Click your way to the right bottle of wine

Birds of a feather ? A new interactive search system

BY MARION DE BOO

Dozens of television programmes to choose from, hundreds of colours in the paint shop, hundreds of different kinds of red wine at wine merchants or supermarkets. We're simply spoilt for choice. Making the right choice will become easier with the interactive search system developed by researchers at the Industrial Design department of tu delft. What started out as a design tool is turning out to be useful for others as well, from supermarket managers to estate agents. A patent was recently granted.

Modern search systems often fall short when people are asked to make subjective or complex choices. The consumer has to start by very carefully defining the query.

'Ask the library computer for every title Graham Greene wrote in the sixties, and you will get the list in no time,' says Dr Pieter Jan Stappers, associate professor at the Design Theory and Techniques section of tu delft. 'But if you're looking for a similar book, only with a bit more comedy in it, or lighter reading, things become a lot more complicated. You could be looking for the right video, a holiday trip, or a good bottle of wine, and in every case you'd have to first thumb through a thick catalogue, or get to grips with the jargon, in order to be able to properly


This MDSI-display, designed by Bram van den Nouweland, shows four examples of rollers skates from the shop's collection. The general view (on the left) shows them in a multi-dimensional arrangement. Similar models are arranged close together, and models with many differences are kept further apart. The top right-hand corner shows the model from the last query result, or the model activated on the screen, with the necessary details. The selection triangle (bottom right) can be used to increase the emphasis attached to a certain group of properties, e.g. price/quality, design, or activity. The display interfaces with a database containing information on dozens of different roller skates, each with a picture and 21 properties. The dialogue between the user and the display consists of removing and inserting samples in the action field.

define your query. In a library you must be able to name the different categories, such as fantasy, science fiction, or literature, to be able to indicate your preference', Stappers goes on. 'Many of these genres are pretty loosely defined, and you know by instinct how they fit together. But in many cases differences in taste and connotation are difficult to express in words. So, we are working on search systems in which language plays a secondary role.'

Fitness

Stappers opens his laptop computer to show a presentation he has given in Pittsburgh for the Computer-Human Interfaces conference. As part of the presentation, the consumer could retrieve roller skate information from a database containing 70 different models, with descriptions of 21 properties or attributes in three main categories: design, quality, and activity. The design category for instance, differentiated between laces or buckles, colour, and boot height. The range of quality properties included the type of ball-bearing, boot material – leather or plastic – and a host of other technical properties. Activities include fitness, off-road, hockey, and grind, i.e. stunting. To begin with, a random selection of three skates is displayed, just as a good salesman will start by showing a couple of different models to get an idea of the customer's preferences. The skates are displayed in a circle. Clicking on one of the images will open a separate window showing a larger image of the skate together with some essential information such as brand, type, activity, and price. As it happens, all three of these models are made by Roces. The Big Atsas is a black and white, high-booted skate with two eye-catching wheels at the front and the rear, an off-road skate which sold for about us $ 380 in 1998. It isn't difficult to see the difference between this skate and the bright yellow Stealth, a speed skate with five wheels, for use on smooth surfaces only, priced at us $ 649. And the high-booted 5th Element, lacking the brake pad at the rear, is a typical example of a skate for stunting (grind).

The classic shortcoming of most databases, according to Stappers, is that they don't contain pictures, and if they do, the images are shown one at a time, so consumers will have forgotten what the first looked like by the time they get

to number four or five. In short, they don't get the bigger picture. In addition, they are constantly distracted by search commands and skate jargon. Ball-bearing quality, fastener systems, hardness factor – whatever that may be – these are all things the buyer doesn't want to have to know about, until they become a major difference between existing samples, according to Stappers.

