Information Spaces as Interactive Worlds

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ABSTRACT
This poster abstract re-conceptualizes information interfaces as immersive "worlds" of information with rules that govern their behavior. It is argued that rethinking interfaces in this way has the potential to suggest new and innovative ways to study, present, and interact with information in computing environments.

Categories and Subject Descriptors
H.5.2 [**User Interfaces**]: *Graphical User Interfaces (GUI).*

General Terms
Design, Human Factors.

Keywords
Interface, Information, 3D, Spatial, Space, Interactivity, Metaphor

1. INTRODUCTION
In the computer world, interaction with information takes place largely in two dimensions and often through just one or two of the five senses (e.g. vision and hearing). From web sites to computer operating systems to mobile applications, outside of specialized areas such as computer aided design [1] or video gaming, information is typically presented and interacted with via the flat and sensory-poor WIMP (window, icon, menu, pointer) paradigm.

Edward Tufte, in his influential discussion of information design [2], argued for an "escape from flatland" – an escape from the constraints of two-dimensional presentation formats such as paper or video screens. Tufte suggested that, "…all the interesting worlds (physical, biological, imaginary, human) that we seek to understand are inevitably and happily multivariate in nature. Not flatlands," [2]. Nonetheless, in the twenty years since Tufte wrote, the escape from flatland in computer information spaces still remains largely unachieved.

2. WORLDS OF INFORMATION
Our world, the physical world, is a three-dimensional information space; objects have properties like size, position, weight, density, texture, and color that convey meaning to us through our five senses: sight, hearing, touch, taste, and smell. Through these senses, we are able to observe and manipulate physical objects. As a species, human-beings are extremely well-fitted for interactions with the immersive information space that is the world.

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For the past several decades, human-beings have been creating new information spaces, housed in computer systems and presented primarily on flat, two dimensional display screens. Curiously, instead of mimicking real world's three dimensions of physical space, new information spaces such as the World Wide Web, mobile applications, and computer operating systems typically offer just two. Instead of the real world's immersive and sensory rich environment, these information spaces usually cater to just one or two of the senses (sight and sometimes hearing), often ignoring the rest. Whole worlds of information are, in their presentation, at odds with humanity's well-developed ability to interact with three-dimensional, immersive space. We have, in a sense, deliberately settled on "flatland" as the preferred domain for interacting with computer-based information.

3. WHY FLATLAND?
Most current display and presentation technologies are not up to the task of perfectly recreating physical reality, especially the accurate and useful recreation of several of the human senses. For example, while high definition and recent developments in 3D video display make visual presentation at its best exceptionally close to reality, and while surround sound offers an equally compelling aural experience, simulations of touch, taste, and smell are much more primitive. Too, while state-of-the-art 3D computer graphics technologies are capable of achieving extremely realistic visualizations of objects and environments, the creation of such visuals can be difficult, time consuming, and expensive. Finally, it must also be acknowledged that some computer-based information spaces are truly better served by traditional 2D WIMP interfaces; not every information system requires total sensory input or three dimensions of visual space.

Nonetheless, these arguments seem not to fully explain why, for example, sound is not more heavily used in many kinds of information interface, or why three dimensions of visual space are not more often exploited for activities such as personal information management, information retrieval, or information visualization. After all, many current video games, regardless of development time and budget, feature highly successful interactions with well-developed, sensory-rich, and three dimensional worlds; why shouldn't interactions with information in organizational or personal computing settings also take advantage of these techniques?

4. WHY (ESCAPE) FLATLAND?
The use of three dimensions of visual space is often argued for from a technological standpoint: that because modern computer systems *can* support 3D graphics and rich sensory input, information spaces built upon these technologies *should* be used [1, 3-6]. While this point of view is useful if one's argument is for the feasibility of such interfaces (i.e. development time, cost,

practicality), it does little to answer larger questions about how worthwhile an immersive interface will be to a given user in a given context undertaking a given task [7].

Others have argued for immersive interfaces by way of metaphor: that a 3D interface should simulate familiar information spaces and recreate well-known interactions with them [8-10]. Familiarity with a real-world interface will, so the argument goes, assist users in manipulating the digital version of that interface.

Both of these arguments – the technological and the metaphorical – have their merits, but each also omits something important. Arguments from technology omit the user, merely suggesting that because a technology can be used, it should be. Arguments from metaphor ignore important questions: is the metaphor suitable for the user, task, and context? Is the real-world interface that will be recreated the best solution to this information problem? Does the real world impose unnecessary constraints that could be eliminated in a computer-based version of the interface?

5. RECONCEPTUALIZING THE INTERFACE AS INTERACTIVE WORLD

Instead of producing immersive interfaces without consideration of the user, and instead of creating real-world interface metaphors (e.g. bulletin boards [9], books [10], library shelves [8], etc.) in three dimensions, a re-conceptualization of information interfaces is suggested here as a new means of "escaping flatland."

The world – the real world – is effectively a set of complex rules for the interaction of objects based upon the laws of physics, biology, chemistry, and other natural sciences. It is proposed here that information interfaces be similarly considered as discrete, self-contained, interactive worlds which are subject to their own sets of governing rules. These rules should be imposed with the requirements of the user, the task, and the context of the interaction as their basis [11].

For example, consider the desktop metaphor employed by many operating systems, chosen because it simulates something that many users are familiar with from the real world. From a metaphoric point of view, the desktop metaphor is an excellent choice for this interface: many users will be familiar with real desktops, and will feel comfortable manipulating a digitally recreated one. Furthermore, the real desktop is home to disparate types of functions and objects, just as a computer operating system controls a vast array of functions on the computer.

From an interactive world perspective, however, the desktop metaphor is inadequate. The real world has gravitational pull; anyone who wishes to write comfortably, set objects down (folders, files, pens, paper), or store things in plain view must have a flat, horizontal surface to facilitate these actions. In the real world, gravity, not the user, has dictated the design of the desktop.

In a computer-based information space, gravity is optional. It is a rule which may either be established or omitted (e.g. in *this* interface, gravity does not exist). Why, then, simply assume that the desktop, an information interface designed in a world where gravity exists, is necessarily the best model for interacting with information in a computer-based world where gravity need not exist? Removing the "gravity rule" from the desktop metaphor raises interesting questions: what would a "desktop" look like in this world? Could information objects simply be left to float in space? Could writing be accomplished simply by gesturing in mid-air? Would the folder and file metaphor continue to make sense to users? Ultimately: could a "gravity-less" information space be designed that does not rely on the desktop metaphor but is equally (or more) usable for the same kinds of tasks?

Extrapolating, it is possible to see how any interactive information space may be shaped, potentially to the great benefit of the user, by the rules that govern it. Instead of thinking of information spaces as a metaphors for existing, real-world interfaces, it makes more sense to re-conceptualize such spaces as individual, discrete worlds with rules that govern the behavior and interactions between objects and users of those objects. By so doing, the many worlds of information now available via computer devices – web sites, mobile applications, personal data, textual content, images, audio, video, etc. – may ultimately be spirited away from Tufte's flatland [2] and presented in new, exciting, and more usable ways.

6. CONCLUSION

The re-conceptualization of information spaces as interactive worlds raises interesting questions for future research: What effects might this re-conceptualization have on things like user satisfaction, task completion, annoyance, or perceived credibility? Could a "world rules" taxonomy be generated to describe the possibilities for immersive information interfaces? How successful might such interfaces be in various contexts, such as personal information management, data visualization, or information retrieval? While much empirical research is required, the interactive world perspective suggests interesting new ways of conceiving and implementing user interfaces for a variety of uses.

7. REFERENCES

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