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Labels for Open-ended Exhibits: Using Questions and Suggestions to Motivate Physical Activity

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ABSTRACT

The phrasing of labels at interactive science exhibits can affect visitors' feelings, attitudes and actions. The Exploratorium traditionally has avoided posing questions in labels for fear of intimidating visitors or making them feel unknowledgeable. Instead, the museum has offered suggestions or instructions in labels. However, prior research indicates that questions in diorama labels can increase visitor engagement. In the present case-study of a single exhibit, we compared three labels and assessed visitors' attitudes and behavior. Interviewing 60 visitors, we found a preference for labels containing both questions and suggestions. We also observed 96 visitors as they used the exhibit with one of the three versions of the label. The results indicated there was no effect of label type on the number of actions visitors took or on holding time. The results of the case study suggest that visitors prefer a mix of questions and suggestions in exhibit labels, but that this type of phrasing may not always affect visitor behavior.

INTRODUCTION

Exhibit labels are a critical part of museum exhibits. They can frame perceptions, offer perspectives, challenge assumptions, and provide explanations. For this reason, museum professionals spend a great deal of time talking with each other about labels and studying the effects of labels on visitor behavior. For example, exhibit developers and others have written numerous papers and books on the subject of label design (e.g., Campbell,

2000; Kennedy, 1990; McLean, 1993; Serrell, 1996; Stout, Talbott & French, 1993; Weiner, 1963). Researchers have studied the effects on museum visitors of font size, length and formatting of label text, and the chunking or grouping of text to make it more readable, just to name some of the issues considered (Bitgood & Patterson, 1993; Kanel & Tamir, 1991; Thompson & Bitgood, 1988).

At science centers, the interactive nature of exhibits can lead to a greater

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reliance on the label text, which often contains critical instructions for how to use the exhibit. Since visitors must sometimes read the label to know what to do with the exhibit, the text must be inviting, engaging, and yet refrain from becoming the exhibit itself. At the Exploratorium, we have traditionally shied away from asking questions in labels to get visitors started with an exhibit, out of a concern that questions may intimidate them, make them feel unknowledgeable, or fail to guide them adequately in using the exhibit. Although questions can motivate and drive inquiry learning, they can also stymie exploration if appropriate guidance is not provided (Rankin, et al., 1999). For this reason, the Exploratorium has typically employed suggestions to instruct visitors on how to manipulate an interactive exhibit.

The disadvantage of instructions in exhibit labels is that they may subtly convey the notion that the museum is an authority and the visitor is a recipient of information (Humphrey & Gutwill, 2005). In the extreme, instructions can communicate an endpoint or finality that could inhibit playful exploration by the visitor; when visitors reach the end of a set of instructions, they may believe they are finished with the exhibit. This is particularly problematic when designing exhibits that fit with a constructivist model of learning: multi-option, multi-outcome exhibits that encourage visitor-driven exploration rather than discovery-based exhibits that try to teach a particular concept or idea (Hein, 1998).

In contrast, label questions could be worded as an invitation or challenge for visitors to use the exhibit to accomplish a certain goal. Visitors determine how they will answer the question, instead of following directions from the museum. Employed in this way, questions may communicate that the

visitors are participants rather than merely recipients in the learning process. In fact, prior research on questions in labels of non-interactive exhibits suggests that questions may heighten visitor engagement. For example, Hirschi and Screven (1988) found that adding large-font questions to diorama labels increased reading time and non-reading time at exhibits at the Milwaukee Public Museum. Jane Marie Litwak Clipman (1996a; 1996b) found that adding questions to label titles at the Bell Museum of Natural History significantly increased visitors' scores on post-visit tests assessing comprehension and recall of the label text. However, she also found that the questions reduced visitors' ability to remember the content of the diorama displays, highlighting the need to pose questions that focus on the exhibit as well as the interpretive label.

The present case study asks whether posing questions in the instructional part of the label for a particular science exhibit would intimidate visitors or engage them. Do such questions increase visitor involvement with the

physical exhibit, or distract them from it?

CREATING THREE LABEL VERSIONS

To examine these issues, we wrote three versions of a label for an open-ended exhibit called Spindrift, built in 2000 by Exhibit Developer Shawn Lani at the Exploratorium. At the exhibit, visitors spin metal rings of different shapes and sizes inside a large, plexiglass bowl. Because of the shape of the bowl, the rings roll and flop around in interesting and sometimes surprising ways. (See Figure 1 for a photograph of the exhibit.) Spindrift exemplifies the kind of open-ended, interactive exhibit that requires a strong starting point, but also relies on visitor initiative for engagement. The exhibit's interactive features are physical rather than virtual, adjustable rather than fixed and relevant to the phenomenon rather than gratuitous (Allen and Gutwill, 2004). Still, when visitors first approach the exhibit, they may not know exactly how to begin, so the label is important for initial engagement. Once they get



Figure 1. The Spindrift exhibit.

started, visitors should feel that they are exploring the behavior of the rings for their own satisfaction; there is no didactic goal for the exhibit.