'Research has shown that different people use different search strategies. Sometimes they will search with a particular aim, other times they will just browse. Creative people in particular tend to alternate between the two approaches, and the same should be possible in a good search system', Stappers says. They are trying to find the right balance between linguistic and visual database aspects, and between information and
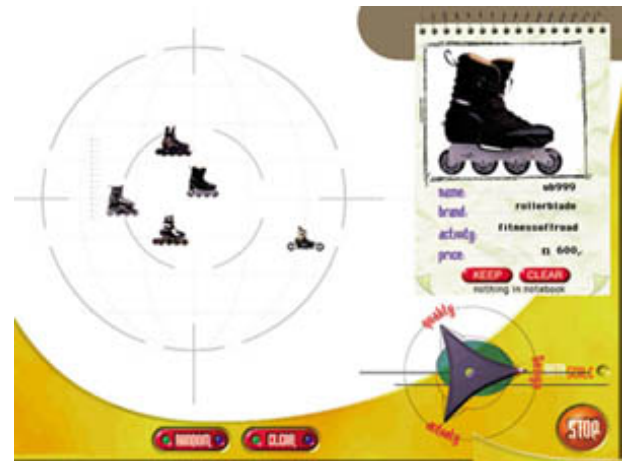
When the user clicks in the action field (see the arrow in the first figure), the database looks for a new model that forms the closest match for the location. Matching involves comparing the properties stored in the database with the samples on the screen. The new roller skate and its properties are shown in the top right-hand corner, and the action field shows a new composition.

By dragging an unwanted model from the screen, the user tells the system to regroup the remaining models into a new area-filling composition.

By moving the lower right-hand point of the triangle, the user changes his criteria from «none» to «activity», causing the fitness skates to be grouped closer together, and away from other types of skates.

inspiration.

Birds of a feather

Existing databases often present the user with a rather rigid, confusing overall range. If you fail to find what you want, the interface seems to say that it's your fault! Stappers: 'Our method provides customers with a choice of different examples, and lets them use the mouse to point somewhere in the circle to indicate their general preference, which could be something in between these two skates, and a little more like this one than like the other. If the computer were to be equipped with a touch screen, all the user would have to do is point on the screen to view and remove different models at will.'

Each time a new roller skate is displayed on the screen, the entire collection of skates shown so far is reshuffled. Models that are very similar will move together in the circle, and skates that are very different from each other will move apart. If a skate differs too much from what you're looking for, you just remove it from the circle, and the remaining skates will automatically be regrouped. If no new models appear, you have seen everything in that category. Displaying images in different positions in a single plane is called multi-dimensional scaling (mds). It is a visualisation technique that has been in use since the nineteen-sixties for psychological statistics and market research. Stappers: 'What's new in the Delft system is the interactive nature of the search process, and in particular the possibility of clicking in between two samples. Using this method, spotting the similarities and differences between the objects becomes easier than if you are presented with the entire collection in one go and have to hop from model to model. We have been granted a patent for this interactive search method, in which the roller skates or other objects are continuously reshuffled.'

Selection criteria

The way the skates attract or repel each other makes them look a bit like magnets. This is the result of the algorithm that forms the basis of the process. The mds algorithm used in the prototype was developed by Dr. Patrick J. F. Groenen of the Data Theory section at Leiden University, and determines how the skates select their position relative to the other models. 'mds started out as a visualisation method, and we have converted it into an interaction method,' Stappers explains. 'If the user points to a spot near model a and far from model b, the program uses these relationships to search for a new model that looks a lot like model a and less like model b. The search program always takes each one of the models on the display into account. The concept is a logical result of previous research in our group. Our style of research involves a lot of designing and testing small conceptual prototypes of interaction techniques, and in addition our research focus includes spatial thinking and visualisation.'

To what extent do two roller skate models share similarities? The computer model makes its decisions using the criteria mentioned above: quality, design, and

By changing the emphasis to design, an entirely new arrangement is obtained.

If a new roller skate is retrieved, the skates in the action field are rearranged to accommodate the newcomer in the right spot.

Retrieving another new model...

activity. Initially, the three criteria are of equal importance. The consumer can decide to indicate that quality carries additional weight by using the mouse to emphasise the quality criterion on the display. This causes the skates on the screen to be reshuffled within the circle. At the same time the consumer is unconsciously introduced to the roller skate jargon. Some people may not know what an off-road skate is designed to do, but one look at the picture will tell them that it can be used on rough surfaces.

