

## Learning Outcomes:

- Emphasize visuals and interactivity as the key features of contemporary information design;
- Describe how visual and interactive affordances of technology support design of information display;
- Describe different types of Information Displays; and
- Design information display digital resources for learning.

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## 2.1 What Is an Information Display Resource?

An information display digital resource for learning is a digital media that presents certain information in an organized manner, often through visual and interactive affordances of representational technologies. We might also refer to these as *infographics* for learning. The purpose of that information is to be used in the contexts of learning activities to, for example, stimulate thinking, provide essential information, illustrated cases, stories and examples, provide technical information in an organized and easy to understand manner, and present informational material in an effective way for learners to use as required by their learning activities. An information display is primarily a strategy for designing and presenting educationally-useful information through visuals and interactivities that contemporary digital representational technologies afford, and in a way that can be effectively utilized as a mediating tool for learning.

**Important**

An information display is a strategy for the design and presentation of educationally-useful information that can be effectively utilized as a mediating tool in a learning activity.

Information is everywhere around us, and we come into contact with it daily through, for example, newspapers, books, television programs, billboards, Internet sites, posters, signs and messages, mobile devices and interaction with people and the environment. How well we can understand information, and how effectively we can reuse it to mediate our activities, depends in the first place on how effectively that information is represented, organized and arranged for purposes of informing a specific targeted audience. Parameters that define target audiences might include, for example, age, level information and media literacy (or literacy in general), language, culture, nationality, religion, disabilities, motivation, physiological characteristics, disabilities, etc. There are those aspects of cognitive abilities of a human to intellectually work with information which appear common across all of us, such as the ability to more easily and quickly use visual information, and give attention to details based on perception (unless we are dealing with individuals with specific disabilities impairing their visual abilities). Scanning with our eyes over a display of visual information can occur in no time. For example, as Tufte (1997) argues, a human eye can identify a single black pixel on a screen display amongst a million of white pixels within seconds. Tufte writes:

Our eyes can make a remarkable number of distinctions within a small area. With the use of very light grid lines, it is easy to locate 625 points in one square inch or, equivalently, 100 points in one square centimetre... The resolving power of the eye enables it to differentiate to 0.1 mm where provoked to do so. (pp. 160–162)

However, giving attention to messages embedded in that screen is not always well-developed for learners today because visual literacy is hardly noted in a curriculum in schools, unlike reading and writing traditional text. Although in early childhood and primary school education, children are frequently engaged with consuming and producing visuals, very quickly, this fades out, and the predominant mode of communication and expression through education tends to become traditional text (e.g., reading articles, writing essays and presenting arguments as lines and pages of linearly distributed text. This needs to change and students need to learn to effectively work with and produce visual and other multimodal information, not just in the context of their daily information activities, such as in communication and social networking, but also in the context of their school-related information work. The development of visual literacy, in addition to other new literacies, is a much needed change in education. Educators need to give attention not only to the traditional literacy of reading writing, speaking and listening, but also to emerging new literacies including, for example, visual literacy, digital literacy, critical literacy, media literacy, etc. This is, in particular, important because

emerging representational formats are beginning to dominate our information-related activities and uses of technologies. Students in schools need to learn how to engage with these formats, not only to consume information, but also to represent their knowledge and ideas in visual and interactive ways.

Contemporary representational technologies can afford for a large quantity of information to be effectively structured and presented in small screen spaces. The use of visuals (composed for example of lines, shapes, color, images, symbols, signs, animations, videos, etc.), and other modalities such as audio and special effects, screen arrangement and interface design possibilities, as well as interactivity are made possible by contemporary representational technologies (e.g., sliders, clickable area, drag & drop, and text inputs), to create innovative possibilities for the design of information. Here are some possibilities for the design of information displays in visual format:

- Illustrations;
- Timelines;
- Cartesian coordinates;
- Photorealistic images;
- Paintings and drawings;
- Caricatures and cartoons;
- Charts such as pie, bar, line, area, scatterplot, histogram, box plot, spectrograms;
- Radar chart, spider net charts, Gantt charts;
- Flowchart, Toulmin map, funnel map, bridge diagram, temple diagram;
- Argument slide, V-diagram;
- Cycle diagrams, Venn diagrams, Sakey;
- Mindmaps, cluster maps, concept maps, semantic networks;
- Maps of territories (abstract and real), data maps, tree map, cone tree maps, metromaps, pathways, continuums;
- Motion formats such digital stories, animation and video content;
- Tables such as classification tables, contrast and comparison tables, matrixes;
- Symbols, signs and icons;
- 3-dimensional object and spatial representations;
- Panoramic images;
- Wordly Cloud Tags;
- Virtual reality representations; and
- Augmented reality representations.

