Priming Categorization in a Card Sort

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Abstract. When using the card sorting technique, the goal of a user experience researcher is to determine the user's expected information architecture. Card sorting is a knowledge elicitation method where users are given labeled cards and are asked to place them into groups. This method is commonly used to determine a natural navigation structure for a group of users. We examine the impact of priming, an implicit memory effect in which exposure to a stimulus influences response to a later stimulus, on this popular user-centered design method. A control group did the card sort only, while the experimental group watched a short presentation before performing their card sorts. The dependent measure was the percentage of agreement of each card sort against the *typical sort*. The primed group sort was significantly more similar to the typical response than the control group. This study provides evidence that card sorting can be modulated by priming.

Keywords: Evaluation methods and techniques, Human Centered Design and User Centered Design, Card Sorting, Priming, Knowledge elicitation.

1 Introduction

Card sorting is a user-centered design technique where users are given labeled cards and are asked to sort them into groups. This method is commonly used to determine a natural navigation structure for a group of users. We examine the impact of priming on this popular knowledge elicitation method. If card sorting is affected by a simple priming manipulation, there could be considerable implications for effective use of this technique.

1.1 Card Sorting

Websites are filled with large amounts of information, which users must navigate through making their search tasks difficult. According to Usability.gov, when seeking information on a website, 60% of the time people cannot find what they are looking for [26]. In order to provide better navigation for users, information needs to be organized appropriately. According to Pirolli and Card [19], users ought to be viewed as information foragers (a.k.a., infomavores). They navigate through information trying to find a familiar scent or "good scent", which correctly leads them to what they are searching for. Website links have labels that are semantically related to content on the

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target page. Thus, labels carry a scent of the linked content. Weak or misleading scents produce indecision (e.g., slow click through), frustration (e.g., do not continue along the link chain), and confusion (e.g., follow multiple links on a single page) for our informavore users. However, providing a good scent leads to more efficient and accurate navigation. Effective information architecture is built with a broad, shallow structure. The top levels must provide scent for all levels down the link chain. This is a tricky design task, but appropriate web page groupings can be easily determined through the employment of a card sorting methodology.

Card sorting is a technique used to see how people categorize information; the results are used to infer users' navigation expectations. In the task, participants are given various cards with information on them and asked to group them. Although target users are typically presented with text, pictures and objects can also be placed on cards [21]. There are two major types of card sorts. In an open card sort the participants are asked to write their own titles for each of the groups, while in a closed card sort titles are provided [8, 24]. This grouping procedure ought to help designers determine a familiar information structure for their users, rather than depending on their own life experiences. While card sorting has clear value, it is subject to shortcomings. Miller [15] examined some of these issues revealing that the number of categories used in the card sort, the distribution of cards and sample selection methods can affect its performance. Findings like these raise questions about what else could harm or improve the performance of this popular knowledge elicitation method.

There are several ways to analyze the results from a card sort. We present a few commonly used methods. The *edit distance technique* [5] compares the similarity of card sorts against each other based on the smallest number of card moves to make the sorts identical. Using the *pathfinder* [25], a network of links are used to represent cards that were grouped together with each link reflecting the weight of the relationship between the cards. In contrast, Hudson [9] describes how *quality of fit* can provide additional information from a card sort. When performing in a card sort, participants are sometimes instructed to omit a card if it does not fit anywhere. Interestingly, Hudson observed people were reluctant to omit cards. One way to capture this reluctance is to ask participants to assign a "quality of fit" score to each item based on how well it fit into the group. These scores were used to strengthen how well an individual card fit into the whole card sort by averaging the scores of that card and including confidence of the placements.

In addition to physical card sorting, there are online versions which we have found to be easier to employ. These online tools appear to streamline traditional methods and offer built-in analyzes [3]. The EZSort tool uses Usort to group cards by direct manipulation and EZCalc software to perform analysis [6]. Optimal Sort [18] shows results in a similarity matrix, dendogram, and a participant-centric analysis. The participant-centric analysis specifically tests the participants' card sorts against each other's to find the most acceptable top submissions. UXPunk's Websort [27] shows results as category summaries, tree graph, categories by items matrix, and items by items matrix.