The original label for the exhibit contained the typical Exploratorium “Try This” format, telling visitors to spin the metal rings in the bowl and notice what happens. Our three new label versions differed in the next part of the label:

Version 1: Suggestions.

The text gave visitors suggestions of things to try, similar to the original label. The three statements of things to try were:

- (a) By gently rolling the largest ring, try to get it to stumble around.
- (b) Start the smallest ring rolling sideways on the walls of the dish to get it moving for a long time.
- (c) Spin the star-shaped ring to make interesting shadows.

Version 2: Questions.

The text asked visitors questions in a challenge format:

- (a) Can you get the largest ring to stumble around?
- (b) Can you get the smallest ring to roll for a long time?
- (c) Can you make shadows appear with the star-shaped ring?

Version 3: Questions and Suggestions.

The text posed challenges in the form of questions and then gave suggestions for meeting the challenges:

- (a) Can you get the largest ring to stumble around?
(Try gently rolling it)
- (b) Can you get the smallest ring to roll for a long time?
(Try starting it sideways on the walls of the dish)
- (c) Can you make shadows appear with the star-shaped ring?
(Try spinning it)

We hoped to determine whether visitors would feel and act differently with different versions of the label. Would the Questions format intimidate visitors? Would they feel it offers enough guidance about how to use the exhibit? Would the Suggestions format reduce visitor engagement by subtly conveying the notion of an endpoint when all three suggestions had been followed? To answer these questions, we conducted two sub-studies of the labels at Spindrift, an interview study and an observational study.

SUB-STUDY 1: CUED INTERVIEWS

Method

To capture visitors’ feelings and preferences regarding the label versions, we interviewed 60 visitors on weekend days. We oversampled for adults, since they are probably the main audience for reading standard labels at our museum (cf. McManus, 1987). Table 1 shows

the gender and age breakdowns of the visitors who participated in the study.

To present the labels to visitors, we employed a randomized block design. For each visitor within a block, we randomly chose one of the three versions to show first, and asked the visitor to “spend time playing with the exhibit, reading about it, whatever” with that label present. We observed the visitor’s actions with the exhibit and then asked the visitor to rate on a Likert scale how much guidance they felt the label provided them in using the exhibit. After they had made their rating, we showed them the other two labels and asked them to rank order the three labels from “liked best” to “liked least.” Finally, we asked visitors to explain, in their own words, why one label was liked best, one was liked least and one was in the middle. The next visitor was shown a different first label, but went through the process in an identical manner.

Table 1. Gender and Age of Visitors in the Interview Study

Gender		Age	
Males	Females	Adults	Children
31	29	48	12

Table 2. Visitors’ Rankings of Label Versions

Label Version	Liked Best	Liked Middle	Liked Least
Suggestions	16	31	13
Questions	8	14	38
Questions & Suggestions	36	15	9

Note: Each column represents the entire sample of 60 visitors, because each visitor was asked to rank order the three labels from best to least.

Labels for Open-ended Exhibits

Results

We found that the Questions & Suggestions (Q&S) version of the label was most popular and the Questions (Q) version was least popular. The Suggestion (S) version fell in between. These preferences are independent of which version was seen first by visitors. Table 2 shows the number of visitors ranking each version as liking it the Best, Middle or Least.

To determine whether the distribution of visitor preferences was statistically different from chance, we employed a Chi-square test of independence. There are six possible ways in which the 60 visitors could have ordered the versions. If visitors' rankings had been independent of the versions (i.e., random), we would have expected 10 visitors to choose each of the six possible rankings. A Chi-square test of independence comparing the observed with the expected results, with the Yates correction for small values, found that we must reject the hypothesis that the rankings were independent of label version ($\chi^2 = 38.4, p < .0001$).

With the overall interaction between rankings and versions established, we then performed additional Chi-square tests on the distributions of visitors choosing the Best, Middle and Least favorite labels¹. The results of these tests show that the Questions and Suggestions (Q&S) version was the most popular ($\chi^2 = 19.3, p < .0001$), the Suggestions (S) version was ranked second ($\chi^2 = 9.6, p < .01$), and the Questions (Q) version was least popular ($\chi^2 = 22.6, p < .0001$).