### **Activity 2.1**

*Visualization of information has been used in various disciplines as a means of packing and presenting large quantities and complexity of information. Such is the case, for example, in journalism, information science, business and marketing, sciences, engineering and medicine. Examine the periodic table of images in this link below, and explore various possibilities:*

[http://www.visual-literacy.org/periodic\\_table/periodic\\_table.html](http://www.visual-literacy.org/periodic_table/periodic_table.html)

Also, you can read this article that discusses the periodic table of visuals:

[http://www.visual-literacy.org/periodic\\_table/periodic\\_table.pdf](http://www.visual-literacy.org/periodic_table/periodic_table.pdf)

Furthermore, the following web site shows 50 examples of various visual information displays:

<http://www.hongkiat.com/blog/50-informative-and-well-designed-infographics/>

Review these examples and draw your own conclusion about:

- Which one is the best information display according to your opinion?
- What makes an information display effective?
- What makes an information display ineffective?

Some more interesting examples of visuals: <http://infographicworld.com/>

### Activity 2.2

Designing visual information is not a matter of just copying textual information into a visual format. It can be a very complex and intellectually demanding task. Here is a task for you to illustrate this complexity.

In 1984, linguist Thomas A. Sebeok was commissioned by the Office of Nuclear Waste Isolation and a group of other institutions to create a sign that could be read 10,000 years from now, indicating the danger of any excavation on the nuclear waste storage at the Yucca Mountain.

Your task is to draw such a sign. This is relatively complex task as you must consider a variety of ill-defined parameters in order to articulate your visual representation that could be read so far in the future.

(Source: <http://www.washtimes.com/upi-breaking/20041109-030639-4304r.htm>)

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## 2.2 A Single Interactive Screen for Display of Information

Effective organization and the presentation of information can be achieved through a digital resource by the way of using visuals and other multiples forms of modalities (or modes). Modalities such as sound, text, color, lines, shapes, sizes of objects, pictures, animation, videos, symbols and icons can be all used to communicate information. An important consideration is when a specific modality is the most effective for the purpose of mediation of learning. In some cases, certain

modalities might appear attractive to designers, but actual results can be achieved in different, simpler, and more effective ways. For example, would a video information be more effective than a simpler presentation of that information through few key frames (images) with captions? Or, would presenting information as an animation be more effective than a static diagram that uses arrows to illustrate movements? Moreover, these can be carefully combined in an innovative communication piece, making complex information much easier to understand. So, the main questions here are: (a) how visuals and other modalities can be arranged in an effective information display, (b) which modality is the best for a specific purpose, and (c) how modalities supplement each other to represent information. Combining these visual and multimodal possibilities with interactive affordance of contemporary representational technologies, makes possible to design this particular form of digital resource for learning.

### **Important**

Visuals allow the design of representations that communicate not just information, but also meanings, feelings, moods, giving unique atmospheres to the informational space, while enabling large quantities of information to be presented simultaneously, through visual elements such as symbols, icons, colors, lines, shapes, photographs, highlights, format, etc.

### **Activity 2.3**

*Here some interesting tools on the Internet that can be utilized to develop information displays.*

- *Maps*—e.g., <http://www.ontheroad.to/>
- *MindMaps*—e.g., <http://www.mindmeister.com/>
- *Diagrams*—e.g., <http://www.smartdraw.com/>
- *Flowcharts*—e.g., <http://flowchart.com/> and <http://www.slickplan.com/>
- *Timelines*—e.g., <http://www.preceden.com/> and <http://www.timetoast.com/>
- *Cartoons*—e.g., <http://www.toondoo.com/>

*Review these tools and pay attention to how they afford the design of information displays. Note your observation in a separated display that you create by using one of these tools.*

The author of this book holds that the most powerful modality for all forms of digital resources for learning are those presented in visual form. Visuals allow the design of representations that communicate not just information, but also meanings, feelings, moods, giving unique atmospheres to the informational space, while

enabling large quantities of information to be presented simultaneously, through visual elements such as symbols, icons, colors, lines, shapes, photographs, highlights, format, etc. The human eye has a remarkable power to give attention to visual information, while the human mind has a similar remarkable power to cognitively work with such information.