The user experience literature contains many applications of card sorting. Some applications include: improved web navigation, prioritization of information,

measurement for learning, and classification of problems. When Google AdWorks Help Center was restructuring their website, a card sort containing over 500 cards was used. After their website redesign users found information faster and with fewer errors [16]. A card sort and an informal one-on-one interview protocol were used to develop the loyalty program for Wells Fargo. Participants grouped cards that represented purchase types (clothes, groceries, vacation, etc.) into categories and subcategories and marked their top 10 cards that would encourage them to join. This card sort allowed them to create their first loyalty program that provides maximum incentives to users by taking advantage of both occasional luxuries and everyday necessities [13]. The way cards are sorted can also be used as a quantitative measure of learning outcomes [e.g., 7]. When using the same one-word programming-related cards in a sort they found statically significant differences distinguishing novices from graduates of their computer science department. Being able to sort the cards in several meaningful ways corresponded with participants' knowledge acquisition in the field. Card sorting can also be used to understand and classify problems. A usability evaluation compared four New Zealand university online library catalogues. There were too many problems detected to easily determine a solution. Interestingly, by using a card sort, they were able to understand and classify the problems [28].

1.2 Priming

Priming describes the implicit memory effect in which exposure to a stimulus influences response to a later stimulus [10]. To prime a card sort, the researchers must influence how participants organize the cards without their explicit realization of the influence. Nisbett and Wilson [17] found that participants in experiments often misjudge the logic behind their thought processes. Bargh, Chen and Burrows [1] experiment used priming and found participants were unaware of the fact that had been influenced. Participants were primed with either a neutral, polite, or rude word list and then taken to a room where two facilitators were deep in conversation and ignored them. The proportion of interrupters from each group was related to the word list they had been given with individuals in the "rude" group being faster to interrupt than those in the "polite" group.

After priming, information is retrieved from memory for use. The retrieval theory of priming in memory "assumes that a prime and target are combined at retrieval into a compound cue that is used to access memory. If the representations of the prime and target are associated in memory, the match is greater than if they are not associated, and this greater match facilities the response to the target" [20, p. 385]. Activation theories of priming propose that exposure to a prime activates the conceptual representation of the prime; that activation persists for a given amount of time allowing the concept to be accessed more quickly in the future if the same concept or a related concept is encountered. From either perspective, priming may directly influence the ease of retrieval during a knowledge elicitation task like a card sort.

Priming can affect relatively simple cognitive processes as well as more complex processes; priming can occur for individual letters, words, semantic structure, concepts, decision making, and physical actions. As an example of the scope of priming,

consider the effects of priming on creativity. If given samples before completing a generative task (e.g., create something novel), participants will demonstrate less creativity, tending to adopt features that were shared across the samples into their own creations [14, 23].

A card sort is the visual representation of how an individual mentally perceives the categorization [12, 22]. "Categories are not 'out there in the real world,' external to people. Rather, mental representations depend on factors specific to each person including experience in the world, perception, imaging capabilities, and motor capabilities" [11, p. 284]. Participants in cards sorts are given the instruction to organize the information using a "feels right approach" [2]. Priming of categorization would change how participants' feel the cards should be grouped. Chi and Koeske [4] examined the relationship of interlinking networks of information – the subject was dinosaurs – and how easily the information was remembered. The networks were created using two tasks, production and a clue game, to elicit the participant's prior dinosaur knowledge. Mapping the semantic network was done using the follow links: dinosaur-dinosaur, dinosaur-property, and nine-categories based on general knowledge of dinosaurs. They found that the higher interlinking and better structured network of dinosaurs was more easily remembered and retained over a year later than the less structured network

The ease with which it seems one can be primed, lead to the question of whether participants can be primed to organize cards a certain way. For example, could recently presented marketing material like commercials or brochures prime a user's card sort? If so, does this priming statistically impact their behavior? Card sorting was developed to focus on how people really think when designing a user interface, but priming could influence those results in an unnatural manner.

2 Methods

Ninety undergraduates participated for course credit. The card sort contained 40 items that participants sorted into nine groups for a fictional zoo website. A control group did the card sort only, while the experimental group watched a short presentation before performing their card sorts. The card sorts were completed using WebSort.net, an online card sorting tool that allows participants to drag and drop each item into the different groups. A sample sort is shown in Figure 1.

The priming presentation consisted of a series of slides that contained picture representations of the cards the participant was about to sort. Figure 2 provides an example of a slide in the presentation that shows pictures of a wedding, cocktail party, birthday party, family reunion, and catered food to implicitly suggest these items are associated with each together.

The dependent measure was the percentage of agreement of each card sort against the *typical sort*. This measure allows us to capture the impact on group agreement variability. The typical sort was determined by conducting a frequency count of card categorization across all participants. The category a card was placed in with the most frequency was determined to be the "typical" sort for that card.

