WHEN USERS DO AND DON'T RELY ON ICON SHAPE

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ABSTRACT
It is expected that users learn to associate commands with an icon's shape, and eventually learn to associate its position. The experiment reported suggests that if the icon's shape is hard see as meaningful then subjects rely on position rather than shape in order to identify the appropriate icon. The experiment had four conditions, manipulating the abstractness of icon shape and constancy of icon position. After a training period, conditions changed without warning and the conclusions depend on whether or not performance was disrupted by the change. The effects were large: ranging from zero to four-fold worsening of performance.

KEYWORDS: icon design, position, representation

INTRODUCTION

We often assume, both from introspecting on our experience as users and as researchers, that users learn command names; and that if the interface uses icons rather than textual names, then we learn the icons. More precisely, we learn to associate commands with particular icons through recognition of their visual features and particularly their shape. On the other hand, it is widely suspected (from introspection and other sources) that experienced users have often learned the position of items (e.g. command names on menus) as well. However it is quite difficult to demonstrate this, partly because learning position does not seem to greatly improve measured reaction times. One of the few to show a clear effect is Kaptelinin [2], who showed that after training on textual menus, randomising position had a disruptive affect on selection times, which failed to diminish over time. If however position remained consistent, and instead the letters of the textual commands were masked while retaining word length subjects performed as well as they had with the familiar textual commands.

Blankenberger and Hahn [1] similarly remarked in an experiment designed to compare performance using textual commands, abstract icons, and representational icons, that when position was fixed, subjects appeared to learn position, and no significant difference in performance between conditions was found. Only when position was randomised did they find a superiority effect for the representational icons.

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Combining both the Kaptelinin and the Blankenberger and Hahn experiments, it was expected that by training subjects to use either representational or abstract icons in consistent positions, and then without warning manipulating one of the factors (shape or position), there should be varying effects on user performance. Extrapolating from Blankenberger and Hahn's conclusions, it was hypothesised that subjects would not be significantly disrupted by randomising of position when the icon set they have learned contains guessable, representational icons. In contrast, those subjects using an abstract icon set will sustain a detrimental effect on performance when position is randomised. In addition, if subjects using the representational icons did rely on associating the command with the shape rather than position, then by manipulating the shape of the icon while keeping position constant should result in a decrease in performance. Subjects trained on the abstract set of icons should rely more on position and therefore performance should not be so significantly effected.

METHOD

Subjects

Twenty-four subjects, with a mean age of 24 participated in the experiment. All had normal, or corrected-to-normal vision, and were experienced users of word processing packages.

Materials

A Hypercard stack was designed to replicate the tasks used in the Blankenberger and Hahn experiment. The set of "Near" word processing icons created and validated for the experiment by Blankenberger and Hahn were considered suitable to be used as the set of representational icons in this experiment. A set of 17 abstract icons, created from random geometric shapes was also used. All icons were placed in rectangular frames measuring 27X29 mm.

Design

The experimental session consisted of 8 blocks of 17 experimental trials; one for each of the 17 commands, randlomly ordered. Subjects were randomly allocated to one of four experimental groups. These groups are defined as follows:

- Group 1. Exposed to the representational set of icons, which changed to abstract icons on the sixth block Position remained the same throughout.
- Group 2. Exposed to the abstract set of icons, which changed to representational icons on the sixth block Position remained the same throughout.
- Group 3. Exposed to the representational icons throughout. On the sixth block of trials the position of the commands was altered.
- Group 4. Exposed to abstract icons throughout. On the sixth block the position of the command was altered.

The start of each trial was signalled by a tone. After 0.5 seconds one of the 17 commands was displayed textually for 1.5 seconds. The command disappeared and was replaced by the appropriate set of icons. After the subject responded, the set disappeared, and approximately 0.5 seconds later the next trial started. An erroneous response was signalled by a high tone and recorded. This tone informed the user that they had selected an incorrect icon, and to select again.

RESULTS AND DISCUSSION

Figure 1. shows a graph of the mean reaction times between blocks 4 and 7. The interesting blocks to consider are blocks 5 and 6. Block 5 represents the level of performance users had attained through learning the consistent interface, while block 6 represents performance levels once the appropriate manipulation had occurred.