The most effective digital resources for learning activities might be those that integrate all informational content of a resource in a single screen presentable via a device. This is contrary to most of the current designs which use various forms of structuring, segmenting and presenting information in a series of screens, long scrollable page, menu items, chapters or sections, often overloading cognitive capacity with unnecessary screen complexity, navigation elements and more than one curriculum focus (e.g., declarative and procedural knowledge). Visual and interactive affordances of contemporary representational media and technologies enable a much better design, allowing for a large amount of information to be presented via a small screen space, and even in cases when mobile technologies are used for delivery. In the design, all extraneous and unnecessary content and other information should not be included in order to empower a learner to fully dedicate his or her cognitive load onto the content. This is an important issue that this book will discuss in the later parts in more details.

We need to keep in mind that in the context of teaching, rules are different comparing to, for example, someone browsing a web site for interesting information or news, viewing a billboard, watching a television program or reading a newspaper. A higher level of cognitive engagement is often required from learners for learning to occur. However, learning in the context of information displays, does not mean that learners simply consume and remember content. Critical issues here are how information can be designed to effectively mediate learning activities, and how the intended purpose of that information relates to tasks being completed by learners. A concept of ‘mediation’ is important here. A mediator is something or someone that influences/mediates decision-making and thinking, that is, it refers to learners utilizing digital resources as mediating tools in their activity so that they gain intended learning outcomes. In this context, learning is not simply a process of internalizing external information presented in a digital learning resource. Rather, learning is a direct product of an experience where information is applied and used as a mediation tool in completing a learning activity. The internalization of properties of external mediating tools—not the memorizing of content—and experiences of working on an activity leads to learning. Through learning, the features of information should become part of the learners’ thinking process. We might think that learning has occurred when internalized properties of tools are begging to serve as internal, cognitive or psychological mediating tools. This is consistently emphasized and repeated in this book, and will be re-examined in the context of different forms of digital resources for learning later on. With careful design, arrangement and creative presentation of interface elements and information, information displays would be able to deliver maximum information in a small screen space, and in a way that facilitates intellectual utility of the features of that information.

**Important**

Learning is a direct product of an experience where information is applied and used as a mediation tool in completing a learning activity. Learning is not simply a process of internalizing information presented in a digital learning resource.

This book proposes an approach where designers should almost always design digital learning resources for presentation via a single screen. This should not be seen as granulation of learning content (as classical approaches to digital resources for learning appear to promote), rather, this is an effective strategy of how to maximize a total amount of information to be presented in a minimum screen space, reducing cognitive load expected from a learner for engagement, and requiring less time to extract what is needed to inform actions required by the learning activity, as well as reducing the time needed to be spent glaring at the screen. In simple words, learners do not learn the content of an information display in the way they would do with a presentation resource. Rather, learners interrogate and use features of information to mediate their thinking when working on a learning activity.

**Activity 2.4**

*In addition to visuals and multimodalities, interactivity significantly enhances the power of visual displays of information. Large quantities of information can be structured within a small screen space, while users can be engaged in manipulating parameters and configuring what information they want to preview. Here are some general examples you should review to get understanding of how interactivity functions within a visual display of information:*

- *Eddie the Yeti History of Social Media* <http://avalaunchmedia.com/history-of-social-media/Main.html>
- *Interactive timeline* <http://after64.sbs.com.au/#timeline/en/April-15>
- *Interactive narratives site containing numerous examples* <http://www.interactivenarratives.org/>. Search for good examples.
- *Visual display of information about various tools that can be used for design* [http://www.visual-literacy.org/pages/maps/mapping\\_tools\\_radar/radar.html](http://www.visual-literacy.org/pages/maps/mapping_tools_radar/radar.html)

*What do you conclude about the use of interactivity in design of information displays for learning?*

*Now, try to complete this task. The following is the Basic Wine Guide information display:*

<http://winefolly.com/tutorial/wine-for-beginners-infographic/>

*Although this display contains an effective arrangement of visuals, it is a static image without any use of interactivity. Your task is to carefully analyze*

*this display, and describe (draw a sketch and explain) how it can be redesigned to include interactivity for more effective presentation. In other words, redesign it from visual into visual and interactive format.*

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### 2.3 Examples of Interactive and Visual Information Displays

