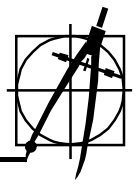
Sources of Ideas & Information



A single designer or even a team of designers cannot have knowledge about all aspects of every design they attempt. It would not be feasible to acquire expertise in all required areas, therefore it is necessary to turn to other sources for knowledge and ideas. Fortunately, these sources are numerous, and thanks to modern communication and the Internet, information can be sought globally, often at little cost.

Project activities in which sources of ideas and information are useful:

- Concept Generation
- Detail Design

Other tools that are useful in conjunction with sources of ideas and information:

- Brainstorming
- Eliciting Input
- Engineering Records
- Evaluation Matrices
- Kano Model Analysis
- Quality Function Deployment
- Morphological Methods

Introduction

One of the largest and most crucial components of design is discovering ideas and information that will ultimately lead to design solutions. Although many ideas result from brainstorming, storyboarding and other creative processes, the majority either stem directly from, or are based on, existing ideas from various sources. For example, an analysis of competitive, legacy or similar products, or individual functions or components of these products, may lead to design solutions. The advantage of this approach is that the designer has the opportunity to know what aspects have proven to work and which can be improved upon.

Working with Ideas

Not all ideas can be directly adopted to form part of the design solution. Often only elements of ideas are used and these must be organized and combined to develop new, feasible ideas. Sometimes, ideas that at first do not appear to be workable, may in fact become practical solutions when modified or combined with other ideas.

Sources of Ideas & Information

There are a number of approaches for organizing, assessing, and manipulating ideas. Some of these approaches are described in Pahl and Beitz (systematic combination, combining with the help of mathematical methods) and Hyman (morphological boxes and charts). The use of checklists is another technique used to enhance creative thinking and the manipulation of ideas. Attachment A provides an example of an idea-generating checklist.

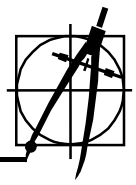
Hints for Locating and Using Information

Mount, in his book *Guide to Basic Information Sources in Engineering*, suggests some basic guidelines to follow when attempting to locate information.

- Take the time to clearly determine the information that is required.
- It always takes longer than anticipated to find information. Be generous with time allotments.
- Determine what is already known such as individuals or companies working in the field of interest. Use relevant dates to help with the search (e.g., information on lasers will likely be found in publications from 1960 and newer).
- Consult the easiest and most accessible tools first.
- Be as specific as possible. However, if a specific search proves futile, a broader search may have to be employed.
- Do not stop with a single reference. Search also for newer and alternate sources.
- If a search is going nowhere, re-evaluate the search criteria and/ or sources.
- It is better to ask for help than waste time.

Other hints that should be considered when searching for ideas and information include:

- Consider the source. If information is obtained from a periodical at a grocery checkout counter or a personal website, it is advisable to seek other sources to confirm or refute the validity of the information. It is even advisable to consult multiple sources to confirm information obtained from reputable sources.
- Weigh the value of the information against the cost (time and remuneration) to obtain the information.



- Peruse cited references within documents for other potential sources of information.

Idea and Information Sources

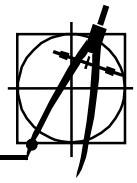
Literature as Idea and Information Sources

Books

- **Handbooks:** The engineering field publishes a variety of handbooks on data, procedures and technical information. These publications are usually available through the library. Examples are *Mark's Standard Handbook of Mechanical Engineering* and the *Tool and Manufacturing Engineers' Handbook* published by the Society of Manufacturing Engineers. The latter handbook includes a number of volumes covering various topics such as materials, finishing and coating, machining, and design for manufacturability.
- **Textbooks:** Books are frequently a good source of information. Although technical information may not be the most up to date by the time a book is published, even some very old texts can sometimes provide, or at least stimulate, some interesting ideas. Some old ideas can find a new life through novel materials, processing or design methods.
- **Industry manuals:** Many engineering associations produce manuals that provide general (e.g., design procedures) and specific (e.g., motors, bearings) information about standard products, parts and procedures. Nuts and bolts, for example, are described in the SAE Handbook.

Periodicals and Technical Reports

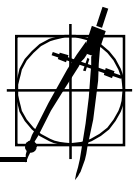
- **Trade Magazines:** There are a number of trade magazines that cover general design issues or are targeted at a specialized technical field. These magazines are often a source of solutions for current problems. In addition to the articles in these magazines, the advertisements can provide a fruitful source of ideas. As it is difficult to pinpoint specific information in trade magazines, it is a good practice to make a habit of regularly reading or at least scanning these publications so information can be located when required.



