation is essential in graphic symbols[146]. The figure ("foreground") should be organised as one unit with close boundaries, appropriate line thickness and any other graphical means that help the visual system

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[143] Tufte, 2003.
[144] Tufte, 2006.
[145] Griffin, 2009.
[146] Easterby, 1970; Dewar, 1999.

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to organise the figure as one unit. Criteria[147] for individual symbols or sets of symbols depend on their application. It is appropriate to use silhouette (side) views of certain components such as vehicles.

Legibility distance is essential in the case of traffic signs and many building signs, but not for symbols on maps or consumer products. Black text on a yellow background is superior as compared to white on black, white on grey and black on white[148]. Complex warning messages need a combination of pictographs and words[149]. Warnings must have high contrast relative to the background[150].

Legibility of Numerical Values

Numerical data and information can be presented in tables and in graphs. A table in an information material must have good legibility. Therefore the information designer should:

Tables
- Use type between 8 and 12-point size for table cells.
- Use vertically oriented tables.
- Use rounded off numbers.

Graphs
- Compare lengths of variables to show their relationships.
- Compare areas of variables to show their parts of a whole.

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[147] Dewar, 1999
[148] Waller, 2007
[149] Dewar and Arthur, 1999
[150] Barlow and Wogalter, 1991; Sanders and McGormick, 1993

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• Use actual figures in graphs when accuracy is needed.

Several researchers have studied design of tables aimed for the general public and other non-professional audiences. Generally speaking type size used in tables should be between 8 and 12 points[151]. Readers prefer vertically oriented tables where it is easy to see the target entries, and then quickly find the data in the table cells to the right[152]. It is easy to compare "side by side." Horizontally oriented tables are harder to use and more difficult to understand[153]. It is complicated to compare "up and down." Tables may show the maximum of amount of information in the minimum amount of space. However, tables are not always the best way to communicate numerical data.

In *friendly graphs[154]*, words are spelled out, they run from left to right (in western societies), and data are explained. Elaborately encoded shadings, cross-hatching, and colours are avoided. Colours are easy to distinguish, type is clear and precise, and is done in upper and lower case with serifs. In *unfriendly graphs*, abbreviations abound, words run in many directions. Graphics are repellent and cryptic with obscure coding. The design is insensitive to colour-deficient viewers Red and green are used for essential contrasts, and type is clotted and in all capitals in sans serif.

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[151] Tinker, 1963; Wright and Fox, 1972, p. 241.
[152] Wright, 1968; Wright and Fox, 1972; Ehrenberg, 1977
[153] Wright, 1968; Wright and Fox, 1972
[154] Tufte, 1983; 1990

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Legibility of Maps

Maps must have good legibility. Therefore the information designer should:

- Use bold and distinct symbols in a consistent size.
- Restrict the number of typefaces and complexity of patterns.
- Provide distinct contrast in form and dimensions.

A graphic language used on maps[155] consists of visual variables. The most important variables are position and place, form (of symbols), directions, colour, density or greyness, granularity or texture, and size of symbols. A variable can be a dot, a line, or an area. Discriminatory responses to map symbols[156] depend on contrast in *form, dimension,* and *colour*. The problem of discrimination is generally more critical in monochrome maps, in which only contrasts in form and dimensions are possible for lines and small symbols.

The use of colour on maps introduces a large number of variables, which may enhance contrast, and therefore extend the number of perceptual differences that can be employed in discrimination. The effect is to *aid legibility*, and therefore to increase the total range of information which the map can present. Shape and colour components are often used for designating a link or relationship between groups of messages. The recognition of geographical features is much enhanced when areas are differentiated by hue. At the same time, complex colour arrangements may raise problems in discrimination, so that

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[155] Bertin, 1967; Baudoiun and Anker, 1984
[156] Keates, 1982

although multi-colour maps enlarge the graphic possibilities, they also increase the probability of errors in the judgment of discrimination. The most common case of quantitative judgment on maps occurs in the use of proportional symbols, that is, point or line symbols constructed to represent specific quantities.

Legibility of Colour

Colours used in information materials must have good legibility. Therefore the information designer should:

- Use a light or a dark background colour appropriate to the content, and then use a colour with good contrast for the figure or text.
- Make sure that differences between colours are clear and obvious.
- Combine colours with shape in warning signs.

As previously colour is regularly used in printed materials, not only in illustrations, but also in the text itself. The most legible combinations of print colours are black or dark brown text on a light yellow background[157]. Black type on a white background gives the highest and most comfortable contrast for sustained reading[158]. Other combinations may attract more attention but are less legible and, thus, require larger type. The legibility will

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[157] Pettersson et al., 1984a; Pettersson, 1989
[158] Bradshaw, 2000; Lipton, 2007

always be affected when there is insufficient contrast between the type and the background.

The background colour of a computer screen should be "fairly light" or "fairly dark," depending on the content. The text displayed on a screen should have an opposite ("fairly dark" or "fairly light") colour[159]. The most legible colour combination is black text on a white or yellow background[160].

Unfortunately, red and green are often used as discriminating colours in symbols and in warning signs. Since many colour-blind people perceive red and green as grey, colour can only be used to code the information redundantly. Colour may be combined with shape, and position, or with both, which is often seen in traffic signs.

Providing Simplicity

Readability is determined by how well the contents and the presentation of the contents are adapted to the readers. Today readability of a message involves the reader's ability to understand the style of text, the style of pictures and the style of graphical form. The choice of words, symbols, and picture elements creates the style. The readability is determined by content and formulations, and how well the language and style are adapted to the readers.

There is a close relationship between guidelines that are aimed at providing *simplicity* and guidelines that are aimed at

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[159] Bradshaw, 2000
[160] Pettersson et al., 1984a

facilitating perception, processing and memory. Simplicity in a message will result in easier and more efficient perception, processing and memory of that message. The information designer has to consider the readability of text, the readability of pictures, as well as the readability of graphical form. Providing simplicity in text, illustrations, and graphical form is probably one of the most important principles in information design. It should be a priority for the information designer to make use of the guidelines related to these areas.

Readability of Text

Originally the concept readability stems from education research concerned with the selection of reading material for children of different age groups[161]. Now readability[162] refers to the ease of understanding due to the construction of the text, including the length of words, sentences, paragraphs and the "style of writing." The style of text is decided by the specific choice of words, consistency, and expressions. Abstract words, jargon, long and complex sentences, passive constructions, and stilted language may obstruct reading and understanding of the text content. Furthermore readability refers to the reader's reading skill and interest and how easy it is to read long passages of text[163].

Research into readability has been directed towards finding the characteristics that make texts easy or difficult to under-

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[161] Sevrin and Tankard, 1988, p. 70
[162] Pettersson, 1989; Lipton, 2007, p. 10
[163] Williams, 1994; Williams and Tollet, 1998, p. 214

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stand. Long words and long sentences make a text difficult to read. The number of words in a sentence appears to exert the strongest effect on reading rate and reading comprehension[164].

An easily comprehensible text is characterized by short sentences, short words, and simple sentence structure. Text should be concise, consistent and precise. Other variables which affect the comprehensibility of text are the vocabulary's degree of abstraction, the number of syllables in words, the commonness of words used, the choice of subject, the subdivision into paragraphs, the prevalence of clauses, headings and sub-headings, line length, inter-line distance, illustrations, the size of letters, the relevance of the text to the reader, and the page size. Principles for readability of text are presented in the following subsections: *Readability of Print Media*, *Readability of Text on Wall Charts*, *Readability of Text on Screens*, and *Readability of Projected Texts.*

Readability of Print Media

Texts for information materials must have good readability. Language as well as the style should be correct to avoid distracting the readers. The information designer will have to:

- Use an active voice and avoid too many details.
- Use a style guide and make the message comprehensible for the intended receivers.
- Make an overall check of language, writing style and terminology before the script can be confirmed as an original.

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[164] Catalano, 1990; Newell, 1990

Active, affirmative, clear, declarative, essential and short words in simple, short and precise sentences are the most readable[165]. People may avoid materials that they find difficult and pompous. Readers prefer small text paragraphs to big ones. Often it is quite easy to divide the text in hierarchic and natural parts, portions, or sections. Natural breaks emphasized by typography are helpful. Providing "white space" between portions of the text provides cues to the learners that a new section or a new type of activity follows. The end of a sentence should be determined by syntax rather than by a set width of a line[166].

There are a large number of style guides and publication manuals available. Usually such documents outline standards for design and writing for a specific publication or organization. For example all *journalists* working at *The Economist* are given a stylebook. A condensed version is available on the Internet. Many *editors* may use other well-known style guides like *The Elements of Style*, *The Chicago Manual of Style*, *Fowler's Modern English Usage*[167]. *The Chicago Manual of Style Online* is an online style guide. *Technical writers* have several sources for good advice[168].

Like language itself, many style guides change with time. Therefore they are updated on a regular basis. *Researchers* in human centred areas of research may consult the *Publication*

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[165] Klare, 1985; Lipton, 2007
[166] Hartley, 1980; Bork, 1982
[167] *The Economist* (The Economist, 2003), *The Elements of Style* (Strunk and White 2000), *The Chicago Manual of Style* (2003), *Fowler's Modern English Usage* (2004)
[168] Kirkman; 2003, 2005; Klare, 1985; and Young, 1989

Manual of the American Psychological Association[169] for valuable advice when they want to publish their results in academic journals and conference proceedings.

All those who want to make a contribution to *Wikipedia*, a free online encyclopaedia, can find advice in the *Manual of Style,* a style guide that aims to make the encyclopaedia easy to read, write, and to understand[170]. There is probably a suitable style guide available for everyone. However, it should be noted that there are some style guides that focus on clarity and legibility with guidelines on typography and layout rather than on readability. Furthermore web site style guides focus on a publication's visual and technical aspects, best usage, grammar, prose style, punctuation, and spelling.

When we design information and learning materials, it is very important that the materials are reviewed and approved by people with expert knowledge in the appropriate fields. The effort put into training and learning may actually give a negative result, and the learner may end up less competent than before the learning experience. This may happen when he or she uses information and learning materials that has poor readability of text and pictures, and therefore is hard to understand.

The structure of text should be as clear as possible. Structure can be divided into internal and external textual structure. Internal structure is built into the text itself. External textual structure relates to the embedded strategies, which focus a

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[169] American Psychological Association (2001)
[170] Wikipedia (2007)

learner's attention on particular parts of the text[171]. In many scientific and technical reports it is a good idea to put series items in bulleted lists rather than in paragraphs.

Readability of Text on Wall Charts

A wall chart must have good readability. The information designer should:

- Edit the text into sections that are easily read.
- Check the spelling!
- Use headings and other text elements in a consistent way.

General design rules should be employed also in the design of text on wall charts. These guidelines are similar to those for readability of text on screens and readability of projected texts. Wall charts used to be a fine complement to textbooks. During the 20th century filmstrips, slides, overhead transparencies superseded wall charts. Later computer assisted presentations superseded these AV-media. Compared with traditional graphic presentations, a presentation of information on wall charts is very limited. Usually people are not willing to read long text passages.

Readability of Text on Screens

For graphic presentations on visual displays such as television sets and computer terminals the information designer should:

- Display data so that it is easy to read.
- Recognize cultural differences.

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[171] Jonassen and Kirschener, 1982

- Use a "normal" combination of upper and lower case letters..

General design rules should be employed also in the design of text on screen displays. These guidelines are similar to those for readability of text on wall charts and readability of projected texts. Design may vary with respect to headings, length of lines, justification, spacing and number of columns. Colour as well as blank space on a visual display are essentially free and might be used to increase legibility and readability. All capital letters, *caps*, are harder to read than a "normal" combination of upper and lower case letters[172]. Words become difficult to read which will reduce the speed of reading.

Readability of Projected Texts
In verbal presentations, many of the overhead transparencies, slides, filmstrips, and projected computer presentations consist mainly, or sometimes only of text. In preparing the material the information designer should:

- Consider the use of lists.
- Be careful in the use of acronyms.
- Restrict stylized and fancy typefaces to opening frames.

General design rules should be employed also in the design of projected texts. These guidelines are similar to those for readability of text on wall charts and readability of text on screens. We should not display frames longer than it takes to explain the contents. Always restrict the number of words. Text transparen-

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[172] Tinker, 1965; Kinney and Showman, 1967; Poulton and Brown, 1968; Henney, 1981

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cies are useful for the speaker but may be very boring to the audience. It is also very boring when there simply are too many spelling mistakes. Check the spelling once more. It is a good idea to put the necessary identifications data on each transparency, each slide and each computer file.

Readability of Pictures

Pictures in information and learning materials must have good readability. Therefore the information designer should:

- Write legends to explain pictures.
- Choose illustrations carefully and use visual sequencing techniques to present complex ideas.
- Leave out needless pictures and picture elements and avoid excessive image detail.

The *style of illustration* is decided by the specific choice of drawings, photographs, schematic pictures, and other kinds of pictures, as well as consistency, expressions, picture elements, and symbols. Images can be readable in the sense that they inspire cognitive and affective processing. A drawing style that includes many different kinds of lines, patterns, shadings, and inconsistent use of symbols may obstruct the reading and understanding of the picture content.

A schematic picture has good readability when it is easy for the reader to understand the message. Readability of pictures is governed by the functional properties of picture variables. *In-*

structional illustrations have good readability[173] when the subject matter and pictorial conventions are familiar to the audience and depicted in a realistic manner in illustrations lacking excessive image detail that may distract from the main message.
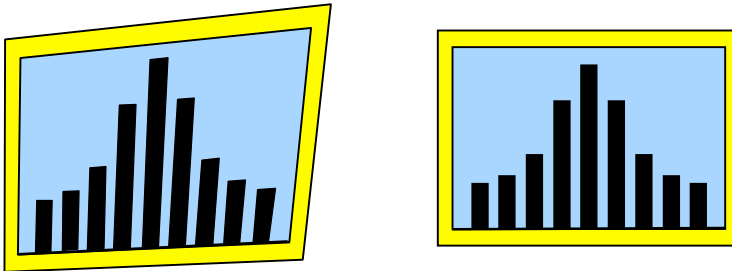
This situation (left) is far too common in Power Point-presentations. The second picture (right) is projected in a correct way.

Depiction of contents. An analysis of a photographic portrayal can identify positive and negative depictions of individuals seen in the photographs[174]. Individuals are viewed more positively when they are shown walking, running or moving than just sitting or standing[175]. Visuals with varied degrees of realistic detail can be used to reduce differences in the performance of learners with different levels of prior knowledge of the subject matter[176].

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[173] Lent, 1980
[174] Moriarty and Garramone, 1986; Wanta and Chang, 2000
[175] Moriarty and Popovich, 1991
[176] Dwyer, 1994

Legends and visuals should interact as parts of a whole and integrated message. Legends should be written with great care. They heavily influence our interpretation of image content. It is possible to interpret most pictures in several different ways until they are "anchored" to one interpretation by a legend[177]. The only way to assure that information conveyed by pictures in information materials is clear and unambiguous is to write a legend for each picture and tell the reader what to see[178].

A printed photo is, in fact, past tense bud legends are usually written in present tense to immediacy[179]. However, when an activity must be explained, present tense and active verbs are appropriate. The legend should be brief and easy to understand. A general reader knows little, if anything, about the subject matter. The legends and the pictures are kept simple, attractive, and informative. They should not be too complicated and, thus, distracting to the reader. A technical reader will understand technical concepts but may not be familiar with special terminology. A specialist reader has a good understanding of the subject matter. Both the text and illustrations, which may consist of detailed drawings, graphs, technical photographs, ultrasonograms, or other realistic pictures or symbols, may be detailed.

Effectiveness. Most people believe that pictures tell the truth[180]. The effectiveness of a visual depends on the medium,

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[177] Barthes, 1977; Pettersson, 1987, 1990;
[178] Zimmermann and Perkin, 1982; Bernard, 1990
[179] McDougall, 1990, p. 134
[180] Lefferts, 1982

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on the type of information, and also on the amount of time learners are permitted to interact with the material[181]. Increasing the size of illustrations by projecting pictures does not automatically improve their effectiveness in facilitating the achievement of the learners. Also language and cultural differences may impact the effectiveness of visuals[182]. Furthermore it is also known that stylized and "simple" pictures are more effective than complex pictures[183].

Usefulness. Picture readability is positively correlated with both the aesthetic rating and usefulness in teaching. The aesthetic rating and assessed usefulness in school were also strongly correlated[184].

Picture readability indexes. I have developed a "Picture readability index"[185] (BLIX). Values range from 0 to 5. A BLIX-5 picture: 1) is executed in a true-to-life colour/ has a clear contrast and grey scale in the picture. 2) Has a shape other than a square or a rectangle or covers an entire page. 3) Has a legend which is brief, easy to understand, and deals with the picture. 4) Is unambiguous and not too "artistic". 5) Has a dominant centre of interest at or near its optical centre (middle of the picture) and few details, which can be regarded as distracting. Picture readability is positively correlated with both aesthetic rating and usefulness in teaching.