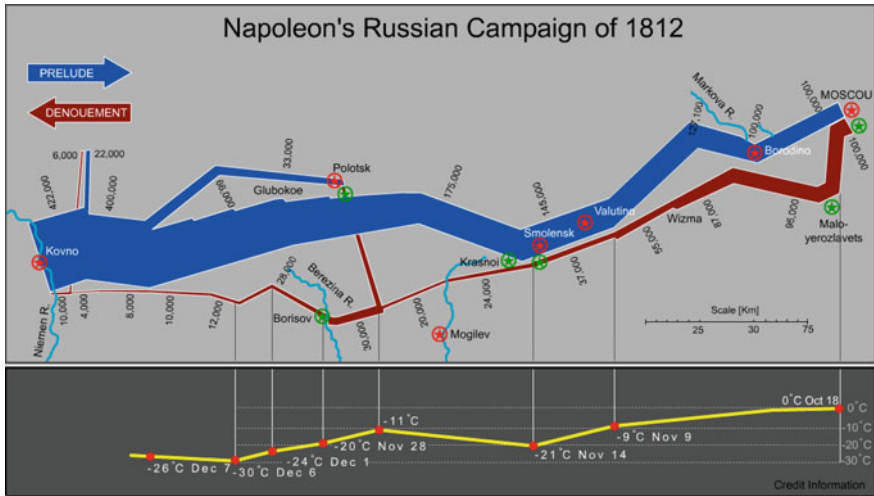
What is characteristic of an information display as a particular kind of digital resource for learning? It is that interactivity and visualization are a critical affordance of contemporary representational technologies that enables the maximum amount of visual and other multimodal information to be presented in a minimal screen space. In this book, particular attention is given to these two affordances of contemporary representational technologies: affordances for (a) visualization of information, data and ideas through the design and arrangements of colors, lines, shapes, images, symbols, etc., and (b) interactivity as a mean for providing learning with tools to manipulation and explore that information, data or ideas through the use of sliders, buttons, clickable areas, text inputs, etc.

#### **Important**

Interactivity is a critical affordance of contemporary representational technologies as it enables the maximum amount of visual and other multimodal information to be presented in a minimal screen space.

The following example in Fig. 2.1 illustrates such a possibility of how a maximum amount of information can be presented in a single interactive display. This is an information display of a revised and digitized version of one of the best examples of a paper-based infographic produced by Charles Joseph Minard in 1869. This original work, is known as ‘Carte figurative des pertes successives en hommes de l’Armée Française dans la campagne de Russie 1812–1813’, or simply as Minard’s map. Minard constructed this infographic to illustrate the adventure of Napoleon and his army during the attempted conquest of Russia in 1812. Minard’s purpose was to portray a powerful and a dramatic display to inform, as quickly as possible, the public in France about the disastrous adventure on Napoleon Bonaparte’s Army in Russia in 1812 during which more than 400,000 French soldiers died. This resource has become one of the most popular examples for authors writing about visual information, infographics and graphic design (e.g., in Edward Tufte’s work on visual explanations, see Tufte 1997).





**Fig. 2.1** Reworked 'Minard's Map' information display resource

The author of this book redesigned and digitized this example in order to demonstrate the affordances of contemporary representational technologies, which enable even more powerful ways of organizing and presenting information through, for example, the uses of sharper shapes and lines, contrasting colors that carry certain meanings, interactive elements such as pop-up areas containing further information, etc. This information display shows advancement and retreat paths of the French army from the then Russian border until Moscow and vice versa. The paths are represented as lines of different thickness. Thickness corresponds to the number of troops at any given point, showing the troop numbers ranging from 412,000 on the point where the French army entered Russia, down to 10,000 at the point where the army left Russia. The advancement line is presented in blue color and the retreat line in red (color giving a special tone). The paths are plotted over a map that corresponds to geographical locations at specific dates where the army came across various rivers and major towns, and engaged in significant battles.

Information presented can lead learners as a user of this information, to connect, contrast and compare different pieces of information (e.g., advancement and retreat pathways). Use of appropriate colours, in particular, provides meta-information that assists learners to pay attention to specific information pieces (e.g., brighter standing out colours of advancement and retreat paths of the French army), and committing certain cognitive processes (e.g., comparing the blue against the red pathway of the army). It might be said that meta-information provides leads to cognitive interactions with information.