Stappers: 'This type of search system is highly suitable for making choices that are not so easily expressed in words, such as choosing from a collection of wines. On top of that, people really like this method. It could be just the thing a supermarket or a specialist shop needs to attract customers.'

To keep the display in balance, the distances between the models are adjusted to keep the circle filled.

Stappers: 'Choosing from 21 different roller skate attributes means that you should actually be working in a 21-dimensional space. Of course we have to compromise in order to be able to present the result on a flat, two- dimensional display, but decades of experience in statistics research show that the result works surprisingly well.'

Selecting colours

In addition to the roller skates search system the Design Theory and Techniques section has developed other demos, including one for selecting colours. Stappers reboots his laptop. The display shows a view of a living room. The user can indicate the colour for the sofa by clicking one of the many different colour blocks in the colour catalogue. The inner circle on the screen shows a nicely graduated field of matching colours, for instance from red to orange, and the outer circle shows which colours differ most from the selection you make.

Stappers: 'In this database, simularities between colours are calculated from their red, green, and blue content. These distances lead to groupings which agree with people's colour experience. We don't have to describe the colours by giving the numbers, because the pictures of the colours speak for themselves.'

One possible application would be for an interior design shop to scan customer's pictures of their home interiors. If you're looking for a new sofa,
the system could project the colour and texture of the new material into the picture.

'It shouldn't be too difficult to realise the technical side of the principle,' Stappers says, 'but valid colour assessment requires the customer to provide properly exposed photographs that manage to show the interior both in daylight and in electric light. The size of the picture also affects the way we see the colours. The aim of this prototype was to test a search principle, not to develop a market-ready application.'

The peatiness of whisky

Taste plays a major, though difficult to categorise, role in the selection of a bottle of whisky. There are thousands of different whiskies. One student at the Industrial Design department entered fifty of them in a

An unwanted model is removed...

Yet another new model. The selection process continues until the user finds the best model to suit his or her preferences.

database which sorted them according to price, sweetness and peatiness. The latter two are important taste parameters for whisky.

Stappers: 'Our intention was to show that database content need not be limited to purely technical parameters. The system can also be fed the results of tastings.'

Again, the search system displays the whiskies, or rather their labels, arranged in a circle, with bottles placed closer together as they share properties. In this case the three criteria of price, sweetness, and peat aroma have been given identical importance by the computer. Using that as a basis, the actual differences between the bottles were calculated.

Stappers: 'The display shows at a glance to what extent the various whiskies differ. It doesn't show you exactly how they differ, for instance which ones are more or less sweet. That requires additional support using words, just like the roller skate demo did.'

Marketing

When Stappers showed the whisky demo to Dr. Jan P. L. Schoormans at the Marketing section of the Product Innovation & Management department of tu delft, he had an instant fan.

'Schoormans thinks it would be a very good system for a supermarket branch manager,' Stappers says. 'The major supermarket chains keep accurate records of what they sell, and they use their intelligent cash register systems to tracks their customers' purchasing habits in detail. Market researchers know down to the zip code how many babies there are in the area, how much milk those households consume, etc. The system would work as follows. The branch manager could start by displaying all the available types of shampoo on the screen. Using his market research and sales data as a basis, branch managers would then set the relative emphasis of the product attributes. Missing items in the range would then show up as empty spots in the search field, with other spots being too crowded. This enables them to spot the missing and superfluous items in the range on offer. By clicking on the empty spots, they could search the main office database for a product to fit their needs. By dragging the icons of identical products off the screen, they can remove these products from the selection. After all, a supermarket doesn't need five more or less identical products sitting on the shelf when they can use that space to cater for other demands.'

Searching together

According to the same principles, estate agents could categorise the houses they have on offer. Instead of wading through endless lists of details such as location, price, age, and number of bedrooms, the consumer could click on pictures of houses in the interactive search system. Each step in the right direction would be immediately apparent, and would cause other, similar houses to be displayed.

