



# The Attribute Explorer

Lisa Tweedie, Bob Spence, David Williams and Ravinder Bhogal

Department of Electrical and Electronic Engineering,  
Imperial College of Science, Technology and Medicine  
Exhibition Road, London, SW7 2BT  
Tel: +(44) 71 225 8505  
E-mail: lisa.tweedie@ic.ac.uk

## ABSTRACT

"The Attribute Explorer" video demonstrates a graphical interactive tool for visualising the relationships within multi-attribute data sets. Rather than using 2- or 3-dimensional multiple views of the data, each attribute is mapped to a single dimensional representation (interactive histogram). Sections of an attribute's histogram can be selected by a variety of means: once selected, the items are represented on each of the other attribute histograms as colour coded distributions. Trends in the data and interesting sub-populations can be examined and explored further. Full implementation and evaluation of the tool is planned.

## KEYWORDS

Information visualization, interactive graphics

## INTRODUCTION

In many tasks the information being handled is not only voluminous but has many attributes describing it. Scientific Research, Business Decision Making and everyday tasks all involve this sort of information. In today's world a combination of spreadsheets and statistical methods allows us to understand this information mathematically. In addition we often examine the relationships between attributes visually - conventionally one would use static graphical methods such as bar charts and scatter plots. However the advent of fast graphical computers means that a new class of tools can be envisaged which allow **interactivity** with the data in order to explore the trends and relationships within it. "The Attribute Explorer" described in this video is such a tool.

## TASK

"The Attribute Explorer" is an artifact for examining multi-attribute data. A common task carried out on this sort of data is that of making a choice from a population of multi-attribute items.

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One example of such a choice task is house search. Every accommodation in an estate agent's file has many attributes such as price, size of garden and number of bedrooms. Each buyer comes to the estate agent with an idea of what they want - this gradually changes as the different priorities and availabilities are traded off.

What is needed is a tool to allow exploration of the problem space. However in most cases the information provided to a prospective house buyer is in the form of brochures. The individual has to sift through each one, in terms of their current priorities until they reduce the population size to a level that they are prepared to investigate further - i.e. to visit. If the attribute relationships were portrayed using interactive graphic tools, this would perhaps empower the user to make much more informed decisions. As Bertin [1] put it "Items of data do not supply the information necessary for decision-making... the useful information is drawn from the overall relationships of the entire set".

"The Dynamic home finder" [4] looked at this same task domain. Sliders were used as inputs to specify a search on particular attributes. The results were shown as house icons on a map. In our tool we have taken this a step further by adding graphical feedback to the sliders themselves.

## REPRESENTATIONS OF THE DATA

A number of other representations for this sort of data have been implemented in the past. These tend to use 2- and 3-dimensional multiple views of the data, linked together in a logical way (2,3). Little evaluation of these representations has taken place in the published literature so it is difficult to compare them. We were interested to see whether using interactive **one dimensional** views of each attribute (histograms) would allow the relationships within the data to be portrayed more simply.

In "The Attribute Explorer" each attribute is assigned to a scale with histograms showing the population spread running up one side. Initially these display each item in the total population. The user can interact with the scales: using sliders for continuous attributes (e.g. price) and buttons for discrete attributes (e.g. type of house). The effect of one attribute on the others can be explored by selecting values of interest on one scale and viewing where those items appear on the other attribute scales. For example in Figure 1. all the houses of £140k -180k have been selected. From this the user can observe,