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[181] Dwyer, 1972
[182] Kovalik, 2004
[183] Melin, 1999b
[184] Pettersson, 1983
[185] Pettersson, 1989

A "Photograph readability index" (PRI)[186] was developed a few years later. This index refers to the success of the image as defined by its objective or legend. It may be used to evaluate photos in textbooks. The initial phase gathers information on how a viewer perceives a photograph during an initial brief period, that is, at a first glance. The latter phase entails extended exposure to the photograph and endeavours to reveal how a viewer encodes information while being influenced by a legend. Later[187] the PRI utilizes an interdisciplinary battery of methods adapted from the fields of cognitive psychology, linguistics, reading of text, semiotics, and visual literacy.

Readability of Layout

The style of the graphical form is decided by the specific choices of typefaces for headings, running text, legends, and also the use of justification, number and placement of columns, number and placement of pictures and tables, the use of colour cues, et cetera. All informative layouts must have good readability. Therefore the information designer should:

• Create standard pages for different information materials.
• Avoid dull, exciting, provocative, or too uncommon graphical designs.
• Review typography and layout for consistency of readability.

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[186] Lantz, 1992
[187] Lantz, 1996

A written text works well when the content of the message is analytical, detailed, logical, narrative, theoretical, and sequential. Visual messages work well when content is emotional, holistic, immediate, spatial and visual. However, combined verbal and visual representations may be the best choice for complex messages. Here the layout is very important.

Paragraphs. White space between portions of a text could be used as a cue to the readers that a new section follows[188].

Headings. Composition, intentional use of space and placement of headings enhance the hierarchic structure in information material and help the readers to get the message[189]. Headings, or headlines, should always be relevant and identify the subject matter. Headings set in different type versions aid comprehension of the text content[190].

Numbering. To achieve a clear structure we can use a combined numbering and lettering system. Main points in a text are traditionally labelled with Roman numerals (I, II, III, IV etc.). Sub points of the first degree are traditionally labelled with capital letters (A, B, C, D etc.). Second-degree sub points are traditionally labelled with Arabic numerals (1, 2, 3, 4, etc.). Numbering and lettering systems can be combined with typographic cueing of headings. Headings set in different type versions aid comprehension of the material.

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[188] Waller, 1987
[189] Jonassen, 1982; Wileman, 1993, p. 88
[190] Jonassen, 1982

Placement of pictures. People who have not learned to read or write do not necessarily look at pictures in the order that has been intended by the designer. Therefore 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[191]. This is a way to better get to know the intended audience.

Placement of legends. Several authors have noted that a picture should be located as close to the relevant text passage as possible in information materials[192]. It is usually a good idea to put pictures between the appropriate paragraphs in the text to get maximum impact[193]. Pictures that are put within a paragraph will interfere with the reading of the text. Above the picture, there should be at least one blank line, unless, of course, the picture is not at the top of the page, in which case the upper margin will provide sufficient empty space.

Readability of Symbols

A message may be communicated to the receiver/s or interpreter/s with several different symbols. A symbol may be used to communicate several different messages. People have to

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[191] Zimmermann and Perkin, 1982; Wileman, 1993, p. 105
[192] Lidman and Lund, 1972; MacDonald-Ross, 1977; Hartley and Burnhill, 1977a; Haber and Hershenson, 1980; Wright, 1982; Braden, 1983; Benson, 1985; Pettersson, 1989, 1993; Mayer, 1993; Mayer and Sims, 1994; Mayer et al 1995; Moreno and Mayer, 2000
[193] Pettersson, 1989, 1993

learn the meaning of the important symbols within their own society. Therefore the information designer should:

- Use colour, position, size and shape.
- Use a combination of pictographs and words.
- Use realistic figures rather than abstract forms.

Many symbols are culturally biased and thus arbitrary to those from other cultures[194]. For example, when using a guidebook with symbols, we often have to look them up in a key in much the same way as we look up unfamiliar words in a dictionary.

The meanings of symbols have to be learned by the readers. Usually they are not naturally understood. Examination of guidebooks and magazines show that that: 1) A certain meaning is explained with several different symbols. 2) A certain symbol has several different meanings. Symbols are of special value and importance in maps. A good symbol is designed so it can be used in many different situations and in many contexts. Wogalter[195] concluded that warnings should contain certain elements:

- A signal word such as "Danger" and "Caution" that enables people to recognize that the message is a warning, that a hazard is present, as well as providing information on the hazard level (with "Danger" signalling more serious and probable injury than "Caution")

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[194] Mangan, 1978
[195] Wogalter, 1999, p. 94

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- A description of the hazard, e.g. in the case of a no diving sign, a statement such as "Shallow water" provides information about the specific danger involved;
- A description of the consequences that could occur if the person fails to obey the warning's directions, e.g. "You can be permanently paralysed";
- The directions or instructions, i.e., the specific actions that should or should not be done, e.g. "No diving".

Readability of Numerical Values

Numerical data and information can be presented in tables and in graphs. A table in an information material must have good readability. Therefore the information designer should:

- Provide all the information the learner will need in the table.
- Group items in a clear way.
- Put target entries to the left of the answers.

Wright and Fox[196] made recommendations regarding design of tables in texts for the general public and other non-professional audiences. Some of the recommendations concern readability:

- All the information the learner will need should be presented in the table. That is, the learner should not be required to interpolate, combine entries, draw inferences, or otherwise manipulate the contents of the table in order to determine the correct answer. Rather, the learner should only be required to scan the list to find the correct target entry.

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[196] Wright and Fox, 1972, p. 241

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- Items within columns should be grouped and separated from other groups by either white space or rules (lines) in order to facilitate reading without accidentally moving to another row. Groups should contain no more than five items.
- Redundant abbreviations of units should not be included within the table entries [although they should be included in the column or row headings].
- Whenever possible, columns should be arranged so that the target entries are to the left of the answers.

Also Ehrenberg[197] provides guidelines for the construction of tables for the general public and other non-professional audiences:

- Numbers should be rounded off to no more than two significant figures to facilitate learners' making comparisons.
- Averages of rows and columns (as appropriate) should be given to facilitate learners' making comparisons of individual cell entries to them.
- Put the most important comparisons into columns (rather than rows), as columns make for the easiest comparisons.
- Numbers in rows or columns should be arranged in some meaningful order whenever possible (e.g., increasing or decreasing).

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[197] Ehrenberg, 1977

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Readability of Maps

Maps must have good readability. Therefore the information designer should:

• Restrict the number of visual symbols on maps.
• Keep it as simple as possible.
• Be consistent! Inconsistencies will confuse the readers.

Symbols are of special value and importance in maps. However, symbols have to be learned by the readers. The way in which different visual variables are combined has greater importance than how the variables are comprehended[198]. Using too many visual variables at the same time makes map reading more difficult. When several variables are used simultaneously the hierarchy of visibility is important. The largest symbols are always perceived first. *Size is more important than form and colour.*

Readability of Colour

Colours that are used in information materials must have good readability. Therefore the information designer should:

• Use colour to emphasize or to play something down.
• Use colour to show differences or similarities.
• Use colour to help readers recall information and to find things.

When colours of equal intensity are compared, the most visible hues are white, yellow, and green — in that order. The least visi-

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[198] Bertin, 1967; Baudoiun and Anker, 1984

ble hues are red, blue, and violet. Yellow is a powerful colour because of its luminosity. It is especially powerful when combined with black.

Graphic symbols often make use of bright colours to intensify their meaning – in fact in some instances a change of colour creates a diametric change of meaning. Common hues in graphic symbols are pure yellow, red, blue, green, white and black, or combinations of the same. Unfortunately, red and green are quite often used as discriminating colours in symbols and in warning signs. Since many colour-blind people perceive red and green as grey colour can only be used to code the information redundantly. Colour may be combined with shape, and position, or with both, which is often seen in traffic signs. Complementary colours contrast, and they provide a warm – cool effect.

Female and male subjects showed no differences in reading efforts of different colour combinations[199]. Furthermore there was no difference between colour blind (red-green) users and users with normal vision. Colour coding improves attention, learner motivation, and memory[200]. Subjects dislike the use of more than three or four text colours on the same page, screen, or slide. For some learners and for some educational objectives, colour improves the achievement of the learners. However, in some cases the added cost of colour may not be justified[201].

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[199] Pettersson, 1993
[200] Dwyer, 1994
[201] Dwyer, 1972

Sound

In oral presentations it is important that it is easy to *clearly hear* the individual words and sentences. Legibility in the written message is comparable to *audibility* in the spoken message. It is important that the listeners *clearly understand* the words in oral presentations. Readability in the written message is comparable to *distinctness* in the spoken message. Visuals designed to complement oral instruction does not always automatically improve the achievement of the learners[202]. For certain types of educational objectives and for certain types of learners, oral instruction without visualization is as effective as visualized instruction[202]. All types of cueing techniques do not equally facilitate the instructional effectiveness of different types of visual illustrations in oral instruction.

Providing Emphasis

The most important elements in information material may be emphasized to enhance attention and perception. A dark dot in a light field and a jog in a straight line are two good examples of emphasis. Emphasis may be used to *attract*, *direct* and to *keep* attention. Typography and layout will better show the structure and the hierarchy of the content in the information material when important parts are emphasised. The information designer should:

• Use specific elements for emphasis.
• Use clear contrasts for emphasis.

[202] Dwyer, 1978

- Use variables like complexity, directionality, exaggerated features, humour, isolation or motion for emphasis.

It is possible to provide emphasis in information material with the help of a number of specific design elements. Generally speaking highlighting cues and emphasis in a message will result in attention to that message. We should, however, never overuse any accenting techniques because if we do they may completely lose their meanings and their power to emphasize[203].

Emphasis in Text

Boldface or italics should normally not be used for continuous text. Italic print is read more slowly than regular type and is also disliked by many readers[204]. However, the information designer can also use boldface and italics for emphasis of parts of a text[205]. The use of underlining and all capital letters should be restricted to headings and titles, if they are used at all. Usually bold and italics are quite sufficient. Underlining in the middle of a sentence makes the lower line more difficult to read[206]. Shadow and outline letters should be avoided. There are a few other possibilities to emphasize paragraphs in texts, such as ad-

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[203] Dwyer, 1978; Hartley, Bartlett, and Branthwaite 1980; Benson, 1985; Bausell and Jenkins 1987
[204] Tinker, 1965
[205] Tinker, 1965; Mayer, 1993; Lipton, 2007
[206] Isaacs, 1987

junct questions[207] to relevant information, and statements of objectives for emphasis[208].

Indents are the distance between the beginning of a line and the left margin. Paragraphs may be indented and/or separated with extra space. Indenting of the first sentence of each paragraph, so called *"first line indents,"* improves legibility[209], as well as comprehension of printed materials[210]. Indenting of every sentence will, however, slow down reading speed.

Hanging indents are used in numbered paragraphs (with or without numbers) and in different "tables." *Nested indents* may be used to graphically show the relationship between sections, sub-sections and paragraphs within a text. When a paragraph extends into the left or right margin this is called negative indents. In this book *negative indents* are frequently used in reference lists. The width of an em dash is commonly used for paragraph indentation. This width is equal to the height of the type. So in 12 point Georgia an em dash is 12 points wide.

Emphasis in Pictures and Symbols

Emphasis is used to attract or direct attention or dramatize a certain point within a visual. There are a several possibilities to emphasize elements, or parts, within visuals. Many different

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[207] Mayer, 1993
[208] Briggs and Wager, 1989; Mayer, 1993
[209] Tinker, 1963
[210] Frase and Schwartz,1970

elements in a visual can cause emphasis. Such examples are[211]: Areas of colour, areas of shading, arrows, change in size, circles or ovals around objects, colour, colour against no colour, complexity, detail against no detail, directionality, imbalance, implied motion, isolation, letters in pictures, light against dark, line drawings in photos, line intersections, lines, position or placement of elements, reducing details, repetition, stars, tonal contrast, variation out of context, and words in pictures.

A special area of emphasis is the design of signs and symbols. Warning signs must have a high contrast relative to their background[212]. Informative words shall be used for signals such as "Danger"; for descriptions of a hazard such as "Shallow water"; and for specific actions that should or should not be performed[213], such as "No diving."

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[211] Areas of colour (Mijksenaar, 1997), areas of shading (Pettersson, 1989; Mijksenaar, 1997), arrows (Pettersson, 1989; Mayer, 1993), change in size (Pettersson, 1989), circles or ovals around objects (Pettersson, 1989), colour (Winn, 1993; Wogalter, 1999), colour against no colour (Pettersson, 1989), complexity (Pettersson, 1989), detail against no detail (Pettersson, 1989), directionality (Pettersson, 1989), imbalance (Fleming and Levie, 1978), implied motion (Pettersson, 1989), isolation (Pettersson, 1989), letters in pictures (Pettersson, 1989), light against dark (Pettersson, 1989), line drawings in photos (Pettersson, 1989), line intersections (Pettersson, 1989), lines (Mijksenaar, 1997), position or placement of elements (Pettersson, 1989), reducing details (Pettersson, 1989), repetition (Mayer, 1993), stars (Pettersson, 1989), tonal contrast (Pettersson, 1989), variation out of context (Pettersson, 1989), and words in pictures (Pettersson, 1989).
[212] Barlow and Wogalter, 1993
[213] Wogalter, 1999

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Emphasis in Layout

Most people read instructional materials selectively. Readers rarely, if ever, begin at the beginning and read straight through to the end of a document. Usually we use a combination of browsing, reading headings, looking at illustrations, reading captions, reading certain parts carefully, skimming others, and avoiding some parts completely. Many readers will only spend time on a limited amount of information in a newspaper. It is known that elements like headings, photos, drawings, and information graphics attract attention and often are entry point into a page. Size and placement of such elements influence how the reader will actually read the page. Many readers may jump over too large pictures and never look at them at all.

The competition for our attention is usually very fierce in commercial arts and in advertising. Thus *discontinuity* is often used intentionally to attract and even to hold attention of the viewers. There are a several possibilities to emphasize elements in typography and layout. The information designer can use[214]:

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[214] Areas of colour (Mijksenaar, 1997), areas of shading (Mijksenaar, 1997), arrows (Lamberski and Dwyer, 1983; Beck 1984; Pettersson, 1989; Mayer, 1993), bold against standard (Pettersson, 1989), boldface (Mayer, 1993), boxes (Mijksenaar, 1997), bullets (Mayer, 1993), clear contrasts (Pettersson, 1989), colour (Winn, 1993; Wogalter, 1999), colour against no colour (Pettersson, 1989), detail against no detail (Pettersson, 1989), directionality (Pettersson, 1989), headings (Mayer, 1993), highlight relevant information (Mayer, 1993), icons (Mayer, 1993), illustrations (Mijksenaar, 1997), imbalance (Fleming and Levie, 1978), italics (Pettersson, 1989; Mayer, 1993; Mijksenaar, 1997), key words in red (Fleming and Levie, 1978), larger font (Mayer, 1993), light against dark (Pettersson, 1989), line drawings in photos (Pettersson, 1989), lines (Mijksenaar, 1997), logos (Mijksenaar, 1997), margin notes (Mayer, 1993), repetition (Mayer, 1993), shaded areas against plain

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Areas of colour, areas of shading, arrows, bold against standard, boldface, boxes, bullets, clear contrasts, colour, colour against no colour, detail against no detail, directionality, headings, highlight relevant information, icons, illustrations, imbalance, italics, key words in red, larger font, light against dark, line drawings in photos, lines, logos, margin notes, repetition, shaded areas against plain backgrounds, small against large, symbols, tonal areas against plain backgrounds, underlining key words, variation out of context, and white space. Italics give emphasis to a word or a group of words. In order not to confuse the readers, it is important to establish a consistent system for how to signal emphasis. Use italics for emphasis sparingly; too many italicised words may reduce the emphasis.

Providing Unity

Information materials should have unity, an "overall coherence and togetherness." Inconsistencies may confuse the receivers. There is a close relationship between guidelines aimed at providing unity and guidelines aimed at providing harmony. To provide unity in information material the information designer can:

- Use style and terminology in a consistent way in each specific information material.

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backgrounds (Pettersson, 1989), small against large (Pettersson, 1989), symbols (Mijksenaar, 1997), tonal areas against plain backgrounds (Pettersson, 1989), underlining key words (Fleming and Levie, 1978; Mayer, 1993), variation out of context (Pettersson, 1989), and white space (Mayer, 1993).

- Use layout and typography in a consistent way.
- Use highlighting techniques in a consistent way.

As previously noted many authors have found that pictures should be put as close to the relevant text as possible[215]. Illustrations in textbooks are often "forgotten" by students as well as teachers; therefore it is important for editors and information designers to clearly instruct the learners to make good use of the pictures[216].

[215] Lidman and Lund, 1972; MacDonald- Ross, 1977; Hartley and Burnhill, 1977a; Haber and Hershenson, 1980; Wright, 1982; Braden, 1983; Benson, 1985; Pettersson, 1989, 1993; Mayer, 1993; Mayer and Sims, 1994; Mayer et al 1995; Moreno and Mayer, 2000
[216] Reinking, 1986; Peeck, 1993, 1994; Hannus, 1996

Administrative Principles

This category of principles includes the following four design principles: *Information Access, Information Costs, Information Ethics, and Securing Quality.*

Information Access

Regardless of the selected medium and the system for distribution the intended receivers must have easy access to facts and information when they need it. There are two quite different aspects of the concept "information access." One aspect concerns the *external access* to information materials stored in an office and information contents stored within an information system. The other aspect concerns the *internal access* to relevant facts and information contents within a specific information material. First we have to find the correct source and then we have to find the interesting content.