Stappers: 'The big advantage is that users can see what's happening together. When you're opposite an insurance salesman who's looking for the insurance policy to suit your requirements, in nine out of ten times

The scientific library features an advanced search system that allows queries to be defined in terms of publication year, author, or on the occurrence of jargon in the title or the list of keywords. In a normal library, where people come to look for a gripping, relaxing, funny, or romantic read, an associative system will offer a better service.

Student Arvid Smit has prepared a demonstration based on fifty different whiskies, each of which has been classified according to peatiness, sweetness, and price. Each whisky brand is represented by the label on the bottle.

Sketch of a colour selector that could be used in interior design shops. Using a scanned photograph of the living room, consumers can fill in the colour of the material they have selected and assess its merits in the right context.

you haven't a clue what he is doing with that computer of his, and then suddenly it produces what he says is the right choice for you. When specialists are operating a database, you can't just peek over their shoulder. Even if you could, you wouldn't be able to tell what they were doing. Our system lets consumer conduct their own search, and it is perfectly suited for letting people search together. The system is very easy to learn just by watching someone else operate it. In addition the system can give people ideas, facilitate discussion, and make suggestions without being imposing and frightening them off.'

Marketing

The clinching factor for the quality of the advice, to consumers as well as experts, is that the search system must be filled with meaningful attributes that are relevant to the users. Stappers: 'You don't want to include the number of screws in the base of a roller skate, since they don't matter one bit to the user. A search system for experts could combine visual actions with additional linguistic information. In addition, such a system must offer extended selection options that users can change for themselves. It could include special filters to prevent unwanted selections, for example a filter will select only off-road skates, or exclude all models over one thousand guilders.'
In the meantime, Stappers is looking hard for commercial cooperation opportunities.
'We've got several different applications in mind. The idea is perfect for people designing software for the music trade, or for arranging computer files in a more meaningful way. Perhaps major software developers would like a licence to use the idea. Another field we would like to participate in is market research. Even so, it's not our intention to start developing all kinds of database interfaces for different kinds of products; that's not part of our role as a university.'

Head full of examples

In addition to the development of computer aids, current research at the section focuses on the more theoretical side of design. This includes the doctoral research of assistant professor Gert Pasman, who has an engineering degree from the University of Twente. He specialises in design methodology, which is the study of design processes and design theories. His special interest is the use of computers as design tools. In addition to design methodology he also looks at interactive design and user interface design methods. Designers use existing products to get new ideas. Pasman is investigating to what extent and in what way these products influence new design concepts.
Pasman: 'The end purpose is to develop software that can help the designer to use existing products in a constructive way, without falling victim to imitation.'
First of all he collected a whole range of product examples. He then went to
the designers to ask them about their working methods and to study their working environment. Pasman was surprised by the number of times designers fell back on existing designs they had created earlier or had collected

A visit to an estate agent usually means going through the entire collection of houses on offer, with only one or two of them worth considering. The current practice is to arrange houses according to price, but this fails to take the customer's taste into account.
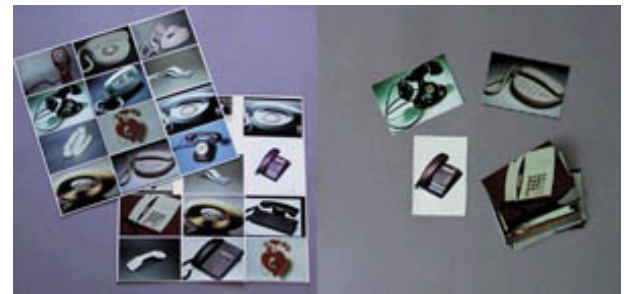
In an experiment conducted by Pasman industrial design students were asked to design a new phone set. One group was given photographs of design samples that had been arranged according to certain aspects of appearance and behaviour, and another group was shown a bunch of loose pictures. Pasman wanted to find out whether or not the prearranged (though not explicitly named) structure affected the design process of the test subjects.
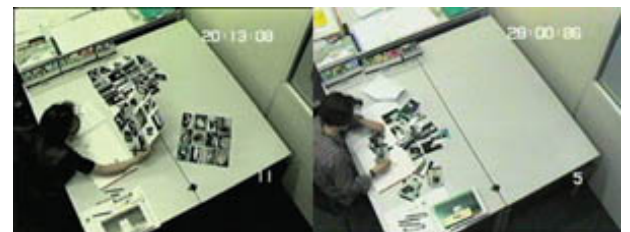
Results of the design experiment for the ordered and the non-ordered conditions. A panel of experts assessed the sketches, which showed that the draft designs from the ordered condition reached higher scores for the properties represented by the product fields, e.g. «feminine», «asymmetrical», and «atypical».