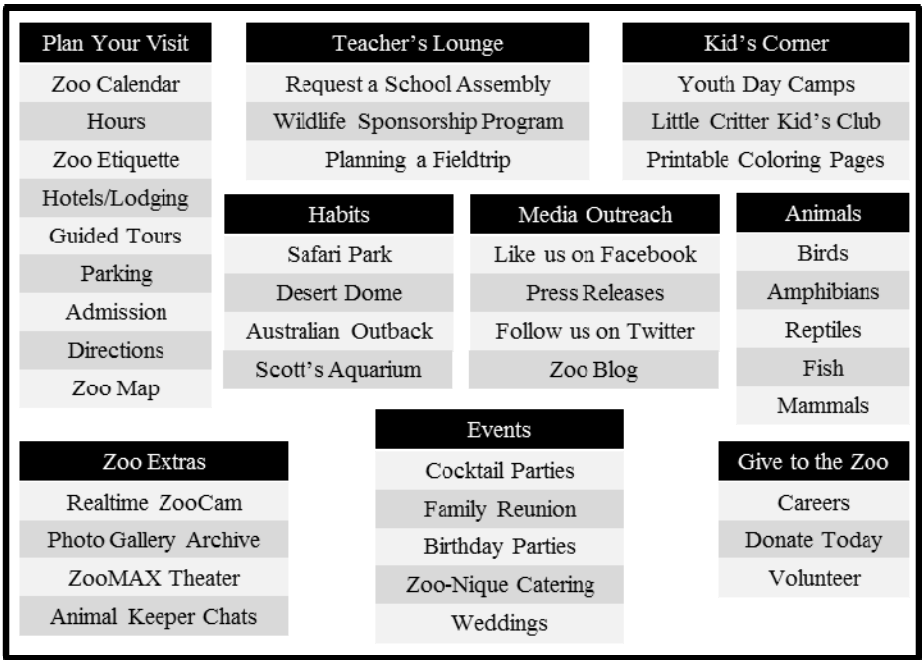

Fig. 1. Representation of a participant's card sort

Fig. 2. Sample slide from the priming presentation

3 Results

This experiment utilized a between-subjects experimental design. The percentages of agreement were compared using an independent samples *t*-test. The primed group ($M = .83$, $SEM = .014$) sort results were significantly more similar to the typical response than sort results for the control group ($M = .78$, $SEM = .018$); $t(88) = 2.499$, $p < .05$. Therefore, priming was found to reduce variability within a card sort. Not only does this demonstrate potential card to category changes, but it can give researchers a false sense of security as most participants categorize the cards in the same way.

4 Conclusion

Card sorting essentially ask participants to sort labeled cards into groups. This method is used to visually represent a natural navigation structure for a group of participants. The goal of card sorting is to determine participants' natural expectations, but priming could affect participant card sorting independent of the expectations they otherwise might have had. This study examines how priming possibly impacts participants' card sorting behavior.

We provide evidence that a card sort can be primed. Card sorting is intended to capture natural expectations. However, we showed that priming decreases card sorting effectiveness by nudging participants toward a typical response. From a practical perspective, this means that when designers introduce their company, build scenarios, or creating orientation scripts they need to be careful not to prime participants' responses to the upcoming task. Therefore, we need to be careful not to decrease the effectiveness of our card sorts through unintentional priming.

References

1. Bargh, J.A., Chen, M., Burrows, L.: Automaticity of social behavior: Direct effects of trait construct and stereotype activation on action. Journal of Personality and Social Psychology 71(2), 230–244 (1996), doi:10.1037/0022-3514.71.2.230
2. Brucker, J.: Playing with a bad deck: the caveats of card sorting as a web site redesign tool. Journal of Hospital Librarianship 10(1), 41–53 (2010), doi:10.1080/15323260903458741
3. Bussolon, S., Russi, B., Missier, F.D.: Online card sorting: As good as the paper version. In: Proceedings of the 13th European Conference on Cognitive Ergonomics: Trust and Control in Complex Socio-Technical Systems (2006), doi:10.1145/1274892.1274912
4. Chi, M.T.H., Koeske, R.: Network representation of a child's dinosaur knowledge. Developmental Psychology 19, 29–39 (1983)
5. Deibel, K., Anderson, R., Anderson, R.: Using edit distance to analyze card sorts. Expert Systems 22(3), 121–128 (2005)
6. Dong, J., Shirely, M., Waldo, P.: A user input and analysis tool for information architecture. In: Proceedings of the CHI 2001 Extended Abstracts on Human Factors in Computing Systems (2001), doi:10.1145/634067.634085