External Access

In order to provide external access to information materials the information designer should:

• Design information materials to fit main systems for storage.
• Use international standards, such as standard page sizes.
• Consider aspects of information security.

The information designer is obviously not responsible for how the intended receivers store their information materials in binders, shelves, and archives or in computer based digital sys-

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tems. However, when possible, the information designer should design for "easy external information access." Information materials should fit the main systems for storage.

In organisations with worldwide activities technical documentation may be produced at one place and distributed over the Internet to many other places. In such cases the typefaces that are used must be available as standard selections in computers and in laser printers in all these countries. Nevertheless, printouts made by different printers will not be identical in appearance. Typography and layout should produce good results on standard paper. In Europe, the standard paper size is A4 (210 x 297 millimetre), whereas in the USA, US letter (216 x 279.5 millimetre) is the standard. It is possible to deal with these differences by varying the margins on the page. It should be possible to print a document and insert the pages directly into a loose-leaf binder. This means that right-hand and left-hand pages should have the same appearance, basically a right-hand page layout.

Digital documents may be coded in accordance with the SGML standard, so that it is easy to use the information in different ways and in different formats. Sometimes other standards may be used (like HTML and XML).

The information designer may also be responsible for the appearance of messages in various places such as placements of signs in factory areas, hospitals, sports grounds and other official buildings. Here, the information designer should provide warning signs with properties that are clear and easily noticed in bad and degraded conditions such as fog, weak illumination,

and smoke[217]. Put warning signs close to the hazard[218], and provide warning signs with adequate reflectance and good lighting equipment.

Internal Access

In order to provide access to relevant facts and information contents within a specific information material the information designer should:

- Create appropriate indexes and other search systems.
- Provide clear contrast between figure and ground.
- Provide a supporting context for important information contents.

In printed books, reports, et cetera it is a good idea to have a list of contents, and one or more indexes. Various indexes, such as a list of illustrations, a list of artists, a list of photographers, a list of references, and a subject matter index with references to page numbers may be very useful. These indexes are easy to compile using modern word processing programs. In computer based systems it is possible to provide automatic search systems for words, for parts of texts, as well as for pictures.

In camouflage the intention is to hide figures in the background. In information design it is the opposite. Information materials must provide clear contrast between figure and back-

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[217] Lerner and Collins, 1983
[218] Wogalter, 1999

ground. Clarity, simplicity, structure, and unity will make information materials well suited for the intended receivers.

Information Costs

The information designer must have control over the costs for the design and production of the information material. It is, however, also important to consider and plan for future costs related to technical production, distribution and storage. This should be done early in the design process. A small mistake may prove very costly. The information designer will have to:

• Consider the costs for design and production of the material.
• Consider future costs for distribution and storage.
• Plan and execute continuous reviews of all costs for the material.

Good legibility and good readability are probably always economically advantageous, whereas poor legibility and poor readability may be a costly business for all parts involved. Good design models make the production of documents simple and inexpensive. In my view it is not economical to cram too much information on a page. It is better to edit the text and reduce its bulk, and thereby increase its legibility.

If a document is to have many readers who will try to read and understand it during working hours, the cost of reading the document will be the greatest expense it incurs. Even though it may be expensive to produce information, it usually costs even more to store, access, and use it. Therefore, the more people who will partake of certain information, the greater the total

cost will be. Because the cost of reading is closely linked to the type of material in the document and to the various groups of readers it targets, there will be great opportunities to reduce the total costs and save money by presenting the information in a suitable fashion.

Information Ethics

As a rule the information designer *must respect copyright* as well as other laws and regulations that are related to design, production, distribution, storage, and use of information materials. This concerns the use of artwork, illustrations, logos, lyrics, music, photographs, specific sounds, symbols, text, and trademarks. It is also very important to respect different ethical rules, media-specific ethical guidelines, and honour all business agreements. The information designer should:

• Respect copyright.
• Respect ethical rules, and media-specific ethical guidelines.
• Never engage in image manipulation.

The rights of copyright holders are protected according to international conventions, terms of delivery and agreed ethical rules. Full copyright protection for a "work" or a "production" requires originality, creativity, and fixation. For literary works the copyright protection duration is the length of the authors' life plus another 70 years. In many countries all kinds of pictures with artistic or scientific merit enjoy protection for 70 years after the death of the copyright holder. Drawings usually belong to this category.

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In practice, also almost all photographs can be said to have some "artistic merit" and thus have protection for 70 years after the death of the copyright holder. It may be hard to prove otherwise. When photographs are produced on commission, the client usually pays for and enjoys all copyright rights, including rights to prints made from the originals. The client can freely utilize the commissioned pictures in any way desired. Publishing rights to archive photographs are usually bought for each specific publishing occasion. The buyer may not then transfer the publishing rights to any third party without written permission from the rightful copyright owner.

As regards drawn illustrations, the client usually pays for the actual sketching and the drawing work, the originals and the reproduction rights for a particular publication. Then the physical drawings, the originals, usually remain the property of the artist. Thus, the artist becomes entitled to financial compensation, equivalent to the "re-acquisition cost", if an original should be damaged or lost. The name of the picture creator or copyright holder must be stated in each printed document containing the pictures, preferably, but not necessary, in direct conjunction with the pictures.

Image manipulation implies the improper control of people's perception of a given reality through the use of pictures. The ethical rules for the press, radio and television clearly warn against manipulation or falsification of picture content through misleading legends, odd montage, or suspicious trimming. Photo manipulation and stylistic embellishment can be used to create dishonest figures and tables. Presenting inauthentic pic-

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tures as though they were real documentary material is forbidden. The party purchasing the right to use pictures is responsible for their proper use. Despite these rules, clear violations occur all too often. In production of news the editors should ask themselves if every photo meets the ethical standards of responsible journalism[219].

The Associated Press has adopted *photo manipulation guidelines* to prevent dishonest reporting[220]: 1) The content of a photograph will never be changed or manipulated. 2) Only the established norms of standard photo printing methods such as burning, dodging, black-and-white toning, and cropping are acceptable. 3) Retouching is limited to removal of normal scratches and dust spots. 4) Serious consideration must always be given in correcting colour to ensure honest reproduction of the original. 5) Cases of abnormal colour or tonality will be clearly stated in the caption. 6) Colour adjustment should always be minimal.

Securing Quality

In information design the content of the message is more important than its context, execution, and format. Data and facts must be correct and also relevant to the situation. The information designer should:

• Establish a system for control of the different versions of documents.

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[219] McDougall, 1990
[220] Cifuentes, Myers and McIntosh, 1998, p. 170

- Review the information material with respect to credibility, graphic design, design objectives, structure, style, and terminology before technical production.
- Invite users to evaluate the information material.

Good information material has a distinct structure, it is relevant, legible and readable for the intended audience. Different information materials may have multiple functions and more than one objective all at the same time. Good information materials meet stringent demands on good economics, good contents and good linguistic and technical quality. Different information materials may have multiple functions and more than one objective all at the same time. Good information materials make everyday life easier for receivers who need the specific information and provide senders with a good economic return and good credibility.

The information designer may influence the perception of the credibility of text and pictures. The receiver's evaluation of the message will affect her or his evaluation of the source[221]. In information materials photographs and bright, warm colours give credibility to the organization behind the message[222]. Frequent use of archive pictures may cause quality problems. In many situations it may be better not to have any pictures at all than employing pictures of poor quality.

A high credibility message has a good structure, convincing arguments, proper references, and relevant examples. High

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[221] Fleming and Levie, 1978; Bettinghaus and Cody, 1994
[222] Kensicki, 2003

credibility sources exert a more persuasive influence on the receivers than low credibility sources. Receivers believe in a message of high credibility.

Aesthetic Principles

Art is valued for its originality and its expressiveness. Focus is on individual artefacts crafted through the manual and aesthetic virtuosity of the individual artist. Design, in contrast, is valued for its usefulness for being appropriate for a particular user and a particular task[223]. The academic discipline "Aesthetics" aims to establish general principles of art and beauty, of harmony and proportion. Aestheticians try to understand art in broad and fundamental ways. Aesthetically pleasing visuals may not be of great instructional value[224]. It is, however, possible that aesthetically pleasing information material will be noticed and used better than material without any aesthetic qualities. The third category of design principles includes *Harmony*, and *Aesthetic Proportion*.

Harmony

Certain design elements look good when they are placed together. Other design elements may look ugly and be distracting. The term harmony may be used in all design disciplines to mean that the design decisions, and the design elements fit together. Graphic designers and information designers often use the term in discussions on typography and layout. There is harmony in information material when all design elements fit well together and form harmonious relationships. Harmony is often closely related to unity. The information designer should:

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[223] Mullet and Sano, 1995, p. 8
[224] Dwyer and Dwyer, 1989, p. 122

- Develop standard templates for graphic design.
- Use standard templates for graphic design.
- Find balance between the design elements.

Man has an intuitive sense of balance. Information material should display good balance, in a manner, which is interesting but not disturbing or distracting. Balance can be formal or informal. Formal balance has total symmetry and it is felt to be static and harmonious. It may, however, also be boring. Composition can be used to direct the viewers[225].

Informal balance contributes to a feeling of dynamism[226]. It may attract attention to a specific picture, to a part of a text or to the entire information material. However, imbalance and inconsistent use of colours, graphics, or typography, have been found to reduce learning[227].

Aesthetic Proportion

Basically proportion is a mathematical concept. However, the concept aesthetic proportion is very much a subjective concept. We may all have quite different ideas of what we find beautiful and rewarding, and what we find boring, disturbing, distracting or ugly. The information designer should:

- Find out receiver preferences of aesthetic proportions.
- Be careful using proportions according to the "golden section."

[225] Wileman, 1993, p. 93
[226] Fleming and Levie, 1978; Pettersson, 1993
[227] Bradshaw, 1996, 2003

- Never mix a decorative use of colour with cognitive importance.

An "information layout" differs from a "decoration layout" in which purely aesthetic aspects are allowed to predominate. When illustrations are not relevant to the prose contents, they do not facilitate the understanding of the text[228]. On the contrary, illustrations can have a negative effect on reading comprehension and prose learning[229]. Therefore illustrations should not be used only for decoration in learning materials. As it is most visuals are too complicated and would communicate better if designers valued simplicity over decoration. Aesthetically pleasing visuals may deceive the learners about their instructional value[230].

There are many situations where colour and typographic elements can be used for decoration. However, a decorative use of colour or typography should never be mixed with the intended use to provide clear structure, simplicity and hierarchy. It must always be clear and easy to understand for the receiver when colour and typography is used for decoration and when the use is meant to have some cognitive importance.

For centuries the proportions according to "The Golden Ratio" has been regarded as beautiful and it has been treated as an important "rule" in architecture, art, design, and typography[231]. The Golden Ratio has been used in the past to estimate

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[228] Levin, Anglin and Carney, 1987
[229] Levie and Lentz, 1982; Melin, 1999b
[230] Dwyer, 1972
[231] Moriarty, 1991; Bringhurst, 2004

suitable levels for headlines in a document[232]. The size of body-type is multiplied with 1.62, and then rounded off. If the body-type is ten Didot points (=10.7 pica points), and there are four levels for headlines in the document, the following sizes are adequate: 10, 16, 26 and 42 Didot points. These rules are, however, not in accordance with the views expressed by subjects who took part in experiments with design of book pages[233].

The Golden Ratio is also known as the Golden Section, the Golden Mean, and the Divine Proportion. It is an irrational number of a line divided into two segments. The ratio of the whole segment to the larger segment is the same as the ratio of the larger segment to the shorter segment; $(a+b)/b = b/a$.

The principle of the Golden Ratio is comparable to the well-known "Fibonacci numbers": 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, and so forth. This is a close approximation of the Golden Quota (8/5 = 1.6). A Golden Rectangle therefore has sides of approximately the same proportions (8/5). Being multiplied by 1.62 enlarges any such rectangle, and being multiplied by 0.62 reduces it.

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[232] Berndal and Frigyes, 1990
[233] Pettersson and Strand, 2005

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Cognitive Principles

How we actually create meaning is an area where a lot of research is still needed. Complicated language, in both texts, pictures and graphical form will impair the understanding of any intended message. Information materials providing the wrong information may actually give a negative result, and the receiver may end up less competent than before. This fourth category of information design principles includes the following four principles: *Facilitating Attention, Facilitating Perception, Facilitating Processing*, and *Facilitating Memory.*

Facilitating Attention

There are always far more stimuli than we can ever notice. Fortunately most stimuli remain unknown, unseen, and unheard of[234]. One of the message designer's and information designer's first problems is to catch the attention of the members of the audience. Then it is up to the designer to hold their attention[235]. Any information material must constantly redraw the attention in order to hold the interest of the viewers alive.

In order to get and to hold attention it is important that information materials facilitate our human attention. As previously noted there is a close relationship between guidelines aimed at providing emphasis and guidelines aimed at facilitating attention. Emphasis in a message will result in attention to that specific message. The sub-sections *Attention to Text, Atten-*

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[234] Winn, 1993
[235] Fleming and Levie, 1978, 1993

tion to Pictures, Attention to Symbols, Attention to Layout, and *Attention to Colour* all provide "attention-oriented" guidelines that may be used in the design of messages and information materials.

Attention to Text

In order to attract and hold attention to texts in information materials the information designer can:

- Use headings with words that will catch the attention of the receiver.
- Set headings in different type versions to get attention.
- Use italics, boldface or colour to get attention.

Advertisements in newspapers, and advertising flyers, must be noticed otherwise they are useless. Here, unusual typefaces can be useful. In these situations the graphical form should stimulate attention, entice the reader to look at the headings and pictures and then actually begin reading the text. Since there are over 60,000 different typefaces (with still more being introduced), it is easy to combine them in many ways[236]. Most of these typefaces are, however, of limited value. Usually only a very few typefaces are needed in information materials.

The intended message may be hidden within verbal or visual puns, within metaphors, satires, parodies, or within humour. In these cases, designers break the traditional rules or guidelines of instructional message design. It might also be pos-

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[236] Mijksenaar, 1997

sible to deliberately use the unexpected to attract attention to instructional materials.

Headings should always be relevant and identify the subject matter. The purposes of headings are to attract the attention of the readers, make the subject matter readily apparent, and indicate the relative importance of different items in the document[237].

Attention to Pictures

The receiver must see or rather "discover" each picture and actually read the message in an active and selective way. The information designer can:

• Provide pictures of people, in particular pictures of their faces.
• Use pictures that are interesting enough.
• Use different types of visuals.

Even simple pictures may cause many different associations. Each receiver will place available information in a wider, expanded, "personal" context[238]. Receivers are apparently capable of sensing far more information than is explicitly displayed in a given picture. Using questions to focus the attention of the learners on the relevant visual learning cues does not improve the instructional potential of the illustrations[239]. Legends can

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[237] Jonassen, 1982
[238] Pettersson, 1991, 1994
[239] Dwyer, 1972

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effectively direct attention where the designer wishes it to be directed within the picture.

Use arrows, bullets, icons, underlining, margin notes, repetition, and/or white space to highlight the relevant information[240]. Use arrows or lines in various colours in order to draw attention to a picture or to specific picture elements[241].

Use humour as a visual pun to attract attention to the content or dramatise certain portions of a visual. However, humour should be used with great care. Misuse of humour and "funny people" may ruin the intended message. This is sometimes referred to as the "vampire- effect." Exaggerate the shape of a known person or object, as in caricature or cartoons to draw attention to the whole figure or to particular relevant features of it[242].

Generally speaking, people, especially our faces, will get maximum attention in images[243]. There are, however, many more ways to get attention to pictures. The information designer can use arrows and lines in various colours to show direction[244]. Arrows and lines in various colours can also be used to attract attention to specific picture elements within a picture[245]. Furthermore, the information designer can use carica-

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[240] Mayer, 1993
[241] Lamberski and Dwyer, 1983; Beck 1984; Pettersson, 1993
[242] Fleming and Levie, 1978
[243] Goldsmith, 1984
[244] Beck, 1984
[245] Lamberski and Dwyer, 1983; Beck 1984

tures and cartoons[246] and pictures that are tilted on the page to attract attention[247].

Moving pictures in movies and television can trigger associations and easily influence emotions and attitudes[248]. Contrast, graphics, shading, split screens, text, voiceover narration and zoom lens movements are tools to emphasize important details within moving pictures[249].

In one study I have listed 169 opinions[250] about image functions. Researchers used more than one hundred different explanatory verbs to express their opinions. According to scholars in the areas of instructional message design, visual literacy, and visual communication the most common or frequent opinions on functions of visuals concern *attention*: 1) *Attract attention* to a given material or a given subject[251]; 2) *Gain or get attention*[252]; 3) *Hold attention*[253] or *maintain attention*[254].

