BLANK SCREENS AND PEEPHOLES: CROWD-BASED METHODS OF DESIGNING AND EVALUATING GEOMETRIC SPACES

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INTRODUCTION

For more than a decade, organizations of all kinds have been using web-based crowdsourcing as a means of capitalizing on the collective wisdom of large groups of people for purposes such as problem-solving, product design, genetics research, policy formulation, and even astronomy. The wisdom of the crowd – that is, the aggregated insights, inputs, or opinions of a large, commonly anonymous community of volunteers – has been shown to be surprisingly powerful, often yielding highly accurate, near-optimal, or surprising solutions to complex problems. In a very real sense, crowdsourcing can thus serve as a low-cost strategy through which organizations can leapfrog over what might otherwise be expensive and challenging problem-solving tasks, or lengthy, iterative cycles of design, testing, and refinement.

This brief abstract describes and reports upon two innovative methods which can be used to leverage the power of crowdsourcing for the purpose of designing and evaluating geometric spaces. The first of these methods, which I refer to as the "blank screen method", allows for the web-based solicitation and aggregation of opinions regarding the design of a geometric space. By contrast, the second of these methods, which I refer to as the "peephole method", allows for web-based evaluation and validation of an existing design for a geometric space. Although described herein in the context of website design, the methods themselves are general in nature, and can be readily applied to the design and evaluation of almost any geometric space, including (but not limited to) stores, movie theaters, shopping malls, schools, parks, major transportation hubs such as airports and train stations, or even entire cities.

DESIGNING WITH BLANK SCREENS

The blank screen method is a strategy in which crowdsourced web users are given a particular design scenario (e.g., "Imagine that you have been asked to design the layout of a hotel lobby"), after which they are presented with an image of a blank, two-dimensional screen. The web user is then asked to use her mouse cursor to click on the screen at the point where she would expect a specific design element to appear. Continuing the hotel lobby example, such elements might include the reception desk, the concierge, the elevators, restrooms, etc. The process is repeated for the complete series of design elements, with the geometric coordinates of the user's selected location being recorded for each element. When the process concludes, the researcher will possess a set of (x, y) coordinate points, each of which reflects the user's best judgment regarding where a specific design element should be located. When considered together, the collection of points gathered from each subject represents his or her cognitive

model of how the overall geometric design problem should be solved. After repeating the process with a large number of crowdsourced volunteers, the researcher will possess a collection of (x, y) coordinates for each design element which can be combined to produce an overall picture that reveals the collective wisdom of the crowd in the context of the given design scenario. These data can then be subsequently explored using both graphical and statistical techniques.

A study involving the general layout of a web interface was undertaken as a means of demonstrating the efficacy of the blank screen method. A total of 1,483 volunteers were recruited for the study by means of a web-based advertising campaign, and were asked to click on an image of a blank computer screen at the points where they expected nine common web interface elements to appear. The results of the study, which reveal the collective opinions of the subjects regarding how a web interface should be designed, are presented as a series of heat maps in Figure 1 below.

