Design Features Which Encourage Psychological Flow In Museum Visitors

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Introduction

Two studies established a link between certain design features commonly found in museum environments and the state of psychological flow. The flow state of consciousness has been determined to be more educationally effective by Csikszentmihalyi (1988) than "ordinary" states of consciousness.

Study One observed visitor behavior in a museum hall at the Denver Museum of Natural History (DMNH) in Denver, Colorado before and after renovation. The study found that after the design changes, visitors attended more to the exhibits.

Study Two, a post-hoc survey analysis, was designed to sort out which design features in particular are responsible for eliciting a high degree of sensory contact from visitors. The survey was administered to visitors at the DMNH after they had been exposed to one of five different exhibit spaces definable in terms of their design features. The survey measured visitors' sense of immersion, psychological flow, and the perceived presence and strength of different design features. Analyses revealed that interactive components, multisensory stimulation, and dynamic displays were important design features that influenced flow and immersion.

Background

Psychological flow occurs when the goal of a museum visit is the experience or behavior itself rather than a future reward or advantage. Psychological flow is characterized by focused concentration and a distorted sense of time where the awareness of self is temporarily lost (Csikszentmihalyi, 1988). Immersing design techniques (Bitgood, 1990) may promote such an experience by pulling visitors' attention toward the environment and away from internal states. The present research is concerned with documenting the effect of immersing design techniques on the visitor experience in several exhibit spaces.

The three general categories of design features under investigation in the present research were (a) human factors information display design principle features, (b) features present in the Virtual Reality (VR) computer environment (e.g., ego-referenced viewpoints and dynamic displays), and (c) features theorized to induce a sense of immersion in visitors (e.g., 3-dimensional objects, interactive components, and multisensory stimulation). VR features and some immersion features are the same (e.g., three dimensional representation of subject matter).

Human Factors Information Display Design Principles (Wickens, 1992)

Exhibit spaces can be said to differ in terms of their adherence to the basic human factors (HF) principles of design that were derived from research conducted on information displays. An exhibit space that uses a consistent format of interpretation embodies the principle of *consistency of representation.* The presentation of information in a variety of forms — for example three-dimensional models, written text, diagrams and graphs — satisfies the principle of *redundancy. Visual momentum* is an engineering design solution employed to prevent users from becoming cognitively lost in a maze of displays that are a part of one system, data-base, or in the present case, a single-theme museum gallery. Ongoing maps at each exhibit in an exhibit space may promote visual momentum. Research suggests that user (visitor) comprehension is optimized when all of these information display principles are used.

Virtual Reality and Museum Environments

Three-dimensional representations of subject matter (a feature of both VR and some museum environments) allow a more realistic view of the subject matter than two-dimensional imagery and may promote a sense of immersion. A museum can exploit *dynamic displays* such as motion pictures and videos which can more accurately depict scientific phenomena than can static images, also like VR. Both museum and VR environments can be *closed-loop interactive* (Wickens, 1992). That is, the visitor is in an interactive mode with the environment such that she or he is in control over what part of the learning world or space is visited. A large and open museum space that does not attempt to control the visitor's attention could be described as allowing a closed-loop interaction.

A fourth parallel feature of VR and some museum environments is the *inside-out (ego) frame-of-reference* where the image of the world or space on display is viewed from the visitor's moment-to-moment perspective (Wickens, 1992). This contrasts with a world-referenced perspective which allows only a fixed, non-dynamic viewpoint. Any exhibit space that permits visitors to actually enter the exhibit gives visitors an inside-out frame of reference. Once inside the visitor is in control of her or his sensory experience of the environment.

Sense of Immersion

Bitgood (1990) theorizes that the following design features, which are examined in the present research, may be responsible for inducing a sense of immersion: *interactive* exhibits which produce environmental feedback, *multisensory stimulation* which pairs visual stimuli with other sensory inputs, *role-playing prompts* which may produce appropriate mental imagery, and *lighting* which may help to set the atmosphere of the exhibit. Many of the features thought to induce a sense of immersion are also features found in the VR environment.

Research Problem

The present research problem is to identify exhibit features that may or may not be perceived by the visitor but nevertheless may influence visitors' feeling of immersion and/or psychological flow. The present

study assumes that a strong sense of immersion will lead to psychological flow (i.e., such deep absorption in an activity that sense of time and self is lost). Study I, an observational study of visitor behavior, was designed to demonstrate differences in patterns of visitor attention due to changes in the design of an exhibit space. Study II, a post-hoc survey analysis of visitors' perceptions, was designed to determine what specific design techniques might be associated with psychological flow and immersing experiences.

Method - Study I

Subjects

Subjects for the observational study were visitors to the Denver Museum of Natural History (DMNH) in Denver, Colorado. Systematic observations of 443 visitors were obtained. Total observations were 373 before renovation of an exhibit space and 70 after renovation. Due to the unequal numbers between groups, tests of homogeneity of variance were performed for all parametric statistical tests (e.g., F tests) in order to determine if that assumption was violated. Nonparametric statistical tests are not affected by the unequal numbers (i.e., survival tests and chi-square tests). Differences between the pre- and post-renovation exhibit space are described below. Visitors were selected according to a representative convenience sampling strategy.

Setting

Pre-renovation. The museum hall under investigation was "Edge of the Wild" formerly known as Boettcher Hall. It was a diorama hall with a total of eight dioramas showcasing large Colorado mammals.

