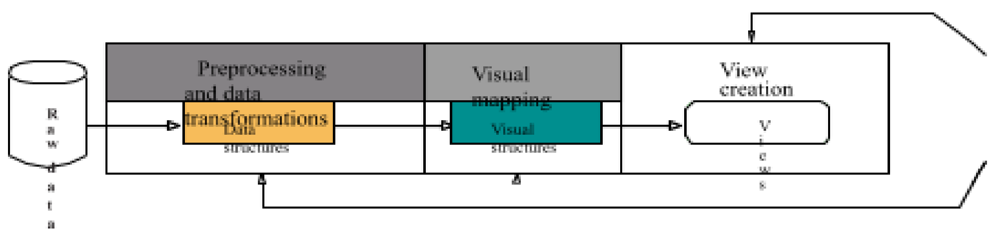
UNIT-2

Visual representations:

Creating visual representations:

The creation of a visual artifact is a process that we can model through a sequence
of successive stages:

1. preprocessing and data transformations,
2. visual mapping,
3. view creation.



Preprocessing and Data Transformations: We use the term "raw" to describe data supplied by the world around us. They can be data generated by tools, like the values of some polluting agents taken from a monitoring station during pollution testing. They can also be generated and calculated by appropriate software, such as weather forecast data. They may even be data linked to measurable events and entities that we find in nature or the social world, like the number of inhabitants or birth rates of the cities in a specific state. In each case, these collections of data (known as datasets) are very rarely supplied to us with a precise logical structure. To be able to process these data using software, we have to give them an organized logical structure. The structure usually used for this type of data is tabular—the arranging of data in a table—in a format appropriate for the software that must receive and process them. Sometimes the input data are contained in one or more databases and are, therefore, already available in electronic format and with a well-defined structure. In this case, the raw data correspond to the data located in the databases, and the phases of preprocessing and elaboration involve extracting these data from the database and converting them into the structured format used by the visualization software.

Visual mapping:

_The key problems of this process lie in defining which visual structures to use to map the data and their location in the display area. As we have already mentioned, abstract data don't necessarily have a real location in physical space. There are some types of abstract data that, by their very nature, can easily find a spatial location. For example, the data taken from a monitoring station for atmospheric pollution can easily find a position on a geographic map, given that the monitoring stations that take the measurements are situated in a precise point in the territory. The same can be said for data taken from entities that have a topological structure, such as the traffic data of a computer network. However, there are several types of data that belong to entities that have no natural geographic or topological positioning. Think, for example, of the bibliographic references in scientific texts, of the consumption of car fuel, or of the salaries of various professional figures within a company. This type of data doesn't have an immediate correspondence with the dimensions of the physical space that surround it

Views

The views are the final result of the generation process. They are the result of the mapping of data structures to the visual structures, generating a visual representation in the physical space represented by the computer. They are what we see displayed on the computer screen.

Visual analytics:

Visual analytics is the science of analytical reasoning facilitated by interactive visual interfaces.

Visual analytics combines automated analysis techniques with interactive visualization for an effective understanding,reasoning and decision making on the basis of very large and complex data sets.

Components of visual analytics:

1.Interactive visualization

2.Analytical reasoning

3.Computational analysis

We have two categories of visual analytical process:

1.visual exploration

2.visual explanation

Visual exploration:

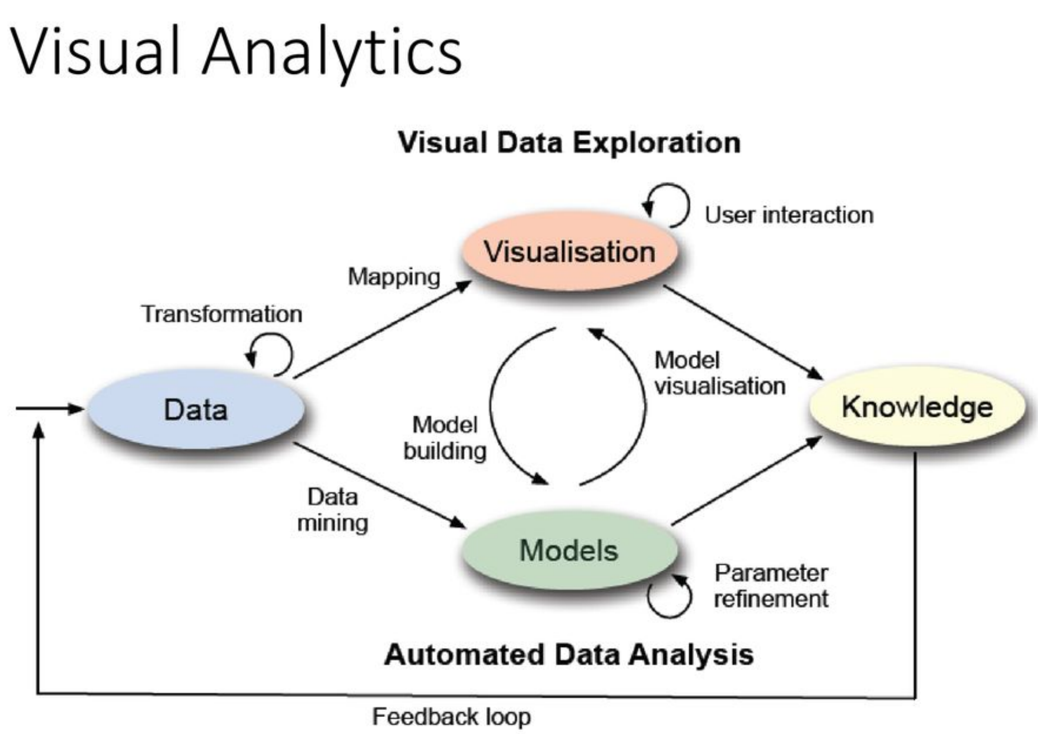


Figure from *Mastering The Information Age*

Data:

Death records.

Model:

Simple aggregation based on address.

Visualization:

Mapping aggregated numbers to map.

Interaction:

Zooming in and out the map.

Knowledge:

Death distribution is not random,centralised around an area,Which has a well.

Visual Mapping

Visual mapping is the technique used for displaying complex information visually.it is the graphical organisation and presentation of information. Some of the types of visual maps are mind maps,concept maps etc.

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The visual structures that correspond to the data that we want to represent visually. This process is called *visual mapping*:

1. spatial substrate,
2. graphical elements,
3. graphical properties.

The **spatial substrate** defines the dimensions in physical space where the visual representation is created. The spatial substrate can be defined in terms of axes. In Cartesian space, the spatial substrate corresponds to x- and y-axes. Each axis can be of different types, depending on the type of data that we want to map on it. In particular, an axis can be *quantitative*, when there is a metric associated to the values reported on the axis; *ordinal*, when the values are reported on the axis in an order that corresponds to the order of the data; and *nominal,* when the region of an axis is divided into a collection of subregions without any intrinsic order.

The **graphical elements** are everything visible that appears in the space. There are four possible types of visual elements: points, lines, surfaces, and volumes .

The **graphical properties** are properties of the graphical elements to which the retina of the human eye is very sensitive (for this reason, they are also called *retinal variables*). They are independent of the position occupied by a visual element in the spatial substrate. The most common graphical properties are size, orientation, colour, texture, and shape. These are applied to the graphical elements and determine the properties of the visual layout that will be presented in the view .

In terms of human's visual perception, not all graphical properties behave in the same way. Some graphical properties are more effective than others from the view-point of quantitative values. Cleveland and carried out a study to evaluate the accuracy with which people are able to perceive quantitative values mapped to different properties, graphical elements, and spatial substrates.

with the users of the system to understand their actual needs, or only afterwards do they effectuate empirical evaluation, when the application prototype has been developed.

The procedure to follow, when creating the visual representations of abstract data, can be outlined in the following steps:

1. **Define the problem** by spending a certain amount of time with potential users of the visual representation. Identify their effective needs and how they work. This is needed to clearly define what has to be represented. Why is a represen- tation needed? Is it needed to communicate something? Is it needed for finding new information? Or is it needed to prove hypotheses? It is necessary to bear in mind the human factors specific to the target audience that the application will address and, in particular, their cognitive and perceptive abilities. This will influ- ence the choice of which visual models to use, to allow users to understand the information.
2. **Examine the nature of the data to represent**. The data can be *quantitative* (e.g., a list of integers or real numbers), *ordinal* (data of a non numeric nature, but which have their own intrinsic order, such as the days of the week), or *cate- gorical* (data that have no intrinsic order, such as the names of people or cities). A different mapping may be appropriate, according to the data type.
3. **Number of dimensions**. The number of dimensions of the data (also called *at- tributes*) that we need to represent very importantly determines the type of rep- resentation that we use. The attributes can be *independent* or *dependent*. The dependent attributes are those that vary and whose behavior we are interested in analyzing with respect to the independent attributes. According to the num- ber of dependent attributes, we have a collection of data that is called *univariate* (one dimension varies with respect to another), *bivariate* (there are two depen- dent dimensions), *trivariate* (three dependent dimensions), or *multivariate* (four or more dimensions that vary compared to the independent ones).
4. **Data structures**. These can be *linear* (the data are codified in linear data struc- tures like vectors, tables, collections, etc.), *temporal* (data that change in time), *spatial* or *geographical* (data that have a correspondence with something phys- ical, such as a map, floorplan, etc.), *hierarchical* (data relative to entities orga- nized on hierarchy, for example, genealogy, flowcharts, files on a disk, etc.), and *network* (data that describe relationships between entities).
5. **Type of interaction**. This determines if the visual representation is *static* (e.g., an image printed on paper or an image represented on a computer screen but not modifiable by the user), *transformable* (when the user can control the process of modification and transformation of data, such as varying some parameters of data entry, varying the extremes of the values of some attributes, or choosing a different mapping for view creation), or *manipulable* (the user can control and modify some parameters that regulate the generation of the views, like zooming on a detail or rotating an image represented in 3D). which levels of the process these types of interactions come into play.