Colour is one distinct element that separates current computer-based representations from those in the past. Such outcomes can be achieved today even through print materials. What distinguishes contemporary technology-based

representational media is interactivity. With interactivity, various areas on the display can be configured to correspond to various forms of user interactions, such as, when the user rolls over a mouse pointer over a specific area, or when a user clicks, right-clicks or double-clicks over a specific area on the display (or when a user places a finger, or uses two or more fingers simultaneously in a finger-driven, multi-touch interactive screen of a device). New collages of information can be displayed based on these interactions, while pointers to further information from other sources can be presented through hyperlinks. In the case of Minard's map, once a user places a mouse point over one of the stars corresponding to city names, certain details about that node will be provided. If the user clicks on that star, more information about a specific event will be displayed.

With the aid of contemporary technology, Minard's Map has been redesigned in a way that new representational and interactive affordances have enhanced its communication capacity. How to use this information display resource in teaching and learning? Traditional approaches would be to give it to learners to study, and then provide them with a worksheet, a test or other form of assignment to reinforce and examine the content remembering and understanding. However, according to a learning-centred approach, learners will be presented with an engaging activity. For example, a learning activity might give learners a task where they are assumed to be a newspaper journalist tasked to write a report about the French military campaign in Russia. Alternatively, learners might be asked to design a multimedia presentation to show what happened in this war. Minard's map is then provided as a source of information they can use to assist them in completing the activity. A learner can cognitively interact, explore and interrogate information presented in this single display of information by:

- Contrasting advancement and retreat of the French Army represented in the red and blue coloured pathways;
- Examining key geographic locations, cities and rivers, and key events that took places there;
- Examining weather conditions at different dates and link these to key battles, troop losses and events taking place at different locations; and
- Reading about specific events and previewing some artefacts from that period.

What is important to understand in this particular context, the activity is not about remembering information from this resource. Engaging in using this information display within an activity is not about memorizing historical facts, rather at the center is learning to work with historical data, engage analytically with information and deeply think about and understand courses and issues affective to the particular historical circumstance.

In addition to what is achieved with the original paper-based representation developed by Minard all the way back in 1869, design features of the new technology-based representation allow:

- Clarity and emphasis of information through the uses of sharp and contrasting colours, e.g., colours of advancement and retreat lines of the French Army, emphasized temperature lines, and coloured stars on the key geographic locations in bright colours to capture attention;
- Structuring of information in panels and pop-up displays enables related groups of information to be presented within specific screen areas;
- Use of interactivity to trigger the display of information, e.g., a roll-over hot-spot area on the display will show one piece of information, while clicking on that hot-spot area, would provide further information; and
- Use of in-built capability of the display technology to zoom on specific areas of the screen for better preview.

**Important**

Visualization and interactivity are the key affordances of contemporary representational technologies and an important strategy for the design of digital resources for learning.

So, going back to how can this information display can be used in learning, certainly, our idea is not just to give this to learners and instruct them to learn from it by consuming and remembering the content displayed. We would not go very far with this approach. According to the idea of the learning-centred approach continuously emphasized in this book, there should be an activity that learners are to work on.

This example demonstrates how a large amount of information can be structured and presented in a small screen space with the aid of visuals, and where interactivity allows the organization and retrieval of that information within a single display. By this stage, this book has emphasized the importance of an activity as an essential component in learning-centred teaching. These ideas will become much clearer later in this module. At this stage, the author hopes that each reader considers visualization and interactivity as the key affordances of contemporary representational technologies and as important part of a strategy for the design of digital resources for learning. Overall, it is argued that an effective digital resource for learning is an interactive and visual representation designed to serve as a mediating tool in a learning activity.

The second example of an information display is as a specific form of digital resource for learning, as presented in Fig. 2.2. It again shows how interactivity and visualization allow for a large quantity of information to be presented in a single information display digital resource for learning. This digital resource for learning displays information related to ‘Machining’ in a Mechanical Engineering area of study. It displays information related to ‘Chip Control’ of chips breaking of a metal work piece during the ‘Turning Machining’ process. Information is displayed based on a combination of two parameters controlled by a learner. The configuration of