Post-renovation. After renovation each diorama had additional interpretive information on front sloper panels and side panels. The front panels had push-button devices which, when activated by visitors, provided them with additional information such as animal sounds or smells. Though the content of the dioramas before and after renovation was generally the same, some of the dioramas were touched up with fresh background paint, some of the animals' positions were re-articulated, and some elements were added to indicate the impact of humans on the animals. Overall,

post-renovation dioramas were more naturalistic (i.e., the animals were positioned into more realistic, dramatic poses).

The size of the exhibits and the objects in them — preserved mammal specimens — were relatively the same in both the pre- and post-test conditions. Design features that were different between the pre- and post-test conditions included: additional interpretive information of the objects; use of touch specimens, sounds, and smells to complement the objects (multisensory stimulation); implementation of interactive exhibitry; a children's activity station (role-playing induction device); addition of seating to enhance comfort level; an attempt to bring a unifying theme to the hall by showing how human contact has impacted large Colorado mammals (visual momentum); information in a variety of formats such as auditory interpretation and the use of graphs (redundancy); and videos of the animals in action (dynamic displays).

Method - Study II

Research Participants

The visitor survey was distributed in a variety of different exhibit spaces that reflect different architectural spaces in the DMNH. A total of 101 visitor surveys were administered in five pre-selected areas. Survey administration was conducted by seven trained museum volunteers plus the first author. The data collection period spanned five-months beginning in February 1995 and ending in June 1995.

Settings

The settings for the survey study were five distinct exhibit spaces at the DMNH. The five different exhibit spaces were:

1) A renovated diorama hall (the same one under investigation in Study I) -- Boettcher Hall
2) An unrenovated diorama hall -- Standley Hall
3) An exhibit space with much interactive (i.e., hands-on) exhibitry -- Hall of Life

4) An environmental surround exhibit space that features a Northwest coast building interior -- North American Native American Hall
5) An object dense exhibit space -- Coors Mineral Hall.

Results and Discussion[1]

The hypothesis of Study I, that visitor attention would be greater in the exhibit space after the implementation of specific design feature changes, was supported. Visitors spent more time in the exhibit space (from an average of about 2 minutes before renovation to an average of 22 minutes for 'serious' visitors -- visitors that explored all four quartiles in the hall -- after renovation), spent more time studying individual dioramas, explored more of the entire exhibit space, stopped at dioramas with greater frequency, and read with greater frequency in the post-test condition even though the size of the exhibits and the objects in them, preserved mammal specimens, were relatively the same in both the pre- and post-test conditions.

The hypothesis of the survey study, that visitors would feel more immersed and therefore more likely to feel psychological flow in an exhibit space which possesses those features believed to induce a sense of immersion, received limited support. According to a physical inventory of the exhibit spaces sampled, the area which theoretically should have induced the strongest sense of immersion and the most frequent occurrence of psychological flow in visitors was post-renovation Boettcher Hall since it boasted a total of eleven of the features theorized to induce a sense of immersion. The next best area, theoretically, should have been Mineral Hall with seven features followed by North American Native American Hall and Hall of Life with six features each, and Standley Hall, an unrenovated diorama hall, in last place with only three of the features. It was predicted that sense of immersion would be stronger and psychological flow would be more frequent the greater the number of features present. The pattern of results conformed to the above-mentioned order with one exception: the exhibit space that elicited the most flow according to the criteria used was the Mineral Hall, which had fewer immersing features than post-renovation Boettcher Hall.

Additional analyses found a substantial difference between Standley Hall (an unrenovated diorama hall) and Boettcher Hall (the renovated diorama hall examined in Study I) for visitors' sense of immersion. This

is consistent with the findings in Study I. Of those design features which were present in post-renovation Boettcher but not in Standley -- interactives, multisensory stimulation, role-playing prompts, soft lighting, consistent and easy to understand labels, visual momentum or strong thematic continuity between dioramas, and dynamic displays -- which were most important for generating these differences in the visitor experience? Based on the results of the survey study, the most important for determining the visitor experience, both in terms of eliciting focused concentration and reflecting what important to visitors, were interactive components, multisensory stimulation, and dynamic displays. These may be the design features that were most responsible for the observed differences in behavior between the pre- and post-test conditions in Study I. This would be consistent with previous research (Davidson, 1991) which found that multisensory stimulation has been successful not only in making exhibitry more accessible to disabled people, but also in eliciting greater involvement from all types of visitors.

Implications

The results of the survey study suggest that flow and immersion are related if not synonymous. Visitors classified as experiencing flow, according to the criteria used, reported feeling significantly more immersed than visitors not experiencing flow. The positive relationship found between flow and immersion is not surprising. A visitor experiencing flow or a loss of sense of self implies that she or he is very involved or immersed in her or his immediate surroundings. Visitors can become decontextualized, in the sense of a radical disassociation from the context of their everyday life, in an immersing museum environment. The present research suggests that visitors' sense of immersion and opportunity for experiencing psychological flow, can be enhanced with the presence of some design features.

References

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Wickens, C. D. (1992). *Virtual reality and education.* Proceedings of the 1992 IEEE International Conference on Cybernetics and Society. Seattle, WA.

Footnotes

[1] Because of space limitations, only a summary of outcomes is presented here. Readers interested in the specific analyses performed should contact the senior author and/or Harvey, M. L. (1995). *The influence of exhibit space design features on visitor attention.* Unpublished doctoral dissertation. Colorado State University, Fort Collins, Colorado.