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[246] Fleming and Levie, 1978, 1993
[247] White, 1987
[248] Zakia, 1985
[249] Leshin, Pollock, and Reigeluth, 1992
[250] Pettersson, 1999
[251] Duchastel, 1978; Peters, 1978; Duchastel and Waller, 1979; Holliday, 1980; Heinich, Molenda and Russell, 1982; Levie and Lentz, 1982; Lamberski and Dwyer, 1983; Evans, Watson and Willows, 1987; Levin, Anglin and Carney, 1987; White, 1987; Pettersson, 1993; Keller and Burkman, 1993; Wileman, 1993; Lester, 1995
[252] Gagné, 1977; Duchastel, 1978; Duchastel and Waller, 1979; Holliday, 1980; Levie and Lentz, 1982; Beck 1984; Evans, Watson and Willows, 1987; Levin, Anglin and Carney, 1987; Moriarty, 1991; Leshin, Pollock, and Reigeluth, 1992; Keller and Burkman, 1993; Pettersson, 1993; Wileman, 1993; Lester, 1995
[253] Fleming and Levie, 1978, 1993, Levin, Anglin and Carney, 1987
[254] Peters, 1978; Keller and Burkman, 1993

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Attention to Symbols

The receiver must be able to see or rather "discover" symbols. This is especially true for different kinds of warning signs. Sometimes the information designer may be able to influence:

- Use clear and distinct symbols for warnings
- Put warning signs close to the hazard.
- Use clear symbols for wayshowing.

Put warning signs close to the hazard[255]. Provide warning signs with properties that allow them to be seen in degraded conditions such as low illumination, smoke, or fog[256]. Provide warning signs with adequate reflectance and good lighting[257]. Arrows and lines[258] in various colours can be used to draw attention within information materials and also for wayshowing[259].

Attention to Layout

As previously noted layout and typography should be transparent and not stick out and cause any specific attention in information materials. However, sometimes, it may be important to direct attention to specific parts within information materials. In such cases the information designer can:

- Use legends to direct attention and interest within pictures.
- Use "bleed" creatively to expand the impact of pictures.

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[255] Wogalter, 1999
[256] Lerner and Collins, 1983
[257] Sanders and McCormick, 1993
[258] Lamberski and Dwyer, 1983; Beck 1984; Pettersson, 1993
[259] Mollerup, 2005

- Use highlighting techniques to enhance relevant information.

When pictures cover an entire page this "bleed" beyond the text-face may expand the impact of attention-getting images[260]. The use of irregular, unexpected, and unstable design will attract attention[261]. It is important to instruct the readers to really use the pictures[262]. Write a legend for each picture[263]. Legends should be used to direct attention and interest within pictures[264]. Put pictures as close to the relevant text as possible[265]. Put pictures between the appropriate paragraphs in the text to get maximum impact[266]. Put pictures on odd-numbered pages. They attract more attention than pictures on even pages[266].

Attention to Colour

In order for colour to be used as efficient cues and attract attention to, or attract attention within information materials the information designer can:

- Use bold and bright colours to get attention.
- Use colour coding to improve attention.

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[260] White, 1987

[261] Fleming and Levie, 1978, 1993

[262] Reinking, 1986; Weidenmann, 1989; Pettersson, 1990, 1993; Peeck, 1993, 1994; Hannus, 1996

[263] Bernard, 1990; Pettersson, 1993

[264] Winn, 1993

[265] Lidman and Lund, 1972; MacDonald- Ross, 1977; Hartley and Burnhill, 1977a; Haber and Hershenson, 1980; Wright, 1982; Braden, 1983; Benson, 1985; Pettersson, 1989, 1993; Mayer, 1993; Mayer and Sims, 1994; Mayer et al 1995; Moreno and Mayer, 2000

[266] Pettersson, 1989, 1993

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- Use colour to enhance attention to a visual message.

To some extent colour is a language of its own. Colour creates instant impact and it becomes a vital part of the first impression. Therefore colours can be used as effective signals in information design. Bold and bright colours will attract and capture our attention[267].

Colour coding can be used as an accenting device to improve attention in documents, in signs and in symbols[268]. However, the number of colour codes must be limited and they must always be explained[269]. Improper use of colour can be distracting, fatiguing, and upsetting and it can actually produce negative results. (Also see section *Processing of Colour*.)

Colour enhances the attention and perception of a visual message. If people like the contents in a picture, they like them even more when the visual is presented in colour. Although full colour photographs increase the costs, publishers of textbooks should make the number of such books more available to primary audiences[270].

Facilitating Perception

Perception is a fundamental characteristic of life. In order to continue living, every organism has to perceive its environment

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[267] Ormrod, 1989
[268] Katzman and Nyenhuis, 1972; Lamberski, 1972; Christ, 1975; Dwyer, 1978; Whiteside and Blohm, 1985; Hannafin and Peck, 1988; Pettersson, 1989, 1993; Winn, 1993; Wogalter, 1999; Bradshaw, 2003
[269] Pettersson, 1989, 1993
[270] Ramsey, 1989

and the changes in this environment. The concept of "perception" is a collective designation for the different processes in which an animal or a person obtains information about the outside world. We organize and analyze information that we have paid attention to. Colours, illustrations, images, lines, pictures, sounds, symbols, texts, and words should be integrated in such a way that they can be interpreted as a meaningful whole rather than a number of individual elements. Perception of two- or three-dimensional representations entails fast, parallel, simultaneous, and holistic processing[271].

In perceiving a message the receiver use sensory organs and the nervous system. When a message is internalized the receiver has got new emotions, new experiences, new feelings, and new knowledge. Often individuals will interpret the same representation in different ways. Here age and gender, cultural, economical, historical, political, religious, and social factors may be important. New impressions are interpreted against the background of our previous individual experience and learning. Experiences and assessments change over time and affect our way of associating. Messages that are contradictory often create more confusion than they provide help. The internalized message will influence the interpretation and understanding of future and related messages.

The Gestalt school of psychology developed about 1912 in Germany. The word "gestalt," means form, pattern or shape in German. It is the basis for the psychological theory that perception is based on patterns. Perception is always organized. We

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[271] Gazzaniga, 1967; Sperry, 1973, 1982

see whole images rather than collections of parts. The whole is different from the sum of the parts. A number of psychologists view our attempts to establish order as an innate faculty carried out in accordance with certain "laws" or principles for display of information.

Closure. Stimuli form meaningful patterns. There is a need for the mind to have a general understanding and it is a key factor in cognitive organisation[272]. We will extract meaning and reach conclusions. If a figure is incomplete, our minds will fill in the missing parts and "close" the outline of the figure. For instance, letters printed with damaged or broken type are typically seen as perfect or whole characters. The use of classical Swiss grid systems in layout is based on regular rows and columns.

Common fate. Objects grouped in a particular way will be expected to change in conformance with this grouping. When change does not follow this pattern, the change is difficult to process.

Continuity. We perceive a slow and gradual change in a stimulus as one single stimulus. It is easier to perceive a smooth continuation than an abrupt shift of direction. Lines moving in the same direction belong together. Straight or curved lines tend to lead the eye along, and even beyond, the line. An arrow or a finger pointed at something leads the eye to it.

Contrast. We tend to order impressions that form natural opposites, thereby reinforcing one another, in groups. We inter-

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[272] Luchins and Luchins, 1959

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pret the information from our sense organs with a bias towards constancy. Usually, there is a constancy of size, shape, colour, brightness, and contrast in the perception of known objects. This is regardless of distance, angle, and illumination.

Density. We perceptually group regions where elements have similar density, or "spatial concentration." A visual element may belong to one group even if it is as close to another group.

Figure/ground. We perceptually construct relationships among events, objects, and picture elements. Some elements in a visual are selected as the figure. The remaining elements constitute the background. We see dots, lines, areas, light, dark, et cetera in an organized way. When it is hard to distinguish between figure and background some structures will be perceived as reversible. A small shape within a large shape will be interpreted as the "figure", while the larger shape is interpreted as the ground. A given contour can belong to only one of the two areas it encloses and shapes. Whichever of the sides, the contour shapes will be perceived as a figure. All the gestalt laws contribute to creating a figure. Reality and what we see at any given moment will always be separated and different.

Grouping. The presence of a boundary is not required for the perception of a form or a shape. When small elements are arranged in groups, we tend to perceive them as larger forms. This is similar to "closure". By grouping headings, paragraphs, illustrations, and legends the designer aids communication.

Objective set. Some phenomena are perceived more strongly than others. For example, two lines that almost form a right angle are perceived as a right angle.

Proximity. Events and objects that are close together are perceptually grouped together. The eye tends to be attracted to groups or clusters rather than to isolates. We can use space to group graphic components. Related data and elements should be put in close proximity to each other.

Similarity. We tend to group our impressions on the basis of their similarity. Objects sharing similar characteristics, such as colour, orientation, pattern, shape, size, texture, and value are seen together and they belong together. This principle can be used to signal a particular kind of graphic component in a consistent way.

As previously noted there is a close relationship between guidelines aimed at providing simplicity and guidelines aimed at facilitating perception, processing and memory. Simplicity in a message will result in perception of that message. The subsections *Perception of Text*, *Perception of Pictures*, *Perception of Layout*, and *Perception of Colour* provide "perception-oriented" guidelines that may be used in the design of messages and information materials.

Perception of Text

A text should be well worth reading for the intended receivers. In order to improve the reading value of the text the information designer can:

- Use a list of contents to create pre-understanding.
- Provide text with a rich language for pleasant reading.
- Avoid irrelevant information and distracting jargon.

In verbal and visual languages prior experience and context are very important to the perception of contents. Perception of verbal content is apparently easier when a text is read than heard. Therefore it is easier to assimilate and profit from a rich language by reading than by listening. It is also known that pictures that are relevant to the content of the text will facilitate learning from reading prose[273]. The information designer should consider embedded meanings of different colours when using colours to accent words in a text[274]. Colour and grey scale can be used to influence the perception of size. Open and light forms are perceived as being larger than closed and darker forms of the same shape[275].

It may take only 2–3 seconds to recognize the content in an image[276], but 20–30 seconds to read a verbal description of the same image[277], and 60–90 seconds to read it aloud[278]. The in-

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[273] Levin, Anglin and Carney, 1987
[274] Hartley, 1987
[275] Winn, 1993
[276] Paivio, 1979; Postman, 1979
[277] Lawson, 1968; Ekwall, 1977
[278] Sinatra, 1986

tended receiver must get the time that is necessary for reading a text. In verbal and visual languages prior experience and context are very important to the perception of contents.

The perception of linear representations, such as music and text, requires slow and sequential processing[279]. Perception of a text is always relative. Therefore people will perceive a text in different ways. However, there is a large degree of perceptual constancy. We can view a text and read it from various distances and various angles and still get the same understanding of the text content[280].

Perception of Pictures

Pictures should be well worth reading for the intended receivers. In order to improve the reading value of the pictures the information designer can:

- Use photographs showing people.
- Provide pictures with interesting contents.
- Provide a good contrast between figure and ground in pictures.

There are major differences between the concepts "seeing", "looking", and "reading"[281]. The pattern for eye movements and fixations depends on what we wish to see, or are told to see in a picture[282]. Persuasion tends to be accomplished in both chil-

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[279] Perfetti, 1977; Sinatra, 1986
[280] Pettersson, 1989
[281] Pettersson, 1986a
[282] Yarbus, 1967

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dren and adolescents almost exclusively through imagery[283]. It is not likely that there will be just one, but several equally good options available for achieving satisfactory communication. The design of a picture can be changed a great deal without any major impact on the perception of the image contents[284]. There is a large degree of perceptual constancy. We can view a symbol or a picture from various distances and various angles and still get the same perception of the content. Our minds constantly fill in missing details and complete images, without our realizing that it has happened.

Generally speaking people like pictures showing people. Pictures are cultural products shared by many individuals[285]. Cultural differences may impact the effectiveness of pictures[286]. An individual who is smiling in the picture is seen as a positive person, while an individual who is frowning is viewed as a negative person[287]. The larger a person's face appears in a picture, the more positively we perceive that individual. And a close-up headshot of a person is more positive than a photo taken from a distance[288]. Colour and grey scale can be used to influence the perception of size. Open and light forms are perceived as being larger than closed and darker forms of the same shape[289].

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[283] Barry, 1998
[284] Pettersson, 1986b
[285] Moriarty and Rohe, 1992
[286] Kovalik, 2004
[287] Moriarty and Popovich, 1991
[288] Archer et al., 1983
[289] Winn, 1993

When a person is shown straight on in a photograph he or she is perceived in a more positive way and perceived as being more in control of the situation than a person who is shown from one side[290]. This person is also perceived much more positively than persons who are shown from behind. An individual appears powerful when he or she is photographed from below with the photographer looking up at him or her. The same individual appears less powerful, and least in control of the situation, if he or she is photographed from above. Individuals shown with closed eyes are viewed more negatively than those shown with open eyes. It is also known that the purpose of a photo is important for our perception of the person depicted in the picture[291].

Perception of Layout

The layout of information material may aid or it may hinder perception of the content. To aid perception the information designer should:

• Avoid too short and too long lines.
• Use colour, orientation, pattern, shape, size, texture, and value to show that objects belong together.
• Make sure that distribution of space reflects relationships.

We read texts as "word pictures," not letter by letter. Readers tend to dislike both very short and very long line lengths. As

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[290] Moriarty and Popovich, 1991
[291] Moriarty and Garramone, 1986

previously noted the optimum line length quite often seems to be about 1 1/2 alphabets – 42 characters[292]. Pictures are perceived more rapidly and readily than text[293]. Sometimes image-enhancements intended to improve the interpretation of image content get in the way of the actual message[294]. A number of studies[295] demonstrate how graphics act as strategies that activate learner's cognitive processes along both horizontal and vertical planes. It is easier to learn left to right sequences than the other way around.

Perception of Colour

Colours should be used with care. In order to aid perception of colour the information designer should:

- Consider that many people are colour blind.
- Use colour to enhance perception of a visual message.
- Use colour and grey scale to influence the perception of size.

Yellow, orange, and red hues are perceived as warm and active colours. Red evokes feelings of strong emotions. Violet, blue, and blue-green are perceived as cool and passive hues. Blue is often used to represent truth and honesty. White is often associated with innocence and purity, and black often represents

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[292] Pettersson, 1989; Walker, 1990. Other suggestions: 35–40 characters (West, 1987), 40–50 characters (Lipton, 2007), 50 characters (Parker, 1988), up to 60 characters (Zwaga, Boersma and Hoonhout, 1999), 60–65 characters (Miles, 1987).
[293] Fleming and Levie, 1978, 1993; Sinatra, 1986
[294] Vogel, Dickson, and Lehman 1986
[295] Winn, 1980, 1981, 1982, 1993; Winn and Holliday, 1985

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evil and darkness. However, it should be noted that certain colours have different meanings in different societies[296].

Subjects dislike the use of more than three or four text colours on the same page, screen, or slide. Colour coding is a good way to show that something is especially important and interesting. When text is shown on a visual display, there is no easily read colour combination. Rather than focusing on specific colours as always best, designers should work to ensure good contrast between text and background[297].

A colour coding process may enable people to retain critical information and disregard redundant and irrelevant information. It is, however, known that extensively trained viewers can reliably recognize only about 50 colour codes. An effective and systematic colour code with a maximum of four to six colours in information material assists the viewer in categorising and organising stimuli into meaningful patterns. The choice of colour and grey scale will influence the perception of size. Open and light forms are perceived as being larger than closed and darker forms of the same shape[298]. (Also see the sub-section *Legibility of Colour.*)

Facilitating Mental Processing

There is no direct correspondence between groups of letters, words, sentences, paragraphs, texts, and reality. Understanding the concepts that words represent in various specialist areas

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[296] Zimmermann and Perkin, 1982
[297] Bradshaw, 2003
[298] Winn, 1993

and sub-cultures may be difficult or even impossible for all non-specialists. Thus the information designer needs to know the audience.

Visual language abilities develop prior to and serve as the foundation of, verbal language development[299]. Development of visual language abilities is dependent upon receiver interaction with images, objects, and also body language[300]. 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[301]. The same visuals are not equally effective for receivers with different prior knowledge. Images and visual language speak directly to us in the same way experience speaks to us, that is emotionally and holistically. There seem to be no major difference between genders in interpretation of image contents[302]. Visual communication is becoming more important as an increasing number of decisions in society are being made on the basis of pictorial representations[303].

As previously mentioned there is a close relationship between guidelines aimed at providing simplicity and guidelines aimed at facilitating perception, processing and memory. Simplicity in a message will result in easier and more effective per-

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[299] Reynolds-Myers, 1985; Moriarty, 1994
[300] Reynolds-Myers, 1985; Fleming and Levie, 1978, 1993
[301] Barry, 1998
[302] Dwyer, 1972, Fleming and Levie, 1978, 1993
[303] Nielsen, 2004

ception, processing and memory of that message[304]. Design has the unique capacity[305] to shape information by:

- Emphasizing or understating,
- Comparing or ordering,
- Grouping or sorting,
- Selecting or omitting,
- Opting for immediate or delayed recognition, and
- Presenting it in an entertaining fashion.

In general one can state that information should be as simple, clear, and unambiguous as possible. However, in any presentation, information can be enriched with a wealth of details. The sub-sections *Processing of Text, Processing of Pictures, Processing of Layout,* and *Processing of Colour* provide "process-oriented" guidelines that may be used in the design of messages in information and learning materials.

Processing of Text

In order to facilitate the processing of text the information designer should:

- Design text to facilitate mental processing.
- Use a variety of examples and non-examples.
- Provide the time that is necessary for the receivers to read, interpret and understand the message in the text.