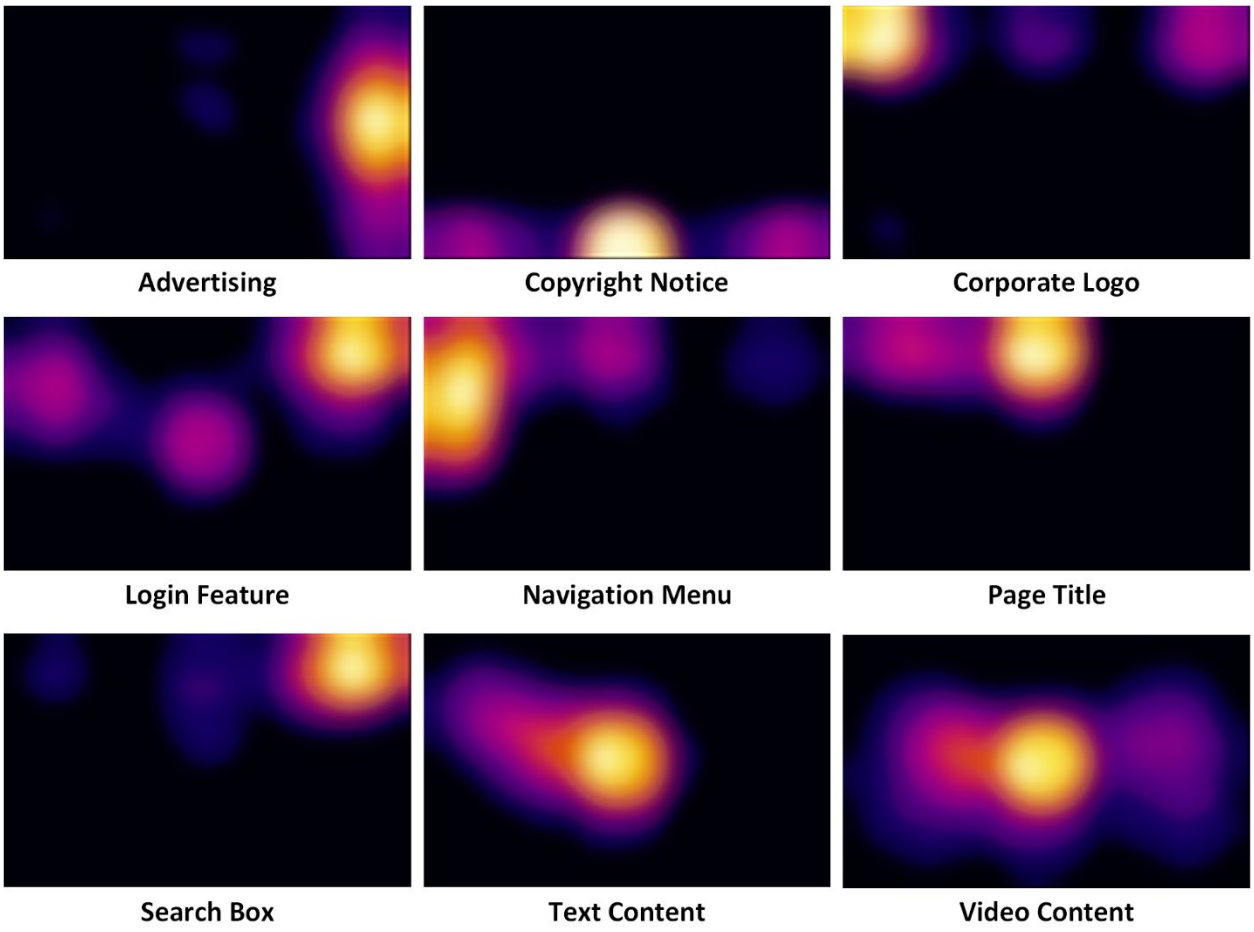


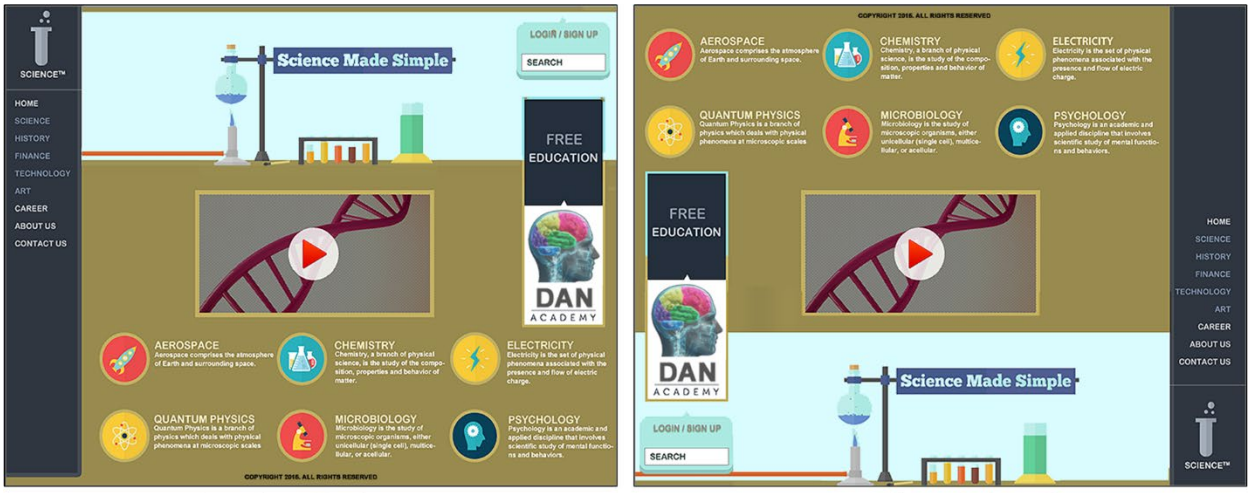
Figure 1. Heat maps depicting the crowdsourced design of a general web interface.