in scrap albums. Of course, nobody starts with a completely clean slate.

If anyone is asked to design a chair, he or she cannot help but have a whole range of examples in their head. On the one hand existing designs can hinder creativity, but on the other designers can also use them to support their own design process.

Knowledge carriers

Over the years the department has developed a theoretical framework for the classification of products, based on the concept that existing product forms are carriers of design knowledge, solutions for certain design problems.

Pasman: 'This knowledge is locked inside the product as it were, and the question is, how do you unleash that knowledge. According to our theory, the knowledge is reflected in certain typical properties of the product. These can be formal properties, functional properties, or properties linked with a certain behaviour, a certain environment, certain applications, or an historical style. We want to retrieve this knowledge by grouping products together according to the way they share these typical properties.'

To illustrate his point, he shows a collection of pictures of chairs. They are arranged into groups according to certain external properties. All the chairs in the first group are made of sheet material curved in one plane, open and fairly regularly structured. The chairs in the second group are intended to impress the people around them rather than provide comfortable seating. They include chairs made of concrete, intended as a statement. Pasman: 'By changing the collection a certain chair belongs to, the emphasis suddenly shifts to other properties, such as expressiveness, impulsiveness, and artificiality. In this way the knowledge is elevated to another level, no longer tied to a single product, but rather to a higher, more general level, tied to a collection of products. In this way it should be possible to convey knowledge to new, hardly formalised design problems,' Pasman says.

The assumption was tested in a design experiment. The question was whether or not the organised provision of design examples affects the result of a new design assignment. The experiment was conducted with sixteen test subjects under two different sets of conditions. The subjects were asked to design a portable telephone set for a businesswoman.

Pasman: 'The experiment was conducted quite a few years ago, when mobile phones were still rather bulky, and practically always black. If the intended user is a woman, the designer has to think about where she will put it when it's not in use, how she is going to use it, and whether she will be wearing earrings that might be in the way.'

Transferring knowledge

Before the businesswoman was introduced into the conversation, the test subjects were asked to make a quick sketch of a mobile phone in fifteen minutes, on about a half sheet of A4 paper, the so-called preconcept. This was followed by the actual design assignment, for

In the classification experiment, the test subjects were each handed an envelope containing 25 pictures of products (scent bottles, mobile phones, watches, or sunglasses). They were then asked to arrange the pictures on a surface in a pattern that made sense to them. The test subjects were left completely free as to the type of pattern, and they could take as long as they wanted. The process was recorded using video and still cameras.

Various stages of the classification process. The test subjects started by arranging a field of products (pictures A1, B1,C1), then they separated the field into different groups (pictures A2, B2, C2). After that, they named each of the groups (pictures A3, B3, C3). Finally, the pictures were ranked on the five given criteria, e.g. masculine/feminine, geometric/organic, and formal/informal. The last stage is not shown here.

which they were allowed 90 minute, resulting in the end concept, the final design. For this stage they had at their disposal a number of photographs with examples of existing telephones, both normal sets and mobiles. For half the test subjects (the «ordered group») the phones had been arranged into five product fields, based on the judgement of a panel which had assessed the phones on a number of characteristics, such as «feminine», even though these labels were not explicitly shown in the product fields. The other half of the participants were shown the same photographs, but this time they were handed over in a bunch instead of being arranged in any particular order.