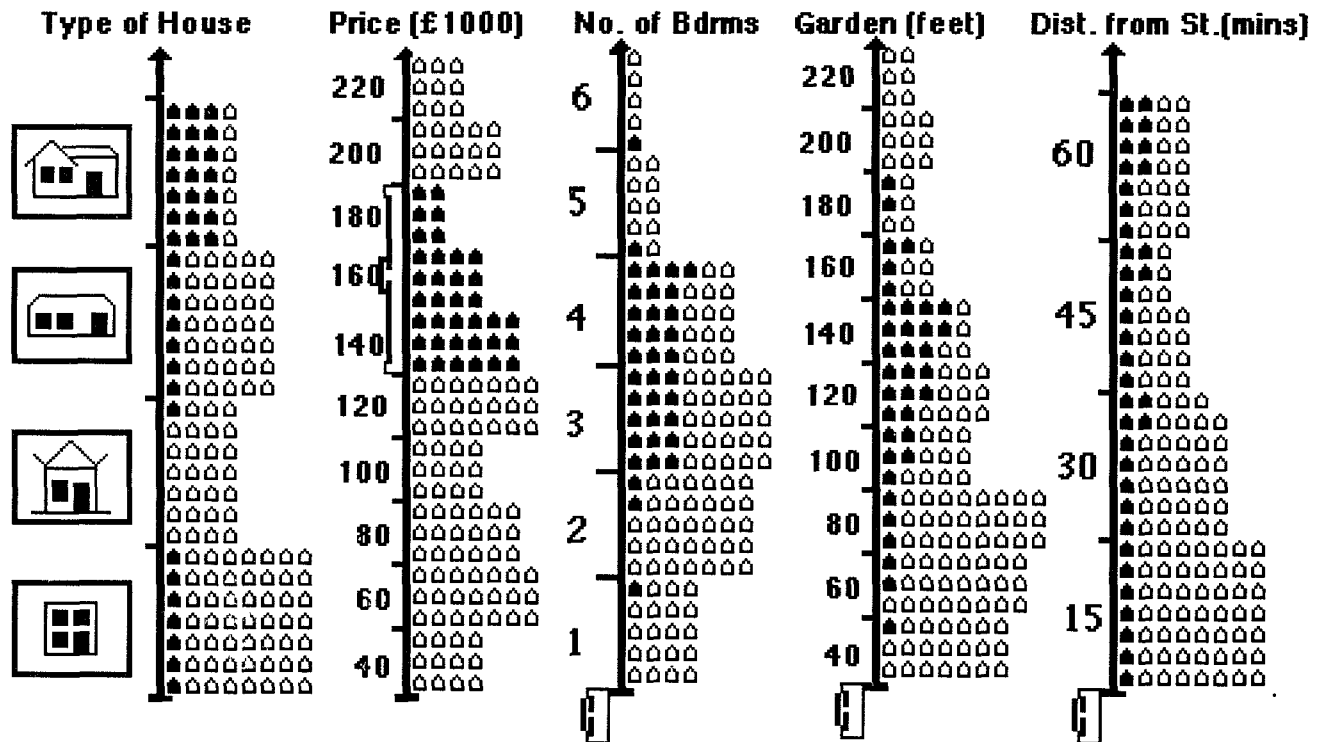


Figure 1: Selecting a section of one attribute shows the distribution of those same houses on each of the other attributes

for example, the fact that there is only one house with six bedrooms in this price range. By moving one slider up and down, changing an attributes value can be explored.

In the prototype we have also exploited the colour performance of today's graphic computers. Each attribute is allocated to a separate colour. Thus when more than one attribute is selected icons in two colours appear across all the attributes. When these intersect (i.e. a house has both of the desired attributes) then a blend of the two colours occurs. Thus the population size defined by these two criteria can quickly be evaluated.

When three or more attributes need to be specified then the values on a particular attribute scale can be locked. This reduces the visible items to those of interest. Within this sub-population the variation of any other two attributes then can be explored, again, using colour intersection. Once a sub-population has been identified individual houses can be

inspected by looking at "house-lines" running across all the attribute scales (Figure 2). A collection of these may be useful for perceiving the trends and outliers. Finally, individual house specifications can be examined .

#### FUTURE WORK

A prototype of "*The Attribute Explorer*" has been built in Macromind Director [4]. We are hoping to implement the tool more fully in Smalltalk soon. Once the tool is implemented we would like to evaluate its use at a cognitive and perceptual level within the context of a wide variety of applications: e.g. as a statistics explanation device, spread sheet tool or decision support tool.

#### ACKNOWLEDGEMENTS

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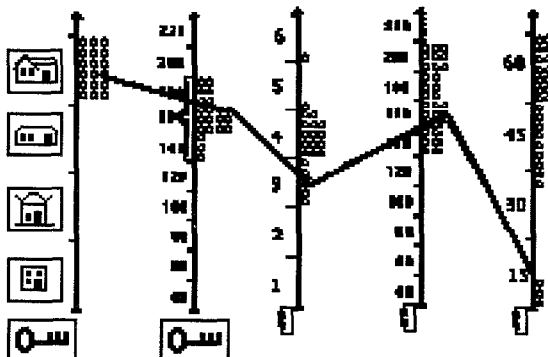


Figure 2: Once a sub-population has been identified the individual "house-lines" can be examined.