VALIDATING DESIGNS USING PEEPHOLES

The collective wisdom of the crowd can be leveraged to evaluate or validate existing or proposed designs for geometric spaces by using the peephole method. In this approach, a

crowdsourced subject is given an evaluative scenario (e.g., "Imagine that you are viewing a map of a city park"), and is provided with an image which represents the existing or proposed design. Just as when looking through the peephole in a door, however, only a small circular portion of the design is actually visible to the subject. As the subject moves her mouse cursor, so too does the location of the peephole, thus allowing the subject to reveal different areas of the underlying design. Beginning with a fixed starting point (e.g., the center of the screen), the subject is asked to locate and click on a particular design element as quickly as possible. As the subject begins moving the location of the peephole, her mouse cursor coordinates are recorded at regular intervals (e.g., every 25 milliseconds). The resulting time and coordinate data can then be used to plot each subject's search path through the geometric space. By aggregating the search data for a large pool of crowdsourced volunteers, the researcher can readily determine where subjects looked when searching for each design element, and can easily see precisely how subjects searched the geometric space if an element was not located where they originally expected it to be. The peephole method thus allows for the collection of the same kind of data that are generated in eye-tracking (or gaze-tracking) studies, but has the advantages of being deployable at a much lower cost and on a much vaster scale.

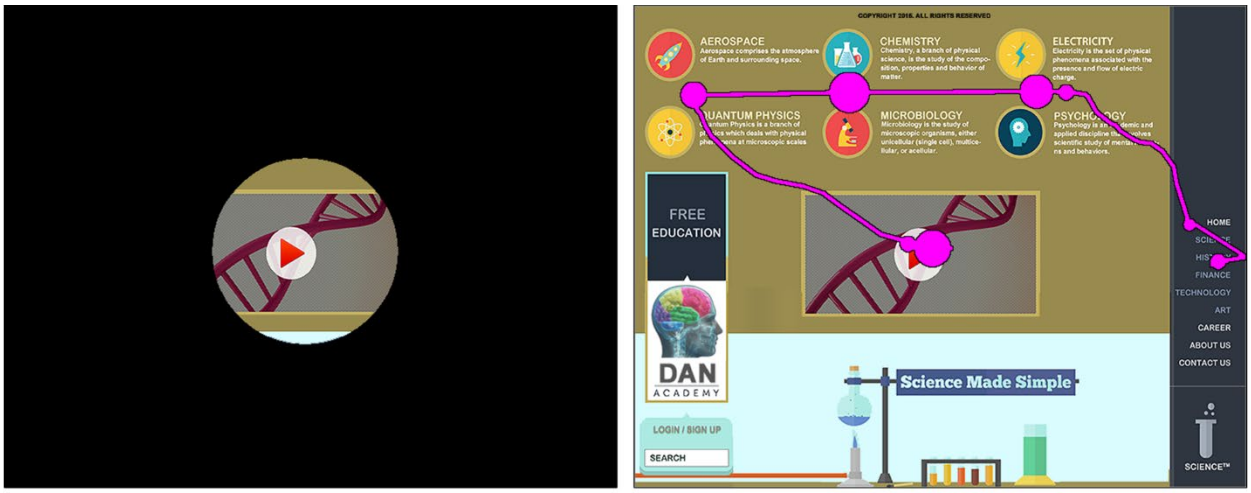
A study involving 1,958 crowdsourced web users was undertaken as a means of demonstrating the efficacy of the peephole method. Using the same web interface design scenario described previously, subjects were randomly assigned to evaluate one of two distinct versions of a web interface, and were asked to locate a randomly chosen interface element as quickly as possible using the peephole method. Figure 2 below depicts the two alternate web interface designs that were encountered by subjects in the experiment. Note that the two designs vary only according to the layout of their constituent elements – colors, fonts, images, and all other design elements are identical for the two interfaces. Note also that the leftmost interface design in Figure 2 below matches the general cognitive model revealed by the experiment involving the blank screen method, while the rightmost interface design is effectively an inverted version of that general cognitive model.