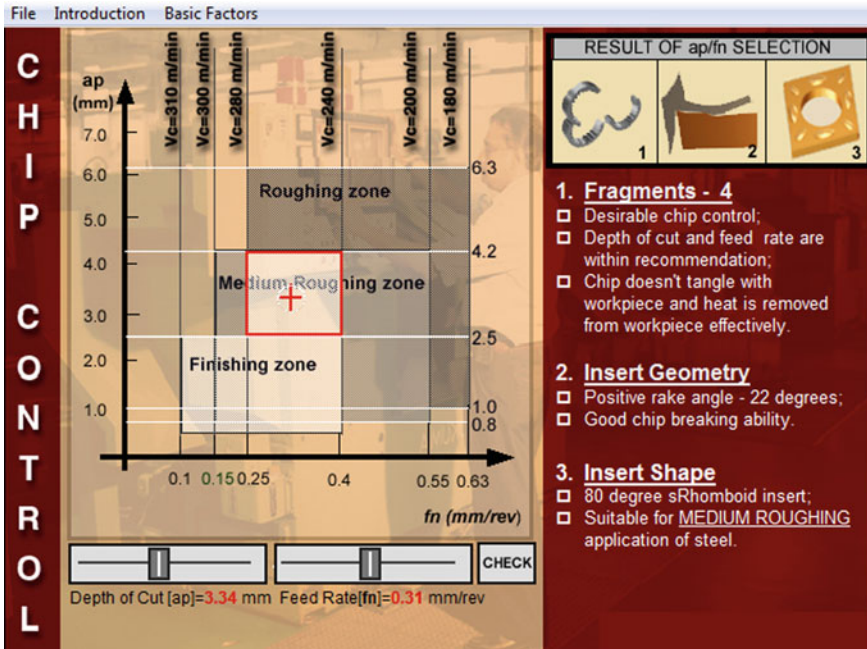
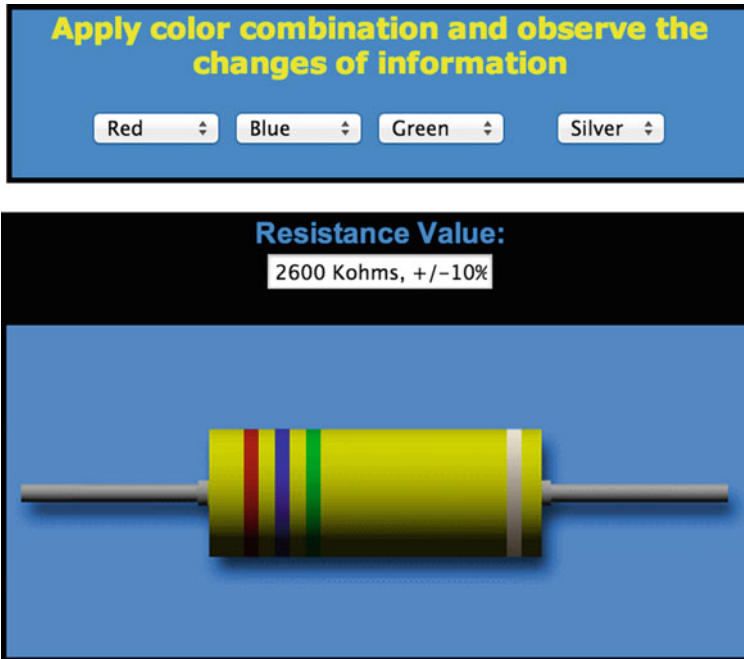


Fig. 2.2 'Chip Control' information display resource

parameters is presented graphically on an X-Y graph depicting different zones of possible configurations, and the outcome of such configurations displays specific visual and textual information. This information is useful within learning activities that require engineering learners to explore and apply concepts of machining parameters and Computer Numeric Programming.

One distinct difference with the previous example is how interactivity functions in this information display resource. In the first example, chunks of information beyond the initial screen display are displayed based on interactions with interactive screen areas. If a mouse is positioned over an interactive screen area, some additional information will be displayed, and if that area is clicked on, some further information will be displayed. In the second example, underlining mathematical regularities drive the display of information. A learner manipulates two sliders to change the values of 'Depth of Cut' and 'Feed Rate,' and depending on the combination of these two values and underlying mathematical processing, certain visual and textual information are displayed (information about 'Fragments', 'Insert Geometry' and 'Insert Shape').

Figure 2.3 shows the third example that further demonstrates the use of interactivity to manipulate information and display chunks of it based on a learner's choices. In this example, titled 'Resistor Colour Code', a new form of interactivity to this chapter is used to configure the information displayed. There is a set of four pull-down lists of items to select. These will configure a band of colours on the



**Fig. 2.3** ‘Resistor Colour Code’ information display resource (developed based on the script from book “JavaScript™ Bible” by Goodman 2001)

displayed ‘Resistor’ and based on that combination display ‘Resistance Value’. What is unique to this information display resource is that no textual information is used to display the main content, rather visuals (colour bands) and numerical (value of resistance) are used. It is important to consider that now days capabilities of representational technologies allow information to be presented in non-textual, and yet powerful ways.