Table 3 shows the reasons visitors gave for choosing a particular version of the label as their favorite. The majority (55%) of visitors who chose either the Q&S or the S label as their favorite said that they liked the label because it gave them the right amount of guidance.

Table 3. Visitors citing reasons for their FAVORITE label version

Reason for why version is best	Number of visitors for each version		
	Q & S	Q	S
Good amount of guidance	25	1	11
Encourages exploration	7	3	0
Encourages thinking	6	1	0
Good challenge	2	1	1
Good text length / Easy to read	1	2	2
Assumes you can do it	0	0	1
Sparks curiosity	2	0	0
Other / incomplete	2	0	0
Only restates version type (e.g., "it asks questions and gives suggestions")	2	1	2
Mentions only a problem with the version	1	0	0
Total	48	9	17

Note: Some visitors gave more than one reason for choosing a label as their favorite.

Table 4. Visitors citing reasons for their LEAST FAVORITE label version

Reason for why version is LEAST FAVORITE	Number of visitors for each version		
	Q & S	Q	S
Not enough guidance	3	26	4
Too much guidance	0	0	2
Too little challenge	0	0	3
Text too long/short	1	1	1
Implies you can't do it	1	0	0
Discourages exploration	1	0	1
Discourages thinking	0	0	2
Smother's curiosity	0	1	1
Only restates version type (e.g., "it asks questions and gives suggestions")	0	1	1
Feels like test / quiz	0	2	0
Mentions only good aspects of version	0	2	0
Other versions are better/same	2	3	2
Other / incomplete	1	3	1
Total	9	39	18

Note: Some visitors gave more than one reason for choosing a label as their least favorite

This indicates that including suggestions in the label may help visitors better understand how to interact with the exhibit. (However, we should not place too much emphasis on visitors' reasoning in terms of "guidance," since the word was introduced by the interviewer in a previous question.) Nearly a third (30%) of the visitors who chose either the Q&S or the Q label as the favorite said that they felt the label encouraged exploration and thinking. It seems that adding a question in a label may help motivate visitors to act or reflect.

Table 4 shows the number of visitors citing reasons a particular version was their least favorite. Of those who felt the Q version was the worst, 67% said that it provided too little guidance.

Overall, the interview results indicate that visitors preferred the Q&S label over the others. But the question remains, did the different labels encourage visitors to use the exhibit differently? Specifically, did the labels with questions engage visitors more deeply, perhaps encouraging them to try a larger number of activities?

During the interview, we observed the actions that visitors undertook at the exhibit, such as spinning the large ring or rolling the medium ring. An Analysis of Variance of the mean number of actions taken per visitor found no statistically significant difference across the visitor groups ($F [2,57] = 1.2, p = .30$). The mean number of actions taken by visitors in each condition is shown in Table 5.

Conclusions of Sub-Study 1

In the interview study, visitors had a clear preference for the type of label on the exhibit: they wanted a hybrid label that both posed a question and gave a suggestion for how the visitor could answer it. They said that such hybrid

Table 5. Number of actions per visitor

First Label	Mean	St. Dev
Suggestions (baseline)	4.1	1.8
Questions	6.3	8.5
Questions & Suggestions	7.3	7.8

Table 6. Mean actions and time spent at each label version

Label Version	Mean Actions (s.d.)	Mean Seconds (s.d.)
Suggestions (baseline)	8.1 (4.3)	84 (40)
Questions	7.3 (5.9)	76 (48)
Questions & Suggestions	7.6 (5.6)	76 (50)

labels give them enough direction while also encouraging them to think and explore for themselves. They made clear that they disliked labels that only asked questions. From this study, it would seem that of the three labels we employed, the hybrid version might be most effective at helping visitors feel enough support and motivation to enter into their own activity at an exhibit.

These data came from cued interviews, when the visitors knew they were being watched. What do visitors do when they do not realize they are being observed? We attempted to answer this question in the next sub-study.

SUB-STUDY 2: UNCUED OBSERVATIONS

The purpose of the observation study was to collect data about the effects of the label versions on visitors' actions in an uncued situation. The visitors in the observation study were not the

same visitors who participated in the interview study.

Method

During one weekday and two weekend days, we rotated through the three label versions on the exhibit, allowing one label version to be up for four separate visitors to use the exhibit, then another version for four more visitors and finally the third. We cycled through in this manner eight times, observing 96 visitors. For each observation, we chose the third person to approach the exhibit. If the chosen visitor was with a group, the actions of the other group members were ignored; only the actions of the chosen visitor were counted. When the chosen visitor left the exhibit, the next person to be observed was the third visitor to approach the exhibit.