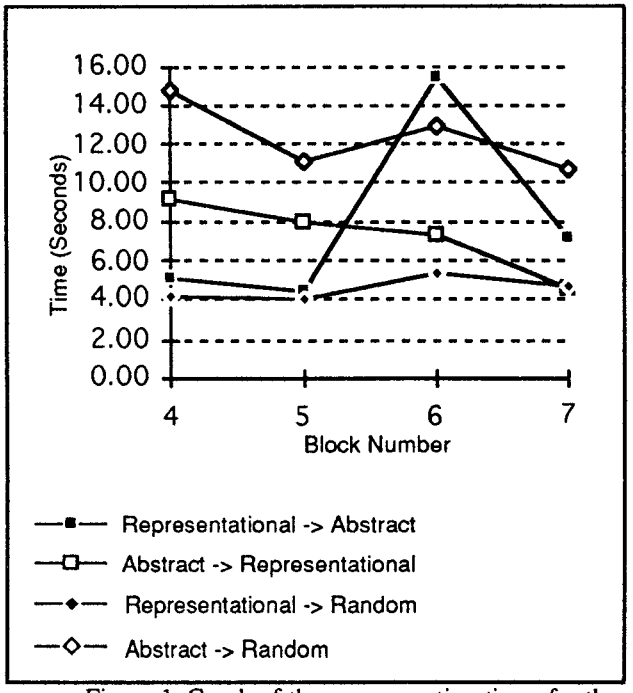

Figure 1. Graph of the mean reaction times for the four groups over blocks 4-7

A two way analysis of variance (ANOVA), with repeated measures on one factor (Block) was carried out to compare performance results over blocks 5 and 6, for groups 1 and 2, and also groups 3 and 4. Significant interaction effects between block and groups were found for both comparisons (for groups 1 and 2, $p < 0.0001$; for groups 3 and 4, $p < 0.01$). Figure 1. gives a clearer description of the results, and can be described as follows:

Group1. Between blocks 5 and 6 there is a four-fold worsening of performance as a direct result of the representational icon set being switched to the abstract set. It appears therefore that subjects relied on shape and failed to use position when recognising the appropriate icon.

Group2. Between blocks 5 and 6 there are no significant improvement in performance caused by the introduction of representational icons ($\tilde{p} = 0.1081$). It appears therefore that subjects used position. In this condition, one subject's spontaneous comment showed that he had not noticed that the shapes had been changed until after he had made his response (correct icon selection).

Group3. Between blocks 5 and 6 the icon shape is maintained (representational) and position is randomised. The graph suggests that no significant change to performance occurred ($p < 0.08$). This reflects the idea that subjects in this group had not come to rely on position, but must have used shape.

Group4. Again shape is maintained however in block 6 position is altered. The graph suggests that performance significantly worsened ($p < 0.01$), suggesting that subjects must have been relying on position in order to recognise the appropriate icon.

It seems clear therefore, that subjects trained on representational icons, i.e. those whose shape was easy to guess and to learn, relied on that shape. If the shape was changed their performance was disrupted, if it was maintained then randomising position had little effect. On the other hand subjects trained on abstract icons (i.e. ones whose meaning and association with function was hard to guess and to learn) relied on position to identify the icon rather than shape: if position was maintained then changing the shape had little effect, while if position was randomised their performance was disrupted.

CONCLUSIONS

In this experimental situation, at least, subjects appear to select either position or shape to associate an icon with a command but not both. Which one they select appears to depend on whether the icons' shapes are easy or hard to learn. Further work, already under way, is clearly needed to investigate the scope of this effect; in particular, whether it depends on length of training or on the size of the set of icons being learned. In this experiment, training was over 5 trials per icon only. It remains to be seen whether people naturally do learn more than one attribute given longer experience. However this experiment has already demonstrated that which attribute is used to identify the appropriate icon depends on which is easier to learn, and is not a fixed property.

Note that the demonstration that users sometimes ignore icon shape entirely casts doubt on the assumptions behind all the research on designing guessable and learnable icons. Should we conclude that poor design often gets away with it because position carries the burden; or even that icon design doesn't matter for longterm usability?

REFERENCES

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