- **Research Journals:** Research journals directly related to the specific area of the problem to be solved may provide modelling and analysis of specific problems as well as more general information that can lead to a design solution. Examples of these journals are *Journal of Engineering Design, ASME Journal of Heat Transfer,* and *Artificial Intelligence in Engineering, Design and Manufacturing.*
- **Databases:** Databases provide a mechanism by which articles from hundreds of technical journals spanning numerous years can be searched for a specific subject. The usability of these databases has been greatly enhanced in recent years by computerization. Examples of these databases include *The Engineering Index* and *The National Technical Information Service*. These databases can be searched by general categories, or specific key words can be used for more targeted searches.

Directories

- **Thomas Register:** The Thomas Register of American Manufacturers is a set of volumes that provide information about manufacturers of a multitude of products and services. It can typically be found in the library but is now conveniently available on the Internet at www.thomasregister.com.
- **Fraser's Canadian Trade Directory:** Similar to the Thomas Register, Fraser's Canadian Trade Directory provides information about Canadian providers of products and services. It is available in both hard copy and CD-ROM formats, and can also be accessed through the Internet at www.frasers.com where searches can be conducted within the categories of company, product/service or brand name.
- **Yellow Pages:** The yellow pages are another source for suppliers and manufacturers. If availability from local suppliers is insufficient, yellow pages for other cities can often be found at the library or on the Internet.
- **Catalogues:** There are hundreds of catalogues of parts, assemblies and materials available through vendors. These catalogues are often available through workshops and resource centres, or can be ordered by mailing away request cards often included in trade publications.



Other Literature Sources

- **World Wide Web:** Searching the Internet can lead to websites belonging to vendors, manufacturers, consultants, design companies, professional organizations and educational centres, to name a few. Almost every organization of one type or another has a website, and the information that is often provided on these websites is remarkable. Information found on the Internet is often more current than what is published, and usually provides an e-mail address to which questions and requests for additional information can be sent. As anyone can create a website, caution should be used to ensure information has been obtained from a reputable source.
- **Brochures:** Marketing publications available from competitors or for related products can sometimes provide valuable information.

People as Idea and Information Sources

An extremely valuable source of ideas that often gets overlooked is people. It is truly amazing the viable ideas that can come from not only subject experts, but also the most unlikely sources including the person sitting next to you on the plane or a small child.

Designers should never be afraid to ask others for ideas. Even if someone does not have any solutions to offer, they may know where to locate information or a person who can provide information. This is called networking and can be one of the most powerful tools in business today.

- **Colleagues:** Colleagues are usually a very approachable source of ideas. They may be people within the same company, contacts within other organizations or former classmates.
- **Consultants:** Consultants are generally people who are experts in a certain area. Although mostly paid for there expertise, many willingly will answer questions and provide information as long as it is not in conflict with their commitments and doesn't require a great deal of time. Consultants can generally be located through word-of-mouth, professional directories, yellow pages, educational institutions or the Internet.

- **Vendors:** Although vendors typically are interested in selling their product, many value the development of relationships and will therefore often be a willing source of ideas and even samples. Vendors are an excellent resource as they often are current in technology and have the opportunity to visit a variety of companies where they can view different ways of doing things.
- **Customers:** Customers are an excellent source of ideas. Often they have conducted their own research before committing to working with a team of designers on a specific project. They may have seen similar products in use and have ideas on different concepts that could be employed.
- **Lead users:** These people are those that had a need for a product long before the general population. Lead users have often created adaptations or invented their own solutions to satisfy their requirements until a new product comes along.
- **Friends/family:** Many designers find ideas for projects when casually talking to friends and family. Sometimes people who have little knowledge of the technology or the specific problem to be solved may look at things from a different perspective and propose creative solutions.

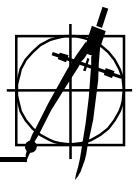
Organizations as Idea and Information Sources

- **Government:** There are numerous sources within all levels of government both within Canada and other countries such as the United States. Many departments, including the Transportation and Safety Board, the National Bureau of Standards and the Department of National Defence, have standards and guidelines based on extensive research. Engineering organizations throughout the world make extensive use of the Military Standards produced by the U.S. Department of Defense, many of which can be accessed through libraries or downloaded from the Internet. The National Technical Information Service, a branch of the U.S. Department of Commerce, is a source for worldwide scientific, technical, engineering and business related information. Much of this information can be obtained through their Internet site www.ntis.gov. Her Majesty's Stationary Office (www.hmso.gov.uk) is a similar source for publications created within the government of the United Kingdom.