An action was counted as placing any ring inside the large bowl in any way. We also recorded the amount of time the observed visitor spent at the exhibit.

Labels for Open-ended Exhibits

Results

An Analysis of Variance found no significant difference in the number of actions visitors undertook at the exhibit as a function of the label ($F [2, 93] = 0.19, p = .83$). There was also no significant difference in the amount of time visitors spent at the exhibit ($F [2, 93] = 0.33, p = .72$). Table 6 shows the mean number of actions and the mean time visitors spent at the exhibit.

Conclusions of Sub-Study 2

The observational study suggests that the different label versions have no significant differential effect on visitors' actions at the exhibit. The findings are similar to those from Study 1.

DISCUSSION

Many Exploratorium exhibits are designed to offer visitors an interesting or surprising experience that draws them in and leads them to an explanation in the label. These kinds of exhibit have been referred to as "discovery-based" (Hein, 1998) and "planned-discovery" (Humphrey and Gutwill, 2005) because they assume that knowledge can be transmitted from the museum to the visitor and are designed for visitors to "discover" the intended concept explained in the label. For such exhibits, the standard Exploratorium label sequence of "Try This, What's Going On? and So What?" works well. The exhibit offers instructions, an intriguing result, an explanation and an application to everyday life. However, this standard label format may imply that the museum is the authority, the keeper of knowledge, while the visitor is the recipient of that knowledge. The virtually linear sequence from instruction to explanation and finally, to application, may also connote a

simplistic view of scientific exploration and experimentation.

Recently, the Exploratorium and other museums have been creating and renovating exhibits based on a constructivist view that learners build their own knowledge out of an interaction between current and prior experiences (e.g., Bailey, Bronnenkant, Kelley & Hein, 1998; Humphrey and Gutwill, 2005; Perry, 1993; Sauber, 1994). For these more open-ended exhibits, label writers and graphic designers have worked to change the tone of the labels, conveying the idea that visitors actively drive their own learning process. This case study explored one method for supporting visitor-driven experimentation at a single exhibit, namely posing questions in the first part of the label, rather than using statements to denote instructions.

Taken together, the two sub-studies at the Spindrift exhibit suggest that while visitors may feel more comfortable and challenged by hybrid labels that ask questions and provide suggestions, they do not actually become more physically engaged with the exhibit. Still, this case study substantiates the concern that questions in labels may intimidate visitors: the Questions-only format was liked least by visitors, mainly because it did not provide them with enough guidance. While posing questions in labels may lead to visitor discomfort, it appears that adding a suggestion for how to answer the question may alleviate that discomfort. The hybrid format with Questions and Suggestions seemed most agreeable to visitors, providing them with guidance while also encouraging thinking.

Although results from a case study of one open-ended exhibit are limited in their applicability, this case influenced the exhibit labels in a subsequent NSF-funded project at the Exploratorium

called Fostering Active Prolonged Engagement (Going APE) (Humphrey & Gutwill, 2005). Both an exhibit development endeavor and a visitor research study, the APE project aimed to empower visitors to explore phenomena according to their own driving questions, interests and enjoyment. The APE label writers felt that the Questions-and-Suggestions format might help visitors get started with the exhibit but then launch them into independent activity. The APE exhibits were designed to offer even more options for interactivity than exhibits like Spindrift, and thus held greater potential for visitors to become deeply engaged. The effectiveness of the Q&S label was borne out to some degree by formative evaluation studies conducted during the APE project. For example, a study of the Spinning Blackboard exhibit found that a Q&S label meant for parents significantly increased group holding time and pattern-making at the exhibit (Gutwill, 2002). A formative study of the Floating Objects exhibit found that when visitors read aloud or explicitly utilized the Q&S label, holding time increased (Gutwill & Buennagel, 2003). Several other APE exhibit labels adopted the Q&S format.

While a single case study and a few formative evaluation studies are not enough to establish the Q&S label format as a winning approach for open-ended exhibits, the promising results invite further research involving additional exhibits and museum contexts.

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NOTES

1. The first post-hoc test is performed by tallying the visitor groups who ranked the Q, S and Q&S labels as the “Best” and calculating a Chi-square statistic against chance. For the second test, we count up those who ranked the Q, S and Q&S labels as their “Middle” favorite and perform a Chi-square test. For the third, we perform the same test on the groups who ranked the labels as their “Least” favorite.
2. On the assumption that larger visitor groups might engage in more actions, we divided the number of total actions we observed by the number of visitors in the interview group. Although only one person from the group was (randomly) chosen to be interviewed, groups were allowed to use the exhibit together.

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