7. Fossum, T., Haller, S.M.: A new quantitative assessment tool for computer science programs. In: Proceedings of the 10th Annual SIGCSE Conference on Innovation and Technology in Computer Science Education (2005), doi:10.1145/1151954.1067489
8. Gaffney, G.: What is Card Sorting? Information & Design (2000), http://www.infodesign.com.au/ftp/CardSort.pdf (retrieved October 28, 2011)
9. Hudson, W.: Playing your cards right: getting the most from card sorting for navigation design. Interactions 12(5), 56–58 (2005), doi:10.1145/1082369.1082410
10. Johnston, W.A., Dark, V.J.: Selective attention. Annual Review of Psychology 37, 43–75 (1986)
11. Lakoff, G.: Women, Fire and Dangerous Things: What Categories Reveal about the Mind. University of Chicago Press, Chicago (1987)
12. Maiden, N.M., Hare, M.M.: Problem domain categories in requirements engineering. International Journal of Human-Computer Studies 49(3), 281–304 (1998), doi:10.1006/ijhc.1998.0206
13. Makoski, D.: Vacations or groceries? Purchase modeling and loyalty programs. In: Proceedings of the 2003 Conference on Designing for User Experiences (2003), doi:10.1145/997078.997086
14. Marsh, R.L., Bink, M.L., Hicks, J.L.: Conceptual priming in a generative problem-solving task. Memory & Cognition 27(2), 355–363 (1999)
15. Miller, C.: Item sampling for information architecture. In: Proceedings of the 2011 Annual Conference on Human Factors in Computing Systems (2011), doi:10.1145/1978942.1979264
16. Nakhimovsky, Y., Schusteritsch, R., Rodden, K.: Scaling the card sort method to over 500 items: restructuring the Google AdWorks Help Center. In: CHI 2006 Extended Abstracts on Human Factors in Computing Systems (2006), doi:10.1145/1125451.1125491
17. Nisbett, R.E., Wilson, T.D.: The halo effect: Evidence for unconscious alteration of judgments. Journal of Personality and Social Psychology 35(4), 250–256 (1977), doi:10.1037/0022-3514.35.4.250
18. Optimal Workshop, http://www.optimalworkshop.com/optimalsort.htm
19. Pirolli, P., Card, S.: Information foraging. Psychological Review 106(4), 643–675 (1999), doi:10.1037/0033-295X.106.4.643
20. Ratcliff, R., McKoon, G.: A retrieval theory of priming in memory. Psychological Review 95(3), 385–408 (1988), doi:10.1037/0033-295X.95.3.385
21. Rugg, G., McGeorge, P.: The sorting techniques: A tutorial paper on card sorts, picture sorts and item sorts. Expert Systems 14(2), 80–93 (1997)
22. Sanders, K., Fincher, S., Bouvier, D., Lewandowski, G., Morrison, B., Murphy, L., Petre, M., Richards, B., Tenenberg, J., Thomas, L., Anderson, R., Anderson, R., Fitzgerald, S., Gutschow, A., Haller, S., Lister, R., McCauley, R., McTaggart, J., Prasad, C., Scott, T., Shinners-Kennedy, D., Westbrook, S., Zander, C.: A multi-institutional, multinational study of programming concepts using card sort data. Expert Systems 22(3), 129–138 (2005)
23. Smith, S.M., Ward, T.B., Schumacher, J.S.: Constraining effects of examples in a creative generations task. Memory & Cognition 21(6), 837–845 (1993)
24. Spencer, D., Warfel, T.: Card Sorting: a Definitive Guide (2003), http://www.boxesandarrows.com/archives/card_sorting_a_definitive_guide.php (retrieved October 28, 2011)

25. Stevens, S.M., Dornburg, C.C.: Utilizing pathfinder in the design of an intranet website. In: Proceedings of the 27th International Conference Extended Abstracts on Human Factors in Computing Systems (2009), doi:10.1145/1520340.1520622
26. Usability.gov, http://www.usability.gov/
27. UX Punk, http://uxpunk.com/websort/
28. White, H., Wright, T., Chawner, B.: Usability evaluation of library online catalogues. In: Proceedings of the 7th Australasian User Interface Conference. Australian Computer Society, Inc., Darlinghurst (2006)