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[304] Sinatra, 1986
[305] Mijksenaar, 1997, p. 25

A text can convey information, contain analyses and describe feelings and facts[306]. Reading a text is a very structured activity with several eye fixations on each line[307]. Therefore lines should not be too short, or too wide. Word identification is a multi-stage process, which will take some time[308]. Word naming and word meaning are processed in the left hemisphere[309].

To avoid too large masses of text, it is a good idea to divide the text into sections, subsections, and paragraphs. Headings on different hierarchic levels will provide the readers with reference point and help them to organize information cognitively for better retention and recall. Headings set in different type versions aid comprehension of the text content[310].

Processing of Pictures

In order to facilitate the receiver's mental processing of pictures the information designer should:

- Use line drawings when study time is limited.
- Provide more realistic versions of artwork when unlimited study time is allowed.
- Use graphics in a consistent way.

With their many meanings visuals create ambiguity in the reception in a way that most expressions of written language does

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[306] Melin, 1986b
[307] Ekwall, 1977
[308] Sinatra, 1986
[309] Pirozzolo and Rayner, 1979
[310] Jonassen, 1982

not[311]. Pupils in junior schools[312] have very low "pictorial capability." The same is true for pupils in intermediate schools, junior high schools, and in comprehensive schools[313]. In addition comprehensive school students are poor at expressing themselves with pictures[314]. Furthermore, inconsistent use of graphics in information and learning materials is quite common. This will reduce understanding and learning[315].

The available study time is important. Line drawings are most effective in formats where the learner's study time is limited. More realistic versions of artwork, however, may be more effective in formats where unlimited study time is allowed[316]. Visual presentation support is persuasive[317]. In a study presentations using visual aids were 43% more persuasive than unaided presentations. At the same time, research in the area of reading indicates that the type of visuals that are used is an important variable in reading comprehension. However, and unfortunately this becomes less important in reality since most students do not attend to the visuals unless they are instructed to do so[318].

There are two kinds of image interpretation[319], one is "immediate" and the other is "analytical." Some assignments cause

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[311] Limburg, 1987

[312] Backman, Berg, and Sigurdson, 1988; Eklund, 1990

[313] Backman, Berg, and Sigurdson, 1988

[314] Backman, Berg and Sigurdson, 1988; Eklund, 1990

[315] Bradshaw, 1996, 2003

[316] Dwyer, 1972; Fleming and Levie, 1978; Soulier, 1988

[317] Vogel, Dickson, and Lehman, 1986

[318] Reinking, 1986; Pettersson, 1990

[319] Pettersson, 1989, 1993

interpretation of image contents on a low cognitive level, and some on a high cognitive level. People may understand and describe a picture in very different ways.

Processing of Layout

In order to facilitate the processing of layout the information designer should:

- Use illustrations that are relevant to the content in the text.
- Make close connections between verbal and visual representations.
- Avoid inconsistent use of typography.

Graphic design is a tool with which we can manipulate the raw materials – words in different typefaces, sizes, styles, empty space, illustrations, colour, paper and ink, and the final number of pages in a document – to achieve the best possible communications between people. Typographic cuing generally refers to the use of bold or italic type or underlining to signal the important ideas in a text. There is little doubt that cuing does work well in drawing attention to the cued material[320]. The consensus is that readers are more likely to remember cued ideas than uncued ideas[321]. In one experiment the use of paragraph headings improved learning[322]. However, underlining of relevant information did not have the same effect.

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[320] Glynn, Britton, and Tillman, 1985
[321] Hartley, 1987
[322] Cisotto and Boscolo, 1995

Most pictures can be interpreted in several ways until anchored to one by a legend[323]. Pictures incorporate numerous "correct" interpretations, although not always one anticipated by the picture creator. Interference in presentation, such as inconsistent use of colours, graphics, or typography, will reduce understanding and learning[324].

Text-relevant pictures facilitate learning from reading prose[325]. When illustrations provide text-redundant information, learning content in the text that is also shown in pictures will be facilitated. However, illustrations that are not relevant to the content in the text can have a negative effect on reading comprehension and prose learning[326]. Conveying information through both verbal and visual languages makes it possible for learners to alternate between functionally independent, though interconnected, and complementary cognitive processing systems[327]. 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[328].

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[323] Barthes, 1977
[324] Bradshaw, 1996, 2003
[325] Levin et al., 1987
[326] Levie and Lentz, 1982; Melin, 1999b
[327] Levie and Lentz, 1982
[328] Mayer et al., 1995

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Processing of Colour

In order to facilitate the processing of colour the information designer should:

- Use colour coding in a consistent way.
- Limit the number of colour codes.
- Find out likes or dislikes of colour.

People might see colours in the same way. However, no two persons experience colour in the same way. Thus the human reactions to colour stimuli cannot be standardised. Depending on age, culture, gender, and profession, there are different subjective reactions to colour. There are likes and dislikes of colour, based on general as well as personal associations.

Colour coding will increase understanding and learning[329]. The number of colour codes should be limited and they should always be explained. To avoid confusion and misunderstanding, it is important that colour be used consistently. Inconsistent use of colours will reduce learning[330]. (Also see the sub-section *Attention to Colour*.)

Facilitating Memory

As previously seen there is a close relationship between guidelines aimed at providing simplicity and guidelines aimed at facilitating perception, processing and memory. Simplicity in a message will result in easier and more effective perception, pro-

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[329] Dwyer, 1972, 1978; Epskamp, 1981; Hannafin and Peck, 1988; Bradshaw, 2003
[330] Bradshaw, 1996, 2003

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cessing and memory of that message. The sub-sections *Memory Models*, *Memory for Text*, and *Memory for Pictures* provide "process-oriented" guidelines that may be used in the design of messages and information materials. In order to facilitate memory the information designer should.

- Present only a limited number of information elements at the same time.
- Provide meaningful contents.
- Present text and illustrations in close connection.

Memory Models

A number of models or theories describe the transfer of infor-mation through memory[331]. One way of viewing memory func-tions is based on information processing in steps[332], the "*infor-mation processing theory.*" The first of these steps is the sen-sory memory, or the immediate memory, which carries out the storage of stimulus information at the peripheral level.

After being processed in the sensory memory, some infor-mation is passed on to the short-term memory (STM), operative memory, or working memory. The short-term memory has se-vere capacity limitations. Miller's initial review of short-term memory research[333] related to items like brightness, colour, dig-

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[331] Waugh and Norman, 1965; Atkinson and Shiffrin, 1968; Norman and Bo-brow, 1975; Broadbent, 1984; Sinatra, 1986; Lockhart and Craik, 1990
[332] Atkinson and Shiffrin, 1968
[333] Miller, 1968, *The magical number seven, plus or minus two: Some limits on our capacity for processing information*

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its, hue, length, letters, loudness, pitch, size, and taste. Subsequent studies have come to similar conclusions[334].

The long-term memory[335] (LTM) is what most people mean when they refer to "memory." The long-term memory has episodic memories of specific things we have done, seen, heard, felt, tasted, and so on. To facilitate these processes the information designer should organise information carefully.

The dual-coding theory[336] proposes that rather than just one sensory memory, one short-term memory, and long-term memory, as might be implied in information processing theory, there are actually separate memory systems for different types of information: one for verbal information and one for imaginal information. Verbal memory includes activity related to language systems (auditory and speech), while imaginal memory includes pictures, sounds, tastes, and nonverbal thoughts (imagination). Memory is greater when a verbal and a visual code are activated at the same time, rather than only one of them[337]. After reviewing picture effects on children's learning

Memory for Text

Retrieval from verbal memory is a serial integration and sequential processing of auditory-motor perception systems[338].

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334 Case, 1974, 1975; Pascual-Leone and Smith, 1969; and Bazeli and Bazeli, 1992
335 Carlson, 1993
336 Paivio, 1990
337 Mayer, 1993; Moreno and Mayer, 2000
338 Sinatra, 1986

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Word identification is a multi-stage process. The right brain hemisphere carries out visual-featural analysis. Word naming and word meaning are processed by the left hemisphere[339]. Utilizing specific textual structure *does not facilitate* recall of instructional text[340]. However, utilizing specific textual structure facilitates recall of instructional text[341].

A meaningful content is understood and learned easier and remembered longer. We best remember what we read at the beginning and at the end of a reading session. The optimum time for learning from reading seems to be 20-40 minutes[342], and then it is time for a pause. We will forget most of what we learn if we do not rehearse the material. After finishing reading, it is time for the first rehearsal, reading keywords and notes. It is a good idea to repeat this after a day, after a week, and after a month. We will remember more from a graphically complex text than a "plain" text[343].

Memory for Pictures

In 1977 one scholar concluded that enough research evidence already had been gathered regarding illustrated text[344]: "No more experiments are required to substantiate the positive effect of pictures on children's learning." However, much more

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[339] Pirozzolo and Rayner, 1979
[340] Frase and Schwartz, 1979, Hartley, 1980
[341] Frase and Schwartz, 1979, Bernard, 1990
[342] Atkinson et al. 1990
[343] Melin, 1999b
[344] Pressley, 1977, p. 613

research in this area has been done since 1977. We know that memory for pictures are superior to memory for words. This is called[345] the "pictorial superiority effect". Visual memory is very fast[346]. Emotionally charged pictures may improve motivation for reading and thus improve the memory[347].

Memory for a picture-word combination is superior to memory for words alone or memory for pictures alone[348]. 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, for example on the same page in a book, or when learners have sufficient experience to generate their own mental images as they read the text[349]. Therefore pictures should be put as close to the relevant text as possible[350].

The design of learning materials should be co-ordinated with a theory of meaningful learning[351]. Such a theory[352] was

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[345] Paivio, 1983; Branch and Bloom, 1995

[346] Beaver, 1994

[347] Melin, 1999a

[348] Adams and Chambers 1962; Haber and Myers, 1982

[349] Mayer et al., 1995

[350] Lidman and Lund, 1972; MacDonald- Ross, 1977; Hartley and Burnhill, 1977a; Haber and Hershenson, 1980; Wright, 1982; Braden, 1983; Benson, 1985; Pettersson, 1989, 1993; Mayer, 1993; Mayer and Sims, 1994; Mayer et al 1995; Moreno and Mayer, 2000

[351] Fleming and Levie, 1993; and Mayer, 1993; Mayer et al. 1995

[352] Mayer et al. 1995

created from components of a generative learning theory[353] and the dual coding theory[354].

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[353] Witt rock, 1974, 1989
[354] Paivio, 1971, 1978, 1983, 1986, 1991

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Summary

This chapter includes lists of the goals, principles and guidelines used in information design and message design.

Goal and Foundation

In information design and message design the main goal is *clarity of communication*. As an area of knowledge information design and message design rests on a *foundation*, which can be expressed in four basic statements:

• It is multi-disciplinary.
• It is multi-dimensional.
• Theory and practice co-operate.
• There are no firm rules.

An exception to the last statement is the only information design and message design rule: *"Respect copyright, and other laws and regulations related to information."*

Principles

The 16 message design principles belong to four groups:

Functional principles
    Defining the problem
    Providing structure
    Providing clarity
    Providing simplicity
    Providing emphasis
    Providing unity
Administrative principles
    Information access
    Information costs
    Information ethics
    Securing quality

Aesthetic principles
    Harmony
    Aesthetic proportion
Cognitive principles
    Facilitating attention
    Facilitating perception
    Facilitating processing
    Facilitating memory

Guidelines

The following 150 guidelines are based on the 16 message design principles.

1 Defining the Problem

1.1 The Sender
- Define what the sender wants to achieve.
- Decide when this is to happen.
- Find out about the project budget, as well as all other requirements.

1.2 The Representation

The Message
- Define the purpose and the objective of the message, always keeping the intended receivers in mind.
- Collect and review necessary facts for later use in the design process.
- Consider the use of words, images, and graphic form.

The Medium
- Select the most suitable medium for the message.
- Produce synopsis for text, pictures, and sound.
- Adopt the graphic design to the medium.

The Receivers
- Carefully define the group of intended receivers.
- Collect data about age, culture, gender, and socio-economic factors.
- When possible, consider any feedback that may be expressed by any previous receivers.

The Context
- Define the internal context of the message.
- Define the external contexts of the message.
- Define how the context may influence the interpretation of the message.

2 Providing Structure
- Develop a clear structure for the content.
- Limit the number of levels in the structure.

- Show the hierarchy and structure of the content in the graphic design.

3 Providing Clarity

3.1 Legibility of Text

Legibility of Print Media
- Use clear, direct, simple and transparent typography.
- Use a common typeface, between nine and twelve Pica points, for continuous text in a book, a pamphlet, or a report.
- Restrict the number typefaces and only use a few per information material.

Legibility of Text on Wall Charts
- Set text bold and large enough, adjusted to the reading distance.
- Use lower case letters and avoid all-capital printing for running text.
- Restrict the number typefaces.

Legibility of Text on Screens
- Use typefaces designed for screen display.
- Use black text on a white or yellow background.
- Avoid the use of all capital letters.

Legibility of Projected Texts
- Use no more than six rows of six words in each image, set in a linear typeface, with characters large and bold enough.

- Maintain a good contrast between foreground and background.
- Avoid graduated and tonal background fills.

3.2 Legibility of Pictures
- Use picture elements that are bold and large enough.
- Use a style guide for picture elements in schematic pictures.
- Set words in images and pictures bold and large enough to read.

3.3 Legibility of Layout
- Use standard page sizes with standard grids for pre-planning of pages.
- Use a clear and simple layout.
- Use arrows, bullets, lines, and symbols in various colours; also margin notes, repetition, and space to highlight relevant information.

3.4 Legibility of Symbols
- Use distinct colours and simple graphical elements to design symbols that will function in any size.
- Design solid figures with a distinct contrast to the background.
- Use characters and graphical elements that are bold, distinct and large enough.

3.5 Legibility of Numerical Values

Tables
- Use type between 8 and 12-point size for table cells.
- Use vertically oriented tables.

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- Use rounded off numbers.

Graphs
- Compare lengths of variables to show their relationships.
- Compare areas of variables to show their parts of a whole.
- Use actual figures in graphs when accuracy is needed.

3.6 Legibility of Maps
- Use bold and distinct symbols in a consistent size.
- Restrict the number of typefaces and complexity of patterns.
- Provide distinct contrast in form and dimensions.

3.7 Legibility of Colour
- Use a light or a dark background colour appropriate to the content, and then use a colour with good contrast for the figure or text.
- Make sure that differences between colours are clear and obvious.
- Combine colours with shape in warning signs.

4 Providing Simplicity

4.1 Readability of Text

Readability of Print Media
- Use an active voice and avoid too many details.
- Use a style guide and make the message comprehensible for the intended receivers.
- Make an overall check of language, writing style and terminology before the script can be confirmed as an original.

Readability of Text on Wall Charts
- Edit the text into sections that are easily read.
- Check the spelling!
- Use headings and other text elements in a consistent way.

Readability of Text on Screens
- Display data so that it is easy to read.
- Recognize cultural differences.
- Use a "normal" combination of upper and lower case letters.

Readability of Projected Texts
- Consider the use of lists.
- Be careful in the use of acronyms.
- Restrict stylized and fancy typefaces to opening frames.

4.2 Readability of Pictures
- Write legends to explain pictures.
- Choose illustrations carefully and use visual sequencing techniques to present complex ideas.
- Leave out needless pictures and picture elements and avoid excessive image detail.

4.3 Readability of Layout
- Create standard pages for different information materials.
- Avoid dull, exciting, provocative, or too uncommon graphical designs.
- Review typography and layout for consistency of readability.

4.4 Readability of Symbols
- Use colour, position, size and shape.
- Use a combination of pictographs and words.

- Use realistic figures rather than abstract forms.

4.5 Readability of Numerical Values
- Provide all the information the learner will need in the table.
- Group items in a clear way.
- Put target entries to the left of the answers.

4.6 Readability of Maps
- Restrict the number of visual symbols on maps.
- Keep it as simple as possible.
- Be consistent! Inconsistencies will confuse the readers.

4.7 Readability of Colour
- Use colour to emphasize or to play something down.
- Use colour to show differences or similarities.
- Use colour to help readers recall information and to find things.

5 Providing Emphasis
- Use specific elements for emphasis.
- Use clear contrasts for emphasis.
- Use variables like complexity, directionality, exaggerated features, humour, isolation or motion for emphasis.

6 Providing Unity
- Use style and terminology in a consistent way in each specific information material.
- Use layout and typography in a consistent way.
- Use highlighting techniques in a consistent way.

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7 Information Access

7.1 External Access
- Design information materials to fit main systems for storage.
- Use international standards, such as standard page sizes.
- Consider aspects of information security.

7.2 Internal Access
- Create appropriate indexes and other search systems.
- Provide clear contrast between figure and ground.
- Provide a supporting context for important information contents.

8 Information Costs
- Consider the costs for design and production of the material.
- Consider future costs for distribution and storage.
- Plan and execute continuous reviews of all costs for the material.

9 Information Ethics
- Respect copyright.
- Respect ethical rules, and media-specific ethical guidelines.
- Never engage in image manipulation.

10 Securing Quality
- Establish a system for control of the different versions of documents.

- Review the information material with respect to credibility, graphic design, structure, style, and terminology before technical production.
- Invite users to evaluate the information material.

