

The Power of First Impressions: Exploring the Design Impact of 'Small Details' and Signage for First-time Makerspace Users

7th International Symposium on Academic Makerspaces

ISAM
2023
Paper
No.:
XX

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Abstract

The Maker Movement has highlighted the challenge of balancing inclusivity and traditional aesthetics in makerspaces. Despite the marketing of makerspaces as democratic and open, attracting diverse user groups remains a persistent issue. This research study focuses on an overlooked aspect of makerspace engagement—the decision students make at the makerspace threshold. By investigating the reasons behind students' choices to enter or turn away from makerspaces, this study aims to shed light on the complexities of makerspace design and its impact on inclusivity.

The entrance of a makerspace serves as the site of inquiry, where students must make a quick decision that can have significant implications. This fleeting moment holds valuable, previously uncollected data, particularly from historically excluded communities. To address this issue, the study shifts the focus from individuals to the makerspace environment itself, examining its underlying values, ideologies, and design elements that may inadvertently undermine inclusivity. By critically evaluating these aspects, educators can identify the causes of tension and work towards creating a more equitable and inclusive makerspace environment.

This study responds to the research question of why students from historically excluded communities turn away from the makerspace threshold. Through qualitative research informed by Grounded Theory principles, the study generates theories directly from the data, employing an inductive approach. Data collection methods include surveys, think-aloud reporting, and post-observation debriefing to gather comprehensive and nuanced insights into participants' perspectives and experiences.

The study aims to uncover actionable approaches to designing makerspace environments that communicate a sense of welcome to first-time users from diverse communities. The paper focuses on one major finding related to first impressions at the makerspace threshold,

specifically exploring the impact of small details, such as artifacts and signage, on creating an inclusive environment.

By combining various data collection methods, this research program provides a comprehensive exploration of the topic, grounded in empirical evidence and reflective of participants' perspectives. The findings contribute to ongoing conversations on addressing underrepresentation in makerspaces and inform the development of inclusive makerspace design strategies.

Introduction

The emergence of the Maker Movement in the mid-2000s has prompted a continuous struggle between the aspiration for an inclusive makerspace and the desire for an environment that embodies the look and essence of a conventional makerspace [1]. Traditional depictions of university makerspaces often showcase technology-driven spaces with an open layout and a laboratory-like atmosphere. While conventional makerspaces may prove effective for certain user communities, there remains an ongoing challenge in attracting diverse groups of users. Makerspaces are marketed as democratic, open, and inclusive, yet the message seems to fall short in terms of outcomes and application [2]. To delve into the complexities surrounding the designs of makerspaces, this research study aims to shed light on a crucial but overlooked aspect of makerspace engagement: the decision that students make to either enter or to turn away at the makerspace threshold.

The site of inquiry for this research study is the entrance of a makerspace. It is not uncommon for makerspace staff to notice this ordinary pattern of behavior: users walk up to the threshold of the makerspace, look inside, and promptly walk away. The threshold is a critical juncture point where students are confronted with a decision: in a matter of seconds, students negotiate questions, observations, and gut reactions that result in them either turning away from the makerspace or entering the space. Although the decision at the threshold takes no longer than a few seconds to make, this fleeting moment is remarkably rich with data that haven't been captured before. What goes through the minds of first-time makerspace users? Specifically, those from historically excluded communities?

To address this issue, it is imperative to shift the focus away from individuals and instead examine the problem within the makerspace environment itself. The underlying values, ideologies, and design of these spaces may inadvertently undermine their inclusive potential [3]. By critically evaluating these aspects, educators can identify the causes of the tension and work towards creating a more inclusive and equitable makerspace environment.

This study responds to this research question, "Why do students from historically excluded communities turn away from the threshold of a makerspace?" The data collection and novel findings from this work contribute to ongoing conversations on actionable approaches to design makerspace environments that communicate a sense of welcome to first-time users from diverse user communities [2][4][5].

This study is a part of a five-year research program. The scope of this paper will focus on one major finding around the first impressions that users have at the threshold. Specifically, this paper explores the importance of the "small details" in a makerspace – how the integration of artifacts and signage can remarkably alter how the space can look and feel inclusive.