Both the preconcepts and the end concepts were assessed by a panel of experts assessing the properties referred to earlier. It turned out that the designers who had been offered the examples in a structured way were better able to express these properties in their designs. Their phone sets were, for example, considered more feminine than those of the control group.

Pasman: 'It would appear that organising the product fields improves the way in which the knowledge contained in the product fields is transferred to new design situations.'

The second thing Pasman noticed was that the final designs of the designers in the «ordered group» differed more from their preconcept than those of the people in the control group. 'Apparently, the people in the ordered group were more flexible and better able to abandon their original ideas and explore new solutions', Pasman says. 'A well-known problem in this field is the reluctance to let go of the first concept, resulting in endless repetition. The idea underlying the arrangement in groups is that it may help the designers to free themselves from their first brainwave so they can look around at other ideas, and so increase their range of solutions and ideas.'

Product classification

Ordering and classifying products would appear to affect design behaviour. For the third part of his research, Pasman wanted to find out whether or not designers also use classifying as a method. Do they really arrange products, and if they do, into which categories? Are these categories product-dependent or not, or does this vary from designer to designer? He also wanted to know the effect on the design process of such factors as context, product, target group, and individual differences between designers. These were very difficult to measure, Pasman explains, since every human being is unique, and we all have our own ways of classification. You are looking for general trends, but you don't want to come up with a cliché. The classification was also investigated in an experiment. Twelve test subjects, divided into two groups, were given the same assignment: to classify a collection of objects. One of the groups received additional context information: Assume that you are a freelance designer and you have a meeting tomorrow with your client, the new phone company, HandsOn, where you will be presenting your first sketches of a mobile telephone for

a businesswoman. The underlying question was whether this context would affect their classification of a series of product images. The cards used showed four types of products, scent bottles, mobile phones, watches, and sunglasses. Pasman got most of his material from the Internet, and they were all arranged against the same background. The test subjects were handed the images in an envelope, and were then asked to arrange them on a surface in way that was meaningful to them. They were free to choose their own basis for the arrangement, and they could take as long as they liked over it. When they finished, the composition was photographed from above. Some designers produced a wild, chaotic result, whereas others followed rigid lines. Some people arranged the cards in neat, geometrical compositions, as if they were playing a game of Scrabble, and others immediately started to arrange the cards into groups, even though that assignment wouldn't come up until the second round. A third assignment was to give each of the groups an unequivocal name, e.g. a design phrase such as «curved», or a concept such as «attractive» or «ugly». And finally, the subjects were asked to arrange the collections according to the pairs of properties used in the earlier experiment, e.g. geometric/organic, and masculine/feminine. The research is now focusing on possible patterns in this behaviour. For instance, do certain types of cards often end up together, and how big are the groups in the arrangements?

Pasman: 'We expect the test subjects who were given a context to show more similarities in the product groups they create. We also expect these subjects to pay more attention to such concepts as «feminine», «business-like», or «geometric». The design context could well narrow down the way in which people regard the subject matter.

This part of the research is still being completed.

'Idea space'

Back to the question of how you can set up an interactive database like the one demonstrated by the roller skate demo.

'The keywords are interactive, dynamic, flexible, and visual,' Pasman says. 'The only difference is that this time the collection will not be completed in advance, ready to be retrieved when needed. Instead, user (i.e. the designer) will themselves build up a database. As they are filling it in, they define the relationships of each product relative to the other products, implicitly assigning different properties to each product. In this way, building up the collection itself becomes a design activity, since it stimulates the designer to regard a product in different ways. The purpose is to help the designer, by looking at different existing products, to design a «modern» or «young» product that is different from anything offered by the competition.

Pasman: 'This will enable us to help designers increase their 'idea space'. Even so, even the best tools can only be an aid, not a guarantee.'

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