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## 2.4 Designing an Information Display Digital Resources for Learning?

Each separate design of an information display, as well as that of other forms of digital resources for learning, is innovation in itself. In the absence of any strong design rules and grammar, designers are left to engage their own creativity and technical skills to develop information displays. To design an information display, it is necessary that a designer is able to think creatively and innovatively about how specific information can be presented in an educationally useful format. At the same time, the designer must understand the content to be presented (or be able to work closely with a content/subject matter expert) and conduct appropriate analysis of

that content in order to develop pieces of information, that like a puzzle, which can be arranged through some rules in a final information display.

Unlike in the case of text that has well-defined grammatical rules, and is navigated from left to right, top down (unless in other specific languages) design of information displays are not informed by any specific rules, that is, the rules for navigation and ‘grammar’ of such design are non-existent. So-called Gestalt Theory,<sup>1</sup> offers some advice on the display and arrangement of information, including recommendations such as proximity, continuation, similarity, figure and ground, closure and symmetry. Furthermore, Theories of Multimedia Learning developed by Mayer (2001), offer a number of principles which might be applied in this context (e.g., the concurrent use of text and visual, modality and redundancy principles). Otherwise, there are no fixed set of rules for design, and designers have almost full and complete freedom in approaching the task in creative and innovative ways.

Let us use the following simple example in Fig. 2.4 to illustrate key issues in the design of an information display resource. This resource includes information regarding possible approaches to dealing with human activities and phenomena affecting our environment, such as of Global Warming, Acid Rain and Ozone Depletion. Information is structured, classified and arranged in diagrams that display further information once a learner clicks on various components. Visuals in the background provides some information regarding the air pollutants such as traffic and factories, while further visual information is displayed within the presentation of each of the additional information for specific components of the diagram. Learners will be able to contrast and compare different methods of keeping the air clean and access various pieces of information related to different options.

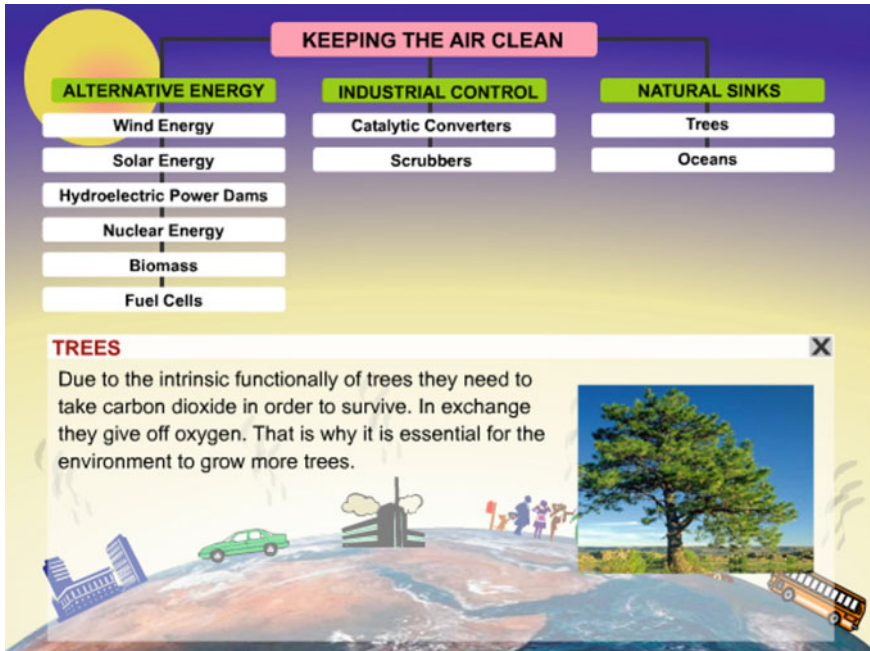
This information display is designed in the following way:

- Identification of the main topic for the information display (Keeping the Air Clean).
- Collection of information to be included in this information display. In this stage, we need to ensure that all relevant sources of information (and/or data) are considered, and that all required information are collected. In certain cases, it might be possible to include dynamic information that emerges and is collected from a database, either internally built in the resource, or externally via the Internet. For example, an approach called ‘mashing’ or ‘mashup’ enables the development of information displays based on information and/or data collected from certain sources on the Internet.<sup>2</sup>
- Separation of information in groups. In this stage, content analysis of the information is conducted, and the information is separated into the smallest possible chunks or units. In the case of our example, information is about each

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<sup>1</sup>See <http://graphicdesign.spokanefalls.edu/tutorials/process/gestaltprinciples/gestaltprinc.htm> for explanation of key some key Gestalt principle.