- **Non-profit laboratories and associations:** Organizations such as the Canadian Standards Association, Underwriters Laboratories, American Society for Testing and Materials, and American Standards Association can provides standards and guidelines at a nominal fee. Often products must be tested against and comply with these standards before they can be offered commercially.
- **Professional Organizations:** Groups such as Association of Professional Engineers, Geologists and Geophysicists of Alberta (APEGGA) and Society of Manufacturing Engineers (SME) often have publications and codes available. These organizations typically can identify and provide contact information for experts on a given subject.

Other Idea and Information Sources

- **Nature:** Many innovative technical solutions are based on principles found in nature. Birds have provided concepts for winged flight as fish have for submarines. Honeycombs have provided examples of lightweight but strong structures and the arch of the human foot demonstrates the effectiveness of a keystone bridge structure for supporting heavy loads. Velcro™, an extensively used fastening device, was based on the gripping capabilities of a burr.
- **Patents:** Patents are an excellent source of technical ideas. Although the use of protected products may be prohibited or may require the payment of a royalty, expired and foreign patents without global coverage can be used. Reviewing restricted patents may spawn innovative new ideas that do not fall under the restriction of these patents. *The Mechanical Design Process* (Ullman) explains the process for researching patents.
- **Analogies:** The creative technique of using analogies involves examining the similarities between the current design problem and another similar problem. Basically, the design team completes the phase "This situation is like…", collects solution ideas for the analogous problem and then transfers these ideas to the original problem. The analogous problem can be another technical example or one from nature.
- The book *Guide to Basic Information Sources in Engineering* by Mount is one reference that highlights additional sources for information. Many engineering design books also provide suggestions for sources of ideas and information.



References

Dixon, John R. and Poli, Corrado, *Engineering Design and Design for Manufacturing: A Structured Approach*, Field Stone Publishers, Massachusetts, U.S.A., 1995, pp. 6-14 – 6-15.

French, M.J., *Invention and Evolution: Design in Nature and Engineering*, Cambridge University Press, Great Britain, 1988.

Hyman, Barry, *Fundamentals of Engineering Design*, Prentice-Hall, Inc., New Jersey, U.S.A., 1998, pp. 237-240.

Mount, Ellis, *Guide to Basic Information Sources in Engineering*, John Wiley & Sons, New York, U.S.A., 1976.

Pahl, G. and Beitz, W., *Engineering Design: A Systematic Approach*, The Design Council, London, 1988. pp. 82-85.

Singh, Karambir, *Mechanical Design Principles: Applications, Techniques and Guidelines for Manufacture,* Impact Printing Pty. Ltd, Melbourne, Australia, 1996. pp. 51-53.

Tool and Manufacturing Engineers Handbook, Volume 6: Design for Manufacturability, Bakerjian, Ramon Ed., McGraw-Hill, Inc., Michigan, U.S.A., 1992, pp. 9-8 - 9-9.

Woodson, Thomas T., *Introduction to Engineering Design*, McGraw-Hill, Inc., U.S.A., 1966, pp. 67-71.

Ullman, David G., *The Mechanical Design Process*, McGraw-Hill, U.S.A., 1997, .pp. 141-149.

Ulrich, Karl T. and Eppinger, Steven D., *Product Design and Development*, Mc-Graw-Hill, Inc., U.S.A., 1995, pp. 85-88.

Attachment A

Idea-Generating Checklist[1]

Put to other use?	How can this product/idea be used as is? What are other uses it could be adapted to?
Adapt?	What else is like this? What other idea does this suggest? Does past offer a parallel? What could be copied? Whom could be emulated?
Modify?	Change the meaning, material, colour, motion, form, shape, odour, etc.?
Magnify?	Add new ingredient? More time? Greater frequency? Make longer, stronger, thicker, higher, etc.? Duplicate? Multiply? Exaggerate?
Minify?	Miniature? Split up? Take something out? Omit? Make lighter, lower, shorter, etc.? Streamline? Understate?
Substitute?	Who else, where else, or what else? Other ingredient, material, process, power, place or approach?
Rearrange?	Interchange parts? Other pattern layouts? Transpose cause and effect? Change positives to negatives? Reverse roles? Turn it backwards or upside down? Sort? Change schedule?
Combine?	Combine parts, units, purposes, ideas? Blend? Alloy? Assortment? Ensemble? Compromise? Combine from different categories?

[1] Adapted from p.238 of *Fundamentals of Engineering Design* (Hyman, Barry) and p.9-9 of *Tool and Manufacturing Engineers Handbook, Vol. 6: Design for Manufacturability.*