Interface Variant 1 **Interface Variant 2**

Figure 2. Alternate web interface designs.

Figure 3 below illustrates the peephole method in the context of subjects searching for the navigation menu on one of the competing interface designs. The leftmost image depicts the subject's peephole view of the underlying design, while the rightmost image illustrates the search path for a single subject through the geometric space (with circles indicating points and durations of pauses during the search process).



Peephole View **Sample Subject Search Path**

Figure 3. A graphical demonstration of various components of the peephole method.

Finally, by aggregating the search paths of subjects according to the experimental condition to which they are assigned, it becomes possible to readily evaluate the extent to which alternate or competing designs for the same geometric space match subject expectations. In the context of our ongoing web interface design example, the subject search paths for each of the alternate interface designs were aggregated in order to generate heat map visualizations which revealed how subjects searched the two interfaces in real-time. Sample frames from these visualizations are provided in Figure 4 below using two-second resolution. In these particular examples, subjects had been asked to locate the website's navigation menu as quickly as possible. Note that subjects encountered much more difficulty locating the navigation menu on Interface Variant 2, indicating that the design of that interface did not match well with subjects' expectations.

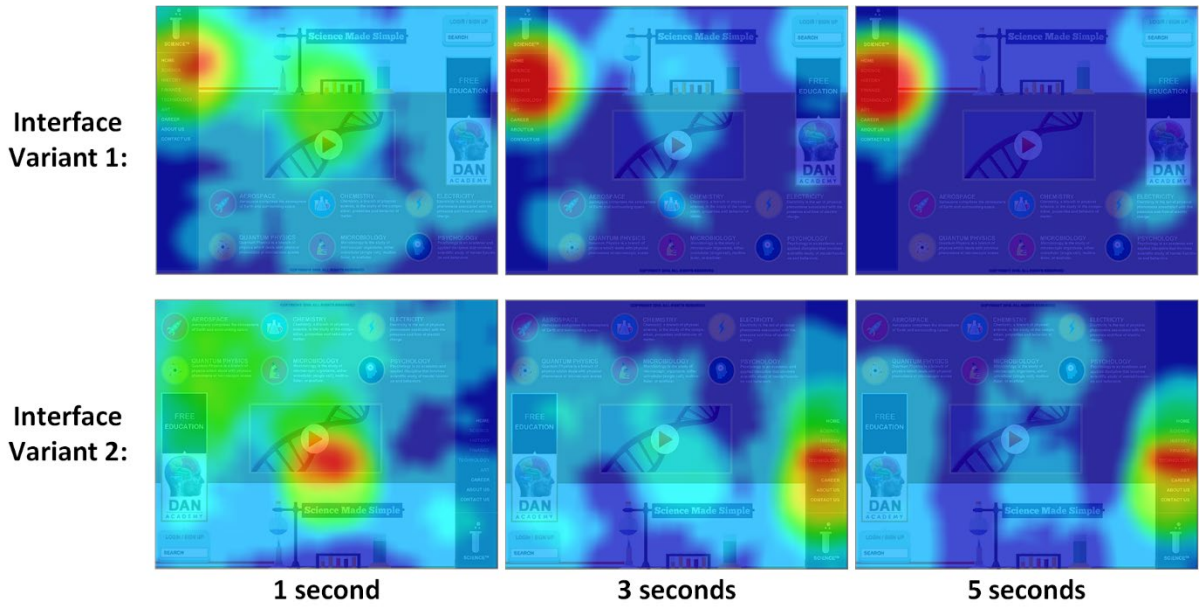


Figure 4. Comparative subject search behavior for two competing interface designs, as obtained from the peephole method.

SUMMARY AND CONCLUDING REMARKS

This abstract briefly described two crowd-based methods for the design and evaluation of geometric spaces – the blank screen method and the peephole method – and provided exemplar data derived from more than 3,400 subjects as a means of demonstrating the efficacy of those methods. Although described here in the context of a web interface design scenario, the blank screen and peephole methods are generally applicable to the design of virtually any geometric space. Many additional details will, of course, be provided during the conference presentation.