11 Harmony
- Develop standard templates for graphic design.
- Use standard templates for graphic design.
- Find balance between the design elements.

12 Aesthetic Proportion
- Find out receiver preferences of aesthetic proportions.
- Be careful using proportions according to the "golden section."
- Never mix a decorative use of colour with cognitive importance.

13 Facilitating Attention

13.1 Attention to Text
- Use headings with words that will catch the attention of the receiver.
- Set headings in different type versions to get attention.
- Use italics, boldface or colour to get attention.

13.2 Attention to Pictures
- Provide pictures of people, in particular pictures of their faces.

- Use pictures that are interesting enough.
- Use different types of visuals.

13.3 Attention to Symbols
- Use clear and distinct symbols for warnings
- Put warning signs close to the hazard.
- Use clear symbols for wayshowing.

13.4 Attention to Layout
- Use legends to direct attention and interest within pictures.
- Use "bleed" creatively to expand the impact of pictures.
- Use highlighting techniques to enhance relevant information.

13.5 Attention to Colour
- Use bold and bright colours to get attention.
- Use colour coding to improve attention.
- Use colour to enhance attention to a visual message.

14 Facilitating Perception

14.1 Perception of Text
- Use a list of contents to create pre-understanding.
- Provide text with a rich language for pleasant reading.
- Avoid irrelevant information and distracting jargon.

14.2 Perception of Pictures
- Use photographs showing people.
- Provide pictures with interesting contents.
- Provide a good contrast between figure and ground in pictures.

14.3 Perception of Layout
- Avoid too short and too long lines.
- Use colour, orientation, pattern, shape, size, texture, and value to show that objects belong together.
- Make sure that distribution of space reflects relationships.

14.4 Perception of Colour
- Consider that many people are colour blind.
- Use colour to enhance perception of a visual message.
- Use colour and grey scale to influence the perception of size.

15 Facilitating Mental Processing

15.1 Processing of Text
- Design text to facilitate mental processing.
- Use a variety of examples and non-examples.
- Provide the time that is necessary for the receivers to read, interpret and understand the message in the text.

15.2 Processing of Pictures
- Use line drawings when study time is limited.
- Provide more realistic versions of artwork when unlimited study time is allowed.
- Use graphics in a consistent way.

15.3 Processing of Layout
- Use illustrations that are relevant to the content in the text.
- Make close connections between verbal and visual representations.
- Avoid inconsistent use of typography.

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15.4 Processing of Colour

- Use colour coding in a consistent way.
- Limit the number of colour codes.
- Find out likes or dislikes of colour.

16 Facilitating Memory

- Present only a limited number of information elements at the same time.
- Provide meaningful contents.
- Present text and illustrations in close connection.

References

Adams, J., & Chambers, R. (1962). Response to simultaneous stimulus of two sense modalities. *Journal of Experimental Psychology, 63,* 125–198.

American Psychological Association. (2001). *The Publication Manual of the American Psychological Association.* (5th Edition.) American Psychological Association: Washington, D. C. : APA. <http://www. apastyle. org/pubma-nual. html>

Ander, J-E. (2003). *Tredje språket – kommunikation med flera sinnen.* Stockholm: Bokförlaget Arena i samarbete med Bild och Ord Akademin.

Archer, D., Iritani, B., Kimes, D. D., & Barrios, M. (1983). Faceism: Five Studies of Sex Differences in Facial Prominence. *Journal of Personality and Social Psychology, 45,* 725–725.

Atkinson, R. C., & Shiffrin, R. M. (1968). Human memory: A proposed system and its control processes. In K. W. Spence, & J. T. Spence (Eds.), *The psychology of learning and motivation: Advances in research and theory, Vol. 2.* New York: Academic Press.

Atkinson, R., Atkinson, R. C., Smith, E. E., Bem, D. J., & Hilgard, E. R. (1990). *Introduction to Psychology.* Harcourt Brace Jovanovic Inc.

Backman, J., Berg, T., & Sigurdson, T. (1988). *Grundskoleelevers produktion och reception av bilder.* Umeå: Umeå universitet. Institutionen för bildlärarutbildning. Rapport nr 7.

Barlow, T. and Wogalter, M. S. (1991). Increasing the surface area on small product containers to facilitate communication of label information and warnings. In *Proceedings of the Interface 91,* 88–93, Santa Monica, CA: Human Factors Society.

Barlow, T. and Wogalter, M. S. (1993). Alcoholic beverage warnings in magazine and television advertisements. *Journal of Consumer Research, 20,* 147-156.

Barry, A-M. (1998). *The Joe Camel Story: Tobacco Industry Manipulation and the Necessity for Visual Intelligence.* Paper presented at Viscom 12, Winter Park, CO, June 26.

Barthes, R. (1977). *The rhetoric of the image.* In *Image, Music, Text, Essays.* Translated by S. Heath. London: Fontana.

Baudoiun, A., & Anker, P. (1984). *Kartperception of EDB-assistert kartografi.* Oslo: Norwegian Computing Center. Publication 744.

Bausell, R. B., & Jenkins, J. R. (1987). Effects on prose learning of frequency of adjunct cues and the difficulty of the material cued. *Journal of Reading Behavior, 9,* 227–232.

Bazeli, F. P., & Bazeli, P. T. (1992). *Instructional implications of visual and verbal short-term memory capacity differences among children.*
In J. Clark–Baca, D. G. Beauchamp, & R. A. Braden, (Eds.) 1992: *Visual Communication: Bridging Across Cultures. Selected Readings from the 23rd Annual Conference of the International Visual Literacy Association.* Blacksburg, VA: International Visual Literacy Association.

Beaver, D. (1994). *Lazy Learning – Making the most of the Brains You were Born With.* Element Books Limited, Shaftesbury, Dorset.

Beck, C. R. (1984). Visual cueing strategies: Pictorial, textual, and combination effects. *Educational Communication & Technology Journal, 32,* 207–216.

Benson, P. J. (1985). Writing visually: Design considerations in technical publications. *Technical Communications Journal. Fourth Quarter,* 35–39.

Bergström, B. (1998). *Effektiv visuell kommunikation.* Stockholm. Carlssons Bokförlag.

Bernard, R. M. (1990). Using extended captions to improve learning from instructional illustrations. *British Journal of Educational Technology, 21,* 215–255.

Berndal, B., & Frigyes, P. (1990). *Typiskt typografiskt.* Stockholm: Bokförlaget T. Fischer, & Co.

Bertin, J. (1967). *Sémiologie Graphique.* Paris and the Hague: Mouton and Gauthiers-Villars.

Bettinghaus, E. P., Cody, M. J. (1994). *Persuasive Communication.* 5th ed. Fort Worth: Harcourt Brace Jovanovich College Publishers.

Black, A. (1990). *Typefaces for desktp publishing: a user guide.* London: Architec-ture Design and Technology Press.

Boeren, A. (1994). *In other words. . . The cultural dimension of communication for development.* The Hague: Centre for the Study of Education in Developing Countries.

Bohman, J. & Hallberg, Å. (1985). *Grafisk design – det synliga språket.* Arlöv: Bokförlaget Spektra AB.

Bork, A. (1982). *Information Display and Screen Design.* Paper presented at the American Educational Research Association Conference. New York.

Braden, R. A. (1983). *Visualizing the verbal and verbalizing the visual.* In R. Braden, & A. Walker (Eds.). *Seeing Ourselves: Visualization in a Social Context. Readings from the 14th Annual Confernce of the International Visual Literacy Association.* Blacksburg: Virginia Tech University.

Braden, R. A. (1985). *The stylish look: A format for visual literacy writers.* In N. H. Thayer, & S. Clayton-Randolph (Eds.). *Visual Literacy: Cruising into the Future. Readings from the 16th*

Rune Pettersson >It Depends–Principles and Guidelines<

Annual Conference of the International Visual Literacy Association. Bloomington, IN: Western Sun Printing Co.

Bradshaw, A, C. (1996). *Presentation interference in crosscultural settings.* Presentation at the annual meeting of the Association for Educational Communications Technology, Indianapolis, IN.

Bradshaw, A, C. (2000). *Evaluating Visuals for Instruction. In* R. E. Griffin, W. J. Gibbs, & V. S. Villiams (Eds.) *Natural Vistas Visual Literacy & The World Around Us. Selected Readings of the International Visual Literacy Association.* International Visual Literacy Association.

Bradshaw, A, C. (2003). Effects of Presentation Interference in Learning with Visuals. *Journal of Visual Literacy, 23,* 1, 41–68.

Bradshaw, A, C., & Johari, A. (2000). *White Space for Clarity: Suggested Guidelines.* In R. E. Griffin, W. J. Gibbs, & V. S. Villiams (Eds.). *Natural Vistas Visual Literacy & The World Around Us. Selected Readings of the International Visual Literacy Association.* International Visual Literacy Association.

Branch, R. C., Bloom, J. R. (1995). *The Role of Graphic Elements in the Accurate Portrayal of Instructional Design.* In D. G. Beauchamp, R. A. Braden, and R. E. Griffin (Eds.). *Imagery and Visual Literacy.* The International Visual Literacy Association.

Briggs, L. J., & Wager, W. W. (1989). *Handbook of procedures for the design of instruction.* Englewood Cliffs. N. J. (USA): Educational Technology Publications.

Bringhurst, R. (2004). *The Elements of Typographic Style.* Version 3. 0. Vancouver B. C: Hartley & Marks.

Broadbent, D. E. (1984). The Maltese cross: A new simplistic model for memory. *Behavioral and Brain Sciences, 7,* 55–94.

Brouwer, H. (1995). Communicating with pictures. The Role of Pictures in Health Education in Outpatient Clinics of Rural African Hospitals. *Visual Sociology 10 (1–2)*, 15–27.

Bull, D. (1999). *Communication Design: Translation, Technology, Typography, And Teaching.* In R. E. Griffin, W. J. Gibbs, & B. Wiegman (Eds.). *Visual Literacy In An Information Age.* International Visual Literacy Association.

Burg, K. F., Boyle, J. M., Evey, J. R., & Neal, A. S. (1982). Windowing versus scrolling on a visual display terminal. *Human Factors, 24*, 385–394.

Burns, D., Venit, S., & Hansen, R. (1988). *The electronic publisher.* New York: Brady.

Carlson, N., R. (1993). *Psychology, The Science of Behavior. Fouth Edition.* Needham Heights, MA: Allyn and Bacon.

Carter, R., Day, B., Meggs, P. (2007). *Typographic Design: Form and Communication.* Fourth Edition. Hoboken, New Jersey, USA: John Wiley & Sons, Inc.

Case, R. (1974). Strictures and structures: Some functional limitations on the course of cognitive growth. *Cognitive Psychology, 14*, 287–302.

Case, R. (1975). Gearing the demands of instruction to the developmental capacities of the learner. *Review of Educational Research, 45*(*1*), 59–87.

Catalano, K. (1990). On the wire: How six news services are exceeding readability standards. *Journalism Quarterly, 67, 1,* Spring, pp. 97–103.

Chomsky, N. (1959). Review of verbal behaviour. In B. F. Skinner (Ed.). *Language, 35,* 26–58.

Christ, R. E. (1975). Review and analysis of color coding research for visual displays. *Human Factors, 17,* 542–578.

Cifuentes, L., Myers, L. J., & McIntosh, K. (1998). Selective Data Analyses, Photo Manipulation, and Honest Message Design. *Journal of Visual Literacy, Autumn 1998, Volume 18,* Number 2, 165–174.

Cisotto, L., & Boscolo, P. (1995). *Effects of paragraph subtitles and underlining on written summaries.* Presentation at the 6th European Conference for Research on Learning and Instruction. European Association for Research on Learning and Instruction. Nijmegen, August 26–31.

Colle, R. and Glass, S. (1986). Pictorial conventions in development communication in developing countries. *Media in Education and Development, 19 (4)*, 159–162.

Collier, D., & Cotton, B. (1989). *Basic Desktop Design and Layout.* Cincinnati, OH: North Light Books.

Davies, F. E., Barry, J., & Wiesenberg, M. (1986). *Desktop Publishing.* Homewood, IL: Dow Jones-Irwin.

Dewar, R. (1999). *Design and evaluation of public information systems.* In H. J. G. Zwaga, T. Boersma, and H. C. M. Hoonhout (Eds.). *Visual information for everyday use. Design and research perspectives.* London, Philadelphia: Taylor & Francis.

Dewar, R., & Arthur P. (1999). *Warning of water safety hazards with sequential pictographs.* In H. J. G. Zwaga, T. Boersma, and H. C. M. Hoonhout (Eds.). *Visual information for everyday use. Design and research perspectives.* London, Philadelphia: Taylor & Francis.

Dillon, A., & McKnight, C. (1990). Towards a classification of text types: A repertory grid approach. *International Journal of Man-Machine Studies, 33,* 623–636.

Donaldson, J. A. & Acheson, S. (2006). *Including A Virtual Reality Environment In An Online Setting.* In R. E. Griffin, M. Avgerinou, J. Giesen (Eds.) 2007. *History,*

Community, & Culture–Celebrating Tradition and Transforming the Future: Selected Readings of the International Visual Literacy Association. International Visual Literacy Association.

Duchastel, P. C. (1978). Illustrating instructional texts. *Educational Technology, 18,* 36–39.

Duchastel, P. C., & Waller, R. (1979). Pictorial illustration in instructional texts. *Educational Technology, 19,* 20–25.

Duchnicky, R. L., & Kolers, P. A. (1983). Readability of text scrolled on visual display terminals as a function of window size. *Human Factors, 25,* 683–692.

Dwyer, F. M. (1972). *A Guide for Improving Visualized Instruction.* State College, PA: Learning Services.

Dwyer, F. M. (1978). *Strategies for Improving Visual Learning.* State College, PA: Learning Services.

Dwyer, F. M. (1994). *One Dimension of Visual Research: A Paradigm and Its Implementation.* In D. M. Moore, & F. M. Dwyer (Eds.), *Visual Literacy. A Spectrum of Visual Learning.* Englewood Cliffs, NJ: Educational Technology Publications.

Dwyer, F. M., & Dwyer, C. A. (1989). Enhancing visualized instruction: A research overview. In R. A. Braden, D. G. Beauchamp, L. V. W. Miller, & D. M. Moore (Eds.). *About Visuals: Research, Teaching, and Applications.* Readings from the 20th Annual Conference of the International Visual Literacy Association. Blacksburg: Virginia Tech University.

Easterby, R. S. (1970). The perception of symbols for machine displays. *Ergonomics, 13,* 1, 149–158.

Easterby, R., & Zwaga, H. (Eds.) (1984). *Information Design. The design and evaluation of signs and printed material.* John Wiley and Sons Ltd.

Eco, U. (1971). *Den frånvarande strukturen. Introduktion till den semiotiska forskningen.* Lund, Swedish translation.

Ehrenberg, A. S. C. (1977). Rudiments of numeracy. *Journal of the Royal Statis-tical Society A, 140,* 277–297.

Eklund, S. (1990). *Bedömning av kunskaper och färdigheter i bild, årskurs 2. Del av en nationell utvärdering av grundskolan.* Umeå. Umeå Universitet. Institutionen för bildlärarutbildning. Rapport nr. 10.

Ekwall, E. (1977). *Diagnosis and Remediation of the Disabled Reader.* Boston: Allyn and Bacon.

Elkind, D. (1975). We can teach reading better. *Today's Education, 64,* 34–38.

Epskamp, K. (1981). Visuele Alfabetisering en de Derde Wereld. (Visual Literacy and the Third World). In A. Boeren and K. Ep-skamp (Eds.) *Registratie, 13,2.* 26–30.

Evans, M. A., Watson, C., & Willows, D. M. (1987). *A naturalistic inquiry into illustrations in instructional textbooks.* In H. A. Houghton, & D. M. Willows (Eds.). *The Psychology of Illustrations: Vol. 2. Instructional Issues,* New York: Springer-Verlag.

Flach, J. M., & Dominguez, C. O. (1995). Use-centered design. Integrating the user, instrument, and goal. *Ergonomics in Design, 3,* 19–24.

Fleming, M. L. & Levie, W. H. (1978). *Instructional Message Design.* Englewood Cliffs, NJ: Educational Technology Publications.

Fleming, M. L. & Levie, W. H. (Eds.) (1993). *Instructional Message Design* (2nd ed.). Englewood Cliffs, NJ: Educational Technology Publications.

Fowler. H. W. (2004). *Fowler's Modern English Usage.* (3rd ed.). Oxford: Clarendon Press.

Rune Pettersson >It Depends–Principles and Guidelines<

Frase, L. T., & Schwartz, B. J. (1970). Typographical cues that facilitate comprehension. *Journal of Educational Psychology, 71,* 197–206.

Gagné, R. W. (1977). *The conditions of learning (3rd ed.).* New York: Holt, Rinehart & Winston.

Gazzaniga, M. S. (1967). The split brain in man. *Scientific American, 217,* 24–29.

Glynn, S. M., Britton, B. K., & Tillman, M. H. (1985). Typographic cues in text: Management of the reader's attention. In D. H. Jonassen (Ed.). *The Technology of Text: Principles for Structuring, Designing, and Displaying Text. Volume 2.* Englewood Cliffs, NJ: Educational Technology Publications.

Goldsmith, E. (1984). *Research into Illustration: An Approach and a Review.* Cambridge, England: Cambridge University Press.