Methods & Methodology

This qualitative research study is informed by Grounded Theory principles, a widely used methodology that focuses on generating theories directly from the data. Grounded theory employs an inductive approach, meaning that it starts with the data itself rather than being driven by pre-existing theories or hypotheses [6].

In Grounded Theory, the data generated from the study are meticulously analyzed, often through a line-by-line examination, to identify patterns, themes, and concepts. The researchers in this study compared different segments of data to uncover relationships and categories. By closely scrutinizing the data, the researchers aimed to develop an understanding of the persistent issue of underrepresentation in makerspaces with a research program that is firmly rooted in empirical evidence and reflects the participants' perspectives and experiences.

In this study, several methods were used for data collection to ensure a comprehensive and nuanced understanding of the research topic and question. These methods included surveys, think-aloud reporting, and post-observation debriefing.

Surveys serve as a widely utilized method for researchers to gather valuable information and gain insights from participants in an efficient manner [7]. Think-aloud reporting, on the other hand, involves asking participants to verbalize their thoughts and reactions while engaging in a particular activity or task. This method provides valuable insights into

participants' cognitive processes, decision-making, and subjective experiences [7]. Think-aloud reporting allowed the researchers in this study to capture the "in the moment" thoughts and reflections of participants, providing rich qualitative data. Lastly, post-observation debriefing is a method commonly used in observational research. After observing participants in a natural or controlled setting, researchers engage in a conversation or interview to gain further insights and clarify any ambiguities. This debriefing session allows participants to reflect on their actions, motivations, and feelings during the observed event, providing additional qualitative data and enhancing the overall understanding of the phenomenon under investigation.

By combining these data collection methods, the researchers aimed to gather a diverse range of data that would capture both the explicit and implicit aspects of the research topic and question. This approach allowed for a more comprehensive exploration of the ephemeral data set, ensuring that the analysis and subsequent theory development were grounded in the rich and varied perspectives of the participants.

Project Design

The researchers ran two sets of research observations. The first observation included 16 participants who were invited into a VR environment that replicated a typical university makerspace [1]. That round of observations generated findings that informed the development of a second VR makerspace that was redesigned with the participants' thoughts on inclusion at the forefront. For the second round, the researchers ran 20 observations. Participants were invited to experience both the original and re-designed makerspace. To minimize ordering bias, the researchers had 10 participants visit the redesigned makerspace and then the original in that order, while the other 10 participants experienced the makerspaces in the opposite order [8]. In sum, there were 36 observations conducted. The scope of this paper includes student reactions to both.

In terms of technology, the VR makerspaces were hosted on a platform called *3D Vista*, providing a virtual environment for the observations. Two virtual reality head-mounted displays, namely the *HTC Vive* and *Oculus Quest*, were utilized during the research. These VR devices offered participants an immersive and interactive experience within the virtual makerspace.

The choice of using the *HTC Vive* and *Oculus Quest* headsets was significant in supporting the research objectives. These devices allowed participants to explore and navigate the virtual makerspace with a high degree of realism and interactivity. By wearing the head-mounted displays, participants could visually and spatially engage with the

virtual environment, simulating a realistic physical experience.

It is important to highlight that the observations took place during the COVID-19 pandemic. Recognizing the potential concerns regarding in-person participation, the researchers provided an alternative option to participants. Those who did not feel comfortable attending in person were offered the opportunity to engage with a desktop version of the virtual makerspace. This flexibility ensured the inclusivity and accessibility of the research, allowing participants to contribute their insights and experiences in a manner that suited their comfort levels and circumstances.



Figure 1- Entrance of the Original Makerspace in VR



Figure 2 – Entrance of the Redesigned Makerspace in VR

In terms of the sample population, participants had to meet the following criteria: currently enrolled as a student, hasn't visited a makerspace before, identifies as being a part of one or more underrepresented communities (i.e. LGBTQIA+, Black, Indigenous, Person of Color, disabled, marginalized gender identity, (cis-gender, woman, non-binary, transgender man, transgender woman), first-generation college student, lower to middle socio-economic status).

Results & Discussion