<sup>2</sup>See [https://en.wikipedia.org/wiki/Mashup\\_\(web\\_application\\_hybrid\)](https://en.wikipedia.org/wiki/Mashup_(web_application_hybrid)) for explanation of Mashups.



**Fig. 2.4** 'Keeping the Air Clean' information display

of the possible methods of keeping the air clean (e.g., solar energy, catalytic converters or fuel cells).

- Exploring possibilities for the organization of information units in some form of network, matrix, flow, mathematical logic, relation, etc.:
  - Analyse common properties of each of the information units. Something belongs with something else, or something is dependent on something else. Can information be structured according to these properties?
  - Is it possible to arrange information units in a temporal space (e.g., a timeline), representation of a real or imaginary space, or a map (e.g., geographical map)? See Fig. 2.1 for an information display organized according to this rule.
  - Is there any underlining mathematical relationship between information units and/or their properties? Can this information be organized according to this relationship? See Fig. 2.2 for an information display organized according to this rule.
  - Is it possible to arrange information units according to certain classification format, a chart, or a network of certain properties? This is the case with the 'Keeping the Air Clean' information display in Fig. 2.3.

- Determining the most effective way of how each of the units of information can be presented in the most consistent and effective way (e.g., as text, numbers, pictures, graphical elements such as lines and shapes and their thickness and color, sounds, movement, animation, video, 3D model, and transitions). Give priority to presenting information in visual ways.
- Storyboarding the main interface of the information display, and storyboard an example of the information unit. If required, evaluate your design, e.g., by showing it to your client and/or a subject matter expert, as secure consensus for further development.
- Designing the main interface. Keep in mind important design specifications, such as screen size for the final display, method of delivery (e.g., a mobile device), and possible interactions (e.g., finger driven). In the case of the featured example in Fig. 2.3, this interface consists of a background informational screen that visually shows some major sources of air pollution, and a foreground classification diagram that presents strategies for keeping the air clean, classified into three main groups (alternative energy, industrial control, and natural sources). Design areas for titles, navigation elements, manipulation/control of information elements, presentation of information, labels, and help messages.
- Developing a prototype. Configure interactivity and navigation in the visual display, and make at least a few areas functional. Evaluate your prototype, e.g., by trying it out with some representatives of real users (learners and teachers) and/or reviewing it by your client and a subject matter expert.
- Finalizing the information display and make it available for learning uses (e.g., deposit it in a repository of learning resources, publish it on the Internet, or make it available through Google Play Store, App Store, etc.).

### Activity 2.5

*Analyze the following text and develop an information display based on its information. Your information display must be presented on a single screen, utilizing multimodalities. Follow-up the procedure described in Sect. 2.3.*

*[Modified based on the Annenberg Foundation (2016)]*

In the deep space, the temperature is a chilly  $-260\text{ }^{\circ}\text{C}$ . Closer to the Sun, temperatures reach thousands of degrees. What makes the Earth's climate so livable? Separating Earth from the extreme climate of outer space is an 800-km-thick cocoon of gases called the atmosphere. The Earth's atmosphere is made up primarily of nitrogen and oxygen, but also includes carbon dioxide, ozone, and other gases. These keep us warm and protect us from the direct effects of the Sun's radiation.

The atmosphere is made up of several layers including the troposphere (closest to Earth), stratosphere, mesosphere, ionosphere, and exosphere. Most of the clouds are found in the **troposphere** which extends up to 16 km above the Earth's surface.



It also includes a number of other gases such as water vapor, carbon dioxide, methane, and nitrous oxide. These gases help retain heat, a portion of which is then radiated back to warm the surface of Earth.

Above the troposphere is the **stratosphere**, which also includes the ozone layer, and extends from about 16 to 48 km above the surface of the Earth. Ozone molecules in this layer, absorb ultraviolet radiation from the Sun and protect us from its harmful effects, and that is why this layer is so important for us. A further 48–80 km above the surface of the Earth is the **mesosphere**, which is the coldest part of the atmosphere. Above it is the layer called the **ionosphere** or the **thermosphere**, which extends about 80–290 km from the surface of the Earth, and where temperatures can reach up to couple or more thousand degrees Celsius. Beyond this is the **exosphere**, extending up to 800 km; it is the outermost layer of the atmosphere, the transition zone into space.

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