Gombrich, E. H. (1969). *Art and Illusion: A Study in the Psychology of Pictorial Representation.* Princeton, NJ: Princeton University Press.

Gould, J. D., & Grischkowsky, N. (1984). Doing the same work with hard copy and the cathoderay tube (CRT) computer terminals. *Human Factors, 26,* 323–337.

Grabinger, R. S. (1989). Screen layout design: Research into the overall appearence of the screen. *Computers In Human Behavior, 5,* 175–183.

Gregory, M., & Poulton, E. C. (1970). Even versus uneven right-hand margins and the rate of comprehension in reading. *Ergonomics, 13,* 427–434.

Griffin, R. E. (2009). *The Healthcare Presentation: PowerPoint And Word Visuals Combine For A Deadly Combination.* Presentation at the 41st Annual International Visual Literacy Association Conference, Chicago, USA, October 6–9, 2009. Pub-

Rune Pettersson >It Depends–Principles and Guidelines<

lished in: M.D. Avgerinou, R.E. Griffin & P. Search (Eds.). 2010. *Critically Engaging the Digital Learner in Visual Words and Virtual Environments.* Loretto, PA: IVLA.

Haber, R. N., & Hershenson, M. (1980). *The Psychology of Visual Perception.* New York: Holt, Rinehart, & Winston.

Haber, R. N., & Myers, B. L. (1982). Memory for pictograms, pictures, and words separately and all mixed up. *Perception, 11,* 57–64.

Hagen, I. (1998). *Creation of Socio—Cultural Meaning. Media Reception Research and Cognitive Psychology.* In B. Höijer and A. Werner (Eds.). *Cultural Cognition. New perspectives in audience theory.* NORDICOM: Göteborg University.

Hall, S. (1980). *Encoding/Decoding.* In S. Hall, D. Dobson, A. Lowe, and P. Willis (Eds.). *Culture, Media, Language.* London: Hutchinson.

Hallberg, Å. (1992). *Typografin och läsprocessen. Grafisk kommunikation med text och bild.* Halmstad: Bokförlaget Spektra.

Hannafin, M. J., & Peck, K. (1988). *The design, development, and evaluation of instructional software.* New York: Macmillan.

Hannus, M. (1996). *Oppikirjan kuvitus koriste vai ymmärtämisen apu* (Textbook illustrations – decoration or an aid to understanding). Turku: Turun Yliopiston Julkaisuja Annales Universtatis Turkuensis.

Hartley, J. (1980). Spatial cues in text: Some comments on the paper by Frase, & Schwartz (1979). *Visible Language, XIV,* 62–79.

Hartley, J. (1985). *Designing Instructional Text* (second edition). London: Kogan Page.

Hartley, J. (1987). Designing electronic text: The role of print-based research. *Educational Communications and Technology Journal, 35,* 3–17.

Hartley, J. (1994). *Designing Instructional Text* (third edition). London: Kogan Page.

Hartley, J., Bartlett, S., & Branthwaite, A. (1980). Underlining can make a difference—sometimes. *Journal of Educational Research, 73,* 218–223.

Hartley, J., & Burnhill, P. (1977a). Fifty guidelines for improving instructional text. *Programmed Learning and Educational Technology, 14,* 65–73.

Hartley, J., & Burnhill, P. (1977b). Understanding instructional text: Typography, layout, and design. In M. J. A. Howe (Ed.). *Adult Learning.* London: John Wiley.

Head, A. J. (2000). *Design Wise. A guide for evaluating the interface design of information resources.* Medford, New Jersey: Cyber Age Books.

Heinich, R., Molenda, M., & Russell, J. D. (1982). *Instructional Media and the New Technologies of Instruction.* New York: Macmillan

Hellmark, C. (2000a). *Bokstaven, ordet, texten. Handbok i grafisk formgivning.* Stockholm: Ordfront förlag.

Hellmark, C. (2000b). *Typografisk handbok.* Stockholm: Ordfront förlag.

Henney, M. (1981). The effect of all-capital print versus regular mixed print as displayed on a micro-computer screen on reading speed and accuracy. *Educational Communications and Technology Journal, 31,* 126.

Hewson, D. (1988). *Introduction to Desktop Publishing.* San Francisco, CA: Chronicle Books.

Hoffman, B., White, A., & Aquino, N. (2005). *Screen Text Readability – Ease, Accuracy, And Speed Of Some Common Computer Typefaces.* In R. E. Griffin, B. D. Cowden, M. Av-

gerinou (Eds.) 2006. *Imagery and Artistry Animating the Mind´s Eye: Selected Readings of the International Visual Literacy Association.* International Visual Literacy Association.

Holliday, W. G. (1980). Using visuals to teach concepts. *Science and Children, 17,* 9–10.

Horton, W. (1991). *Illustrating Computer Documentation. The Art of Presenting Information Graphically on Paper and Online.* New York: John Wiley & Sons, Inc.

Hugo, J. (1996). Prioritizing guidelines for health education message design. *Journal of Audiovisual Media in Medicine, 19 (4),* 171–174.

Hunter, M. W., & Chick, K. A. (2005). Treatment of gender in basal readers. *Reading Research an Instruction, 44 (3).* 65–72.

Hurlburt, A. (1981). *The design concept.* New York: Watson – Guptill Publishers.

Ingvar, D. H., & Hallberg, Å. (1989). *Hjärnan, bokstaven, ordet.* Spektra: Halmstad.

Isaacs, G. (1987). Text screen design for computer-assisted learning. *British Journal of Educational Technology, 18,* 41–51.

Jonassen, D. H. (1982). *The Technology of Text, Principles for Structuring, Designing, and Displaying Text. Volume 1.* Englewood Cliffs, NJ: Educational Technology Publications.

Jonassen, D. H., & Kirschener, P. A. (1982). Introduction to section 2: Explicit techniques for structuring text. In D. H. Jonassen (Ed.). *The Technology of Text: Principles for Structuring, Designing, and Displaying Text. Volume 2.* Englewood Cliffs, NJ: Educational Technology Publications.

Katzmann, N., & Nyenhuis, J. (1972). Color vs black and white effects on learning, opinion, and attention. *AV Communication Review, 20,* 16–28.

Keates, J. S. (1982). *Understanding Maps.* London and New York: Longman.

Keller, J., & Burkman, E. (1993). Motivation principles. In M. Fleming, & W. H. Levie (Eds.). *Instructional Message Design: Principles from the Behavioral and Cognitive Sciences* (2nd ed.). Englewood Cliffs, NJ: Educational Technology Publications.

Kensicki, L. J. (2003). Building Credibility for Non-Profit Organizations through Webpage Interface Design. *Journal of Visual Literacy, 23,* 2, 139–162.

Kinney, G. C., & Showman, D. J. (1967). The relative legibility of upper-case and lower-case typewritten words. *Information Display, 4,* 34–39.

Kirkman, J. (2003). *Full marks: advice on punctuation for scientific and technical writing.* Marlborough : Ramsbury, Books.

Kirkman, J. (2005). *Good style. Writing for science and technology.* (2nd ed.). New York, NY: Routledge.

Klare, G. R. (1985). *How to write readable English.* London: Hutchinson.

Kleper, M. L. (1987). *The Illustrated Handbook of Desktop Publishing and Typesetting.* Blue Ridge Summit, PA: Tab Books.

Koblanck, H. (1999). *Typografi och grafisk design.* Stockholm: Bonnier Utbildning.

Kolers, P. A., Duchnicky, R. L., & Ferguson, D. C. (1981). Eye movement measurement of readability of CRT displays. *Human Factors, 23,* 517–524.

Kovalik, L. C. (2004). *Visuals Across Languages: Training Materials and Developing Countries.* In R. E. Griffin, S. B. Chandler & B. D. Cowden (Eds.) 2005. *Visual Literacy and Development: An African Experience. Selected Readings of the International Visual Literacy Association.* International Visual Literacy Association.

Kristiansen, T., Bjørgen, I, A., & Jørgensen, T, R. (1994). *Norwegian Experiences in Flexible Distance Learning in View of Assumptions of and Barriers in the Present Educational Culture.* Presentation at the Educational and Cultural Barriers to Open and Distance Learning University of Sheffield, June 1994.

Lamberski, R. J. (1972). *An Exploratory Investigation of the Instructional Effect of Color and Black and White Cueing on Immediate and Delayed Retention.* Masters Thesis, The Pennsylvania State University.

Lamberski, J. R., & Dwyer, F. M. (1983). The instructional effect of coding (color and black and white) on information acquisition and retrieval. *ECTJ, 31* (1), 9–12.

Lang, K. (1987). *The Writer's Guide to Desktop Publishing.* London: Academic Press.

Lantz, C. (1992). Development and pilot test of a photograph readability index for use in textbook adoption decisions. (Doctoral Dissertation, Southern Illinois University, 1990). *Dissertation Abstracts International, 53,* 2781.

Lantz, C. (1996). Evaluating the readability of instructional visuals. *Publishing Research Quarterly, 12 (1),* 31–51.

Lasswell, H. (1948). *The structure and function of communication in society.* In L. Bryson (Ed.). *The Communication of Ideas.* New York: Harper & Brothers.

Rune Pettersson >It Depends–Principles and Guidelines<

Lawson, L. (1968). Ophthalmological factors in learning disabilities. In H. Myklebust (Ed.). *Progress in Learning Disabilities, Volume 1.* New York: Grune and Stratton.

Lefferts, R. (1982). *How to Prepare Charts and Graphs for Effective Reports.* New York: Barns & Noble.

Lenze, J. S. (1991). *Serif vs. san serif type fonts: A comparison based on reader comprehension.* In D. G. Beauchamp, J. Clark-Baca, & R. A. Braden (Eds.). *Investigating Visual Literacy. Selected Readings from the 22nd Annual Conference of the International Visual Literacy Association.* Blacksburg: Virginia Tech University.

Lerner, N. D., & Collins, B. L. (1983). *Symbol sign understandability when visibility is poor.* In *Proceedings of the Human Factors Society 27th Annual Meeting*, 944–946. Santa Monica, CA: Human Factors Society.

Leshin, C. B., Pollock, J., & Reigeluth, C. M. (1992). *Instructional design strategies and tactics.* Englewood Cliffs, NJ: Educational Technology Publications.

Lester, P, M. (1995). *Visual Communication. Images with Messages.* Belmont*, CA:* Wadsworth Publishing Company. A Division of International Thomson Publishing Inc.

Levie, W. H., & Lentz, R. (1982). Effects of text illustrations: A review of research. *ECTJ, 30*, 4, 195–232.

Levin, J. R., Anglin, G. J., & Carney, R. N. (1987). On empirically validating functions of pictures in prose. In D. M. Willows, & H. A. Houghton (Eds.). *The Psychology of Illustration: Vol. 1. Basic Research.* New York: Springer- Verlag.

Lichty, T. (1989). *Design Principles for Desktop Publishers.* Glenview, IL: Scott Foresman and Co.

Lichty, T. (1994). *Design Principles for Desktop Publishers. 2nd ed.* Glenview, IL: Scott Foresman and Co.

Lidman, S., & Lund, A. M. (1972). *Berätta med bilder.* Stockholm: Bonniers.

Limburg, V. E. (1987). *Visual "Intrusion": A Two-Way Street in Visual Literacy.* Paper presented at the IVLA Symposium on Verbo-Visual Literacy: Research and Theory. Stockholm, June 10–13.

Lipton, R. (2007). *The Practical Guide to Information Design.* Hoboken, NJ: John Wiley & Sons, Inc.

Lockhart, R. S., & Craik, F. I. M. (1990). Levels of processing: A retrospective commentary on a framework for memory research. *Canadian Journal of Psychology, 44,* 87–112.

Lohr, L. L. (2003). *Creating Graphics for Learning and Performance. Lessons in Visual Literacy.* Upper Saddle River, New Jersey: Pearson Education, Inc.

Luchins, A. S., & Luchins, E. H. (1959). *Rigidity of behavior—A variational approach to the effect of einstellung.* Eugene, Oregon: University of Oregon Books.

MacDonald-Ross, M. (1977). How numbers are shown: A review of research on the presentation of quantitative data in texts. *AV Communication Review, 25 (4),* 359–409.

Malamed, C. (2009). *Visual Language for Designers: Principles for Creating Graphics People Understand.* Beverly, MA: Rockport

Mangan, J. (1978). Cultural conversations of pictorial representation: Iconic Literacy and Education. *ECTJ, 26 (3),* 245–267.

Marsh, P. O. (1983). *Messages That Work: A Guide to Communication Design.* Englewood Cliffs, NJ: Educational Technology Publications.

Mayer, R. E., & Sims, V. K. (1994). For whom is a picture worth a thousand words? Extension of a dual-coding theory of multi-

media learning. *Journal of Educational Psychology, 86(3),* 389–401).

Mayer, R. E., Steinhoff, K., Boweer, G., & Mars, R. (1995). A Generative Theory of Textbook Design: Using Annotatated Illustrations to Foster Meaningful Learning of Science Text. *ETR&D, 43, 1*, 31–43.

Mayer, R. E. (1993). *Illustrations that instruct.* In R. Glaser (Ed.). *Advances in instructional psychology*, Volume 5. Hillsdale, JH: Erlbaum.

McDougall, A. (1990). *Picture editing & layout a guide to better visual communication.* Viscom Press. School of Journalism. University of Missouri. Columbia.

Melin, L. (1986a). *Termer – Ett kompendium om terminologi och termbildning.* Stockholm: Stockholm University, Department of Nordic Languages.

Melin, L. (1986b). *Text, bild, lexivision. En studie i text-bild-samverkan i en lärobok.* Stockholm: Stockholm University, Department of Nordic Languages.

Melin, L. (1999a). *Gör illustrationen vad vi tror?* Nordicom 1–2: 1999. Medie- och kommunikationsforskning i Norden, 52–60.

Melin, L. (1999b). Hur bra är paratexter? *Språk & stil tidskrift för svensk språkforskning. 9,* 101–123.

Mijksenaar, P. (1997). *Visual Function. An Introduction to Information Design.* 010 Publishers: Rotterdam.

Mijksenaar, P. & Westendorp, P. (1999). *Open Here The Art Of Instructional Design.* London: Thames & Hudson Ltd.

Miles, J. (1987). *Design for Desktop Publishing.* San Francisco: Chronicle Books.

Miller, G. A. (1968). *The magical number seven, plus or minus two: Some limits on our capacity for processing information.*

In R. N. Haber (Ed.). *Contemporary Theory and Research in Visual Perception.* New York: Holt, Rinehart, and Winston, Inc.

Misanchuk, E. R. (1992). *Preparing Instructional Text: Document Design Using Desktop Publishing.* Englewood Cliffs, NJ: Educational Technology Publications.

Mok, C. (1996). Designing Business. San Jose, CA: Adobe Press.

Mollerup, P. (2005). *Wayshowing A Guide to Environmental Signage Principles & Practices.* Baden: Lars Müller Publishers.

Moreno, R., & Mayer, R. (2000). *A learner-centred approach to multimedia exlanations: Deriving instructional design principles from cognitive theory.* <http://imej. wfu/articles/ 2000/2/muex. asp>

Moriarty, S. E. (1991). *Creative Advertising. Theory and Practice.* Englewood Cliffs, NJ: Prentice Hall.

Moriarty, S. E. (1994). Visual Communication as a Primary Sytem. *Journal of Visual Literacy, 14*, 2, 11–21.

Moriarty, S. E., & Garramone, G. M. (1986). A study of newsmagazine photographs of the 1984 presidential campaign. *Journalism Quarterly, 63*, 646–734.

Moriarty, S. E., & Popovich, M. N. (1991). Newsmagazine visuals and the 1988 presidential election. *Journalism Quarterly, 68*, 371–380.

Moriarty, S. E., & Rohe, L. (1992). Cultural palettes: An exercise in sensitivity for designers. *Journalism Educator, 46* (4), 566–570.

Morley, D. (1992). *Television, Audiences and Cultural Studies.* London: Routledge.

Mullet, K. & Sano, D. (1995). *Designing Visual Interfaces Communication Oriented Techniques.* Mountain View, California: SunSoft Press A Prentice Hall Title.

Newell, A. (1990). *Unified theories of cognition.* Cambridge, MA: Harvard University Press.

Nielsen, L. M. (2004). *Imagining Space On The Base Of Pictorial Representation.* In R. E. Griffin, S. B. Chandler & B. D. Cowden (Eds.) 2005. *Visual Literacy and Development: An African Experience. Selected Readings of the International Visual Literacy Association.* International Visual Literacy Association.

Nordegren, A. (2004). *Design som teori och emperi. Ett designteoretiskt forsknings-projekt med en prototyputveckling av ett symbolsystem för vinsmaker.* Stockholm: KTH Arkitekturskolan, Doktorsavhandling.

Norman, D. A., & Bobrow, D. G. (1975). On data limited and resource limited processes. *Cognitive Psychology, 7,* 44–64.

Ormrod, J. E. (1989). *Using Your Head. An Owner's Manual.* Englewood Cliffs, NJ: Educational Technology Publications.

Paivio, A. (1971). *Imagery and the Verbal Process.* New York: Holt, Rinehart, & Winston.

