

Split Pane Interactivity

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Abstract. While the internal performance of AI systems has impressively progressed, some necessary auxiliary methods have not adequately advanced. The main user interface for cognitive tasks is still the 2-dimensional page of text and images, with its space scarcity for labeling and annotation, and this is aggravated by an old doctrine which demands that labels have to be close to their referents. This short opinion piece proposes an alternate, two pane, solution for textbook interactivity.

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1 Background and problem

1.1 Think tools

The gap between the conceivable and the currently observable innovation thrust is especially wide in one particular area of user interfaces: While much progress has been made in 'bodily' human-computer interfaces, their counterparts of the more 'cognitive' interfaces, including textbooks, are lagging behind. On one hand, immersive virtual/ mixed reality on the output side, and ubiquitous mobile, touch and gesture interfaces on the input side, enable formerly unthinkable simulation and learning of manipulative skills.

On the other hand, output from and input to systems that assist in cognitive tasks that were formerly based on the paradigm of a paper page with two-dimensional limitations, have pivoted to the digital medium without considerable changes to that 2-dimensional page paradigm.

Obstacles to better adaptation may be seen both in the prevailing general mindset towards the cognitive, and theoretical doctrines. While the theoretical doctrine will be discussed below, let us briefly recap what is a common view about thinking and, for that matter, thinking tools.

While many tools assist us with reading and writing, that what happens in between, is invisible and mostly conceived of as taking place entirely in the skull, with no tapping and tools being imaginable; it seems like mental juggling where the juggling clubs

must be always in the air, i.e., cannot be put down or offloaded in between. For example, the stages between the collection of materials for an article and the structuring of its outline, is typically skipped in the advice guides. A telling indication is that on advertising pages for thinking assistance, the symbolic object shown on the visuals is often a cup of coffee, as if only this 'fuel' could contribute to the result.

Correspondingly, the contribution of thought assistants is often expected as a separate unit of independent work, which is accessed via predefined GUIs like an agent who offers fixed services. Contrast this with Engelbart's [1] vision of "augmenting human intellect" where the user interacted with a 'clerk' and seemed to continually readjust this division of labor: The user "*would find it very natural to develop further techniques on their own*".

Many vendors are happy to offer thinking services in a patronizing way which, by Krakauer's [2] terms, are competitive (prostheses) rather than complementary (tools); e.g. predefined templates, or autogenerated associative links. For the impending Cognitive Automation, this patronizing replacement of users may still 'work', but teaching, and learning to become an independent thinker, is likely to suffer if the augmenting cooperation will not succeed.

Before this background, it is no surprise that the 2-dimensional page paradigm is still in largely unaltered use for the input to, and output from, systems that help to fulfill cognitive tasks, which are invisible and mostly text-based -- teaching resources included. The interactivity is typically confined to a sequence of requests and response presentations, with reading separated from writing, rather than 'collaboratively' creating an artifact for insight. Still more often than not, the 'interactivity' is restricted to a page turner for reading, and a better typewriter for creating, instead of permanently integrated exploring, annotating, and linking.

1.2 Maps and annotations

The limitations of the 2-dimensional page are particularly visible in concept maps on the output side, and annotations on the input side.

In both cases, small text information (labels, notes, explanations) depend on context, which causes a dilemma in utilizing the scarce 'real estate' of the page: on one hand, it is desirable to have as much context as possible on one page or map, e.g. to discover new connections, but on the other hand the text must not be so much shortened that it becomes unintelligible. Typically, this conflict results in a poor compromise which neither caters optimally to the labels nor to the details.

Let us linger for a moment on the interplay of context and details in the popular think tools. The atomicity, i.e. representing one concept by one item (such as one icon on a map, or one zettel in the currently hyped Zettlekasten note taking method), is not only attractive because it creates a haptic impression of tangibility (see Wodtke [3] for the

role of tangibility). It is possible because of the new affordances of creating flexible connections.

Without the mitigating effect of the connective context, and without the mitigating effect of an editable annotation connected to an item, a focus on the construct of a concept by isolating and fixing it, would be a considerable risk for a balanced understanding. (See an account of why this focus is both tempting and dangerous in McGilchrist [4], and some hints on the role of connections in Downes [5], both with great influence on the present idea.) While previous AI generations ("GOFAI") were mostly working with isolated fixed concepts, modern systems can add much flexibility, but this affordance has yet to arrive at the textbook level.

Furthermore, maps mitigate the space problem since in a 2-dimensional area, connection distances are on average shorter than in a linear text. But this again presupposes that explanatory labels are not too large.

2 Split pane

2.1 Split attention theory

An aggravation of the space problem can be found in the established and influential theory of the so-called Split Attention Effect. It originates in a study conducted by Chandler & Sweller [6] in 1992 with paper resources, and it suggests that the cognitive load is increased if an annotation is not immediately next to the item it refers to.

"Learners are often forced to split their attention between and mentally integrate disparate sources of information (e.g., text and diagrams) before the instructional material can be rendered intelligible."

2.2 Drone vs. ballistic

Drone

For a static page such as a paper map, this is immediately plausible. If the eye must search for a text field like a drone navigates to its target, it is beneficial if the distance is not too large. Therefore, in the digital equivalents of Chandler and Sweller's paper resources, it is common to deploy pop-up windows or/ and hover texts. These intrusive, attention-grabbing display elements free the user from finding them.

But at the same time, they cause a certain amount of disruption and temporary cut-off from the surrounding context; they may be associated with a certain delay (reaction time of the system, or a deliberately scheduled delay for hover-text to distinguish pointing from repositioning); and they switch the user from an active (pull) mode in a more 'patronized' pushed mode while passively waiting for the reaction; all of which

may be seen as an alternate form of added cognitive load. It is conceivable that this is one reason for the poor adoption of concept maps, both for pulling information and drafting creative artefacts.

Ballistic saccades

By contrast, if the annotations always appear in a spatially fixed location (say, the upper end of the right pane), the resulting eye movement is a ballistic one, at least after a short period of habituation. This means that, unlike the drone mode, the movement path is calculated in advance and cannot, and need not, be altered subsequently [7]. This is the typical behavior of the eye saccades that are employed to accelerate and ease much of the eye's operation.

Furthermore, the element of a default position, or home, is readily embraced because users are accustomed to such defaults which may be resorted to without any necessity to choose among, or browse through, alternative options.

2.3 Mouse gazing

The ease of viewing different texts in the same place by merely pointing one's mouse to a different item, quickly becomes a habit so unconscious that it feels as if the mouse itself was used for gazing at a text.

For learning analytics, the added fine-granular operations of reading (let alone the annotations in the details pane) provide a considerable source of new significant tracking data. Even the most basic 'textbook' map [8] consisting of plain text concept labels and descriptions, offered for rearranging and connecting, yields rich data points.

Unfortunately, the described method does not lend itself well to smartphones or larger mobile devices without a pen, because finger gestures eat up much of its space-conserving effect.

References

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