Paivio, A. (1978). A dual coding approach to perception and cognition. In H. L. Pick, Jr., & E. Saltzman (Eds.). *Modes of Perceiving and Processing Information.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Paivio, A. (1979). *Imagery and Verbal Processes.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Paivio, A. (1983). The empirical case for dual coding. In J. C. Yuille (Ed.). *Imagery, Memory, and Cognition.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Paivio, A. (1986). *Mental representations: A dual coding approach.* Oxford, England: Oxford University Press.

Paivio, A. (1990). *Mental representations: A dual coding approach.* (2nd ed.). Oxford, England: Oxford University Press.

Paivio, A. (1991). Dual coding theory: Retrospect and current status. *Canadian Journal of Psychology, 45*(3), 255–287.

Parker, R. C. (1988). *The Aldus Guide to Basic Design* (2nd ed.). Seattle, WA: Aldus Corporation.

Pascual-Leone, J., & Smith, J. (1969). The encoding and decoding of symbols by children: A new experimental paradigm and a neo-Piagetian model. *Journal of Experimental Child Psychology, 8,* 328–355.

Paterson, D. G., & Tinker, M. A. (1932). Studies of typographical factors influencing speed of reading: X. Styles of type face. *Journal of Applied Psychology, 16,* 605–613.

Peeck, J. (1993). Increasing picture effects in learning from illustrated text. *Learning and Instruction, 3,* 227–238.

Peeck, J. (1994). *Enhancing graphic effects in instructional texts: Influencing learning activities.* In W. Schnotz, R. W. Culhavy (Eds.). *Comprehension of graphics.* North Holland, Elsevier Science B. V. : Amsterdam.

Perfetti, C. (1977). Language comprehension and fast decoding: Some psycholinguistic prerequisites for skilled reading comprehension. In J. Guthrie (Ed.). *Cognition, Curriculum, and Comprehension.* Newark, DE: International Reading Association.

Peters, J. M. (1978). *Pictorial communication.* Cape town: David Philip.

Pettersson, R. (1983). *Picture legibility, readability and reading value.* Paper presented at the 15th Annual Conference of the International Visual Literacy Association. Bloomington. Oct. In A. D. Walker, R. A. Braden, & L. H. Dunker (Eds.) 1984: *Enhancing human potential. Readings from the 15th Annual Conference of the International Visual Literacy Association.* Blacksburg, Virginia. 92–108.

Pettersson, R. (1985). *Intended and Perceived Image Content.* Paper presented at the 17th Annual Conference of the International Visual Literacy Association. Claremont. Nov. 1–2.
A shorter version published in: L. W. Miller (Ed.). 1985: *Creating Meaning. Readings from the Visual Literacy Conference at California State Polytechnic University at Pomona.* International Visual Literacy Association, Inc., 11–16.

Pettersson, R. (1986a). *Image – Word – Image.* Paper presented at the 18th Annual Conference of the International Visual Literacy Association. Madison, Wisconsin, Oct. 30 – Nov. 2.
Also presented at the Information Design Conference 3, at the University of Warwick, England, Dec. 15 – 17.
In *Journal of Visual Verbal Languaging. Fall 1986*, *6*, *2*, 7–21.
Also published in: R. A. Braden, D. G. Beauchamp and L. W. Miller (Eds.) 1987: *Visible & Viable. The Role of Images in Instruction and Communication.* East Texas State University. Commerce. Texas, 165–181.

Pettersson, R. (1986b). See, look and read. *Journal of Visual Verbal Languaging.* Spring, 33–39.

Pettersson, R. (1989). *Visuals for Information: Research and Practice.* Englewood Cliffs, NJ: Educational Technology Publications.

Pettersson, R. (1990). Teachers, Students and Visuals. *Journal of Visual Literacy*, *10*, 1, 45–62.

Pettersson, R. (1991). *Bilder i läromedel.* Tullinge: Institutet för Infologi.

Pettersson, R. (1993). *Visual Information.* Englewood Cliffs, NJ: Educational Technology Publications.

Pettersson, R. (1994). *Associations from Pictures.* Paper presented at the 26th Annual Conference of the International Visual Literacy Association. Tempe, Oct. 12–16. 1994. In D. G. Beauchamp,

R. A. Braden & R. E. Griffin, (Eds.) 1995: *Imagery and Visual Literacy. Selected Readings. International Visual Literacy Association.*

Pettersson, R. (1997). *Verbo-visual Communication – Presentation of Clear Messages for Information and Learning.* Göteborg: Valfrid Publishing Association and Research Centre for Library and Information Studies, Göteborg University.

Pettersson, R. (1999). *Graphic Symbols–Design And Meaning.* Presentation at The 31th Annual Conference of the International Visual Literacy Association. The University of Wyoming, Jackson Hole, Wyoming, October 6– 10, 1999. In R. E. Griffin, W. J. Gibbs, & V. S. Williams (Eds.) 2000: *Natural Vistas Visual Literacy & The World Around Us. Selected Readings of the International Visual Literacy Association.* International Visual Literacy Association.

Pettersson, R. (2002). *Information Design, An introduction.* Amsterdam/ Philadelphia: John Benjamins Publishing Company.

Pettersson, R., Carlsson, J., Isacsson, A., Kollerbauer, A., & Randerz, K. (1984). *Color Information Displays and Reading Efforts.* (CLEA–Report No. 18a). Stockholm: Stockholm University, Department of Computer Science.

Pettersson, R., Frank, L., Frohm, J., Holm-berg, S., Johansson, P., Meldert, M. och Strand, L. (2004). *Bild & form för informationsdesign.* Lund: Studentlitteratur.

Pettersson, R., & Strand, L. (2005). *The Golden Ratio.* Presentation at the 37th Annual Conference of the International Visual Literacy Association. Orlando, Florida, USA, October 17 – 20, 2005. In R. E. Griffin, B. D. Cowden, M. Avgerinou (Eds.) 2006. *Imagery and Artistry Animating the Mind´s Eye: Selected Read-*

ings of the International Visual Literacy Association. International Visual Literacy Association.

Pirozzolo, F., & Rayner, K. (1979). Cerebral organization and reading disability. *Neuropsychologia, 17*, 485–491.

Postman, N. (1979). *Teaching as a Conserving Activity.* New York: Delacorte Press.

Poulton, E. C., & Brown, C. H. (1968). Rate of comprehension of an existing teleprinter output and of possible alternatives. *Applied Psychology, 52,* 16–21.

Pressley, G. M. (1977). Imagery and children's learning: Putting the picture in developmental perspective. *Review of Educational Research, 47*, 585–622.

Pye, D. (1964). *The nature of design.* New York: Van Nostrand Reinhold.

Rambally, G. K., & Rambally, R. S. (1987). Human factors in CAI design. *Computing Education, 11(2),* 149–153.

Ramsey, I. L. (1989). Primary children's ability to distinguish between illustra-tive styles. *JVL, 9(2)*, 69–82.

Reinking, D. (1986). Integrating graphic aids into content area instruction: The graphic information lesson. *Journal of Reading, 30*(2), 146–151.

Reynolds-Myers, P. (1985). *Visual literacy, higher order reasoning, and high techno-logy.* In N. H. Thayer, & S. Clayton- Randolph (Eds.). *Visual Literacy: Cruising into the Future.* Readings from the 16th annual conference of the International Visual Literacy Association. Bloomington: Western Sun Printing Co.

Rowland, G. (1993). Designing and instructional design. *Educational Technology Research and Development, 41* (1), 79–91.

Sanders, M. S., and McGormick, E. J. (1993). *Human Factors in Engineering and Design* (7th edn). New York: McGraw-Hill.

Schramm, W. (1954). *Procedures and effects of mass communication.* In B. H. Nelson (Ed.). *Mass Media and Education. The Fifty-Third Year-book of the National Society for the Study of Education. Part II.* Chicago: University of Chicago Press.

Severin, W. J. &. Tankard, J. W. (1988). *Communication Theories: Origins, Methods, Uses.* New York: Longman.

Shadrin, R. L. (1992). *Design & Drawing An Applied Approach.* Worcester, Massachusetts: Davis Publications, Inc.

Shannon, C. E., & Weaver, W. (1949). *The Mathematical Theory of Communication.* Champaign, IL: The University of Illinois Press.

Simlinger, P. (1999). The Future of Information Design? *design matters, 3,* 3, 4–5.

Sinatra, R. (1986). *Visual Literacy Connections to Thinking, Reading, and Writing.* Springfield, IL: Charles C. Thomas.

Smith, P. L., and Ragan, T. J. (1999). *Instructional Design.* Merrill, Prentice Hall. Columbus, Ohio.

Smith, P. L., and Ragan, T. J. (2005). *Instructional Design.* (3rd ed.). Hoboken, N.J.: Wiley Jossey-Bass Education.

Sosa, T. & Kong, A. (2006). *Gender Messages In Reading Textbooks – An Analysis Of Textual And Visual Content In Basal Readers.* In R. E. Griffin, M. Avgerinou, J. Giesen (Eds.) 2007. *History, Community, & Culture– Celebrating Tradition and Transforming the Future: Selected Readings of the International Visual Literacy Association.* International Visual Literacy Association.

Soulier, J. S. (1988). *The design and development of computer-based instruction.* Newton, MA: Allyn & Bacon.

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Sperry, R. W. (1973). *Lateral specialization of cerebral functions in the surgically separated hemispheres.* In F. J. McGuigan, & R. A. Schoonever (Eds.). *The Psychophysiology of Thinking: Studies of Covert Processes.* New York: Academic Press.

Sperry, R. W. (1982). Some effects of disconnecting the hemisphere. Science, 217, 1223–1226.

Strunk, W. & White, E. B. (2000). *The Elements of Style.* Boston: Allyn and Bacon.

The Chicago Manual of Style (2003). See *Chicago Manual of Style* (2003).

The Economist (1991). *Style Guide.* The Economist Books. London.

The Economist (2003). *Style Guide*. London: The Economist Books. Retrieved July 4, 2007 from <http://www. economist. com /research/styleguide/>

Tinker, M. A. (1963). *The Legibility of Print.* Ames: Iowa State University Press.

Tinker, M. A. (1965). *Bases for Effective Reading.* Minneapolis: University of Minnesota Press.

Trollip, S. R., & Sales, G. (1986). Readability of Computer-Generated Fill-Justified Text. *Human Factors, 28, 2,* 159–163.

Tufte, E. R. (1983). *The Visual Display of Quantitative Information.* Cheshire, New Haven Conneticut: Graphics Press.

Tufte, E. R. (1990). *Envisioning Information.* Cheshire, New Haven Conneticut: Graphics Press.

Tufte, E. R. (2003). PowerPoint Is Evil. Power Corrupts. PowerPoint Corrupts Absolutely. *Wired, 11* (09). <http://www.wired.com/wired/archive/11.09/ppt2.htm>

Tufte, E. R. (2006). *The cognitive style of powerpoint.* Chesire, CT: Graphics Press.

Van Aswegen, A. & Steyn, M. (1987). *Bepaling van die effiktiwiteit van foto´s en illustrasies as forme van beeldkommunikasie vir die oordra van 'n boodskap onder landelike swartes.* Pretoria: Raad vir Gesteswetenskaplike Navorsing.

Vickery, B., Vickery, A. (1987). *Information Science in theory and practice.* London, Butterworth.

Vogel, D. R., Dickson, G. W., & Lehman, J. A. (1986). Driving the audience action response. *Computer Graphics World,* August.

Walker, A. D. (1990). *Examining visual literacy, 1983–1989: A seven-year bibliography.* In R. A. Braden, D. G. Beauchamp, & J. Clark-Baca (Eds.). *Perceptions of Visual Literacy. Selected Readings from the 21st Annual Conference of the International Visual Literacy Association.* Conway: University of Central Arkansas.

Waller, R. (1987). *The Typographic Contribution to Language: Towards a Model of Typographic Genres and Their Underlying Structures.* Reading: University of Reading, Department of Typography, & Graphic Communication.

Waller, Robert. (2007). Comparing typefaces for airport signs. *Information Design Journal Volume 15*, *1,* 2007 p. 1–15. Amsterdam/Philadelphia: John Benjamins Publishing.

Wanta, W., & Chang, K-K. (2000). Visual Depictions of President Clinton in the International Press After the Release of the Starr Report. Paper presented to the Visual Communication Interest Group at the International Commu-nication Association, Acapulco, Mexico, June 1–5, 2000.

Ware, C. (2004). *Information Visualization. Perception for Design.* 2nd Ed. Amsterdam: Morgan Kaufmann Publishers.

Waugh, N. C., & Norman, D. A. (1965). Primary memory. *Psychological Review, 72,* 89–104.

Weidenmann, B. (1989). When good pictures fail: An information-processing approach to the effect of illustrations. In H. Mandl, & J. R. Levin (Eds.). *Knowledge Acquisition from Text and Pictures.* Amsterdam: Elsevier.

West, S. (1987). Design for desktop publishing. In the Waite Group (J. Stockford, Ed.), *Desktop Publishing Bible.* Indianapolis, IN: Howard W. Sams.

Westendorp, P. (2002). *Presentation media for product interaction.* Delft: Technische Universiteit.

Westendorp, P., & Van der Vaarde, K. (2001). Icons: support or substitute? Editorial introduction. *Information design journal 10(2)*, pp. 91–94.

White, J. (1983). *Mastering Graphics.* New York: Bowker.

White, J. (1987). *New Strategies for Editing and Design.* Presentations at Trialog 87, Stockholm.

Whiteside, C., & Blohm, P. (1985). The effects of CRT text color and decision making tasks on learners' recall. In N. H. Thayer, & S. Clayton-Randolph (Eds.). *Visual Literacy: Cruising into the Future.* Readings from the 16th Annual Conference of the International Visual Literacy Association. Bloomington, IN: Western Sun Printing Co.

Wikipedia (2007). *Manual of Style.* <http://en. wikipedia. org/wiki/Wikipedia: Maual_ of_Style>

Wileman, R. E. (1993). *Visual Communicating.* Englewood Cliffs, NJ: Educational Technology Publications.

Williams, R. (1994). *The non-designer's design book.* Berkely, CA: Peachpit Press.

Williams, R. & Tollet, J. (1998). *The non-designer's web book: An easy guide to creating, designing, and posting your own web site.* Berkely, CA: Peachpit Press.

Winn, W. D. (1980). Visual information processing: A pragmatic approach to the imagery question. *Educational Communication and Technology Journal, 28(2)*, 120–133.

Winn, W. D. (1981). The effect of attribute highlighting and spatial organization on identification and classification. *Journal of Research in Science Teaching, 17*, 201–211.

Winn, W. D. (1982). The role of diagrammatic representation in learning sequences, identification and classification as a function of verbal and spatial ability. *Journal of Research in Science Teaching, 19*, 78–89.

Winn, W. D. (1993) Instructional design and situated learning: Paradox or partnership? *Educational Technology, 33*(3), 16–21.

Winn, W. D. (1993). *Perception principles.* In M. Fleming & W. H. Levie (Eds.). *Instructional Message Design: Principles from the Behavioral and Cognitive Sciences* (2nd ed.). Englewood Cliffs, NJ: Educational Technology Publications.

Winn, W. D. & Holliday, W. (1985). *Design principles for diagrams in charts.* In D. H. Jonassen (Ed.). *The Technology of Text: Principles for Structuring, Designing, and Displaying Text. Volume 2.* (pp. 277–299). Englewood Cliffs, NJ: Educational Technology Publications.

Wittrock, M. C. (1974). Learning as a generative activity. *Educational Psychologist, 11*, 87–95.

Wittrock, M. C. (1989). Generative processes of comprehension. *Educational Psychologist, 24*, 345–376.

Wogalter, M. S. (1999). *Factors influencing the effectiveness of warnings.* In H. J. G. Zwaga, T. Boersma, and H. C. M. Hoonhout (Eds.). *Visual information for everyday use. Design and research perspectives.* London, Philadelphia: Taylor & Francis.

Wright, P. (1968). Using tabulated information. *Ergonomics, 11(4)*, 331–343.

Wright, P. (1982). A user-oriented approach to the design of tables and flowcharts. In D. H. Jonassen (Ed.). *The Technology of Text: Principles for Structuring, Designing, and Displaying Text.* Englewood Cliffs, NJ: Educational Technology Publications.

Wright, P., & Fox, K. (1972). Presenting information in tables. *Applied Ergonomics, 1*(4), 234–242.

Wright, P., & Lickorish, A. (1983). Proof-reading texts on screen and paper. *Behavior and Information Technology, 2(3),* 227–235.

Yarbus, A. (1967). *Eye Movements and Vision.* New York: Plenum Press.

Young, M. (1989). *The Technical Writer's Handbook.* University Science Books. Mill Valley, CA.

Zachrisson, B. (1965). *Studies in the Legibility of Printed Text.* Stockholm: Almqvist and Wiksell.

Zakia, R. D. (1985). Advertising and sexual ethic. *International Journal of Visual Sociology, 3,* 1, 42–58.

Zimmermann, M. L., & Perkin, G. W. (1982). Instructing through pictures: print materials for people who do not read. *Information design journal, 3/2,* 119–134.

Zwaga, H. J. G., Boersma, T., and Hoonhout, H. C. M. (1999). *Visual information for everyday use. Design and research perspectives.* London, Philadelphia: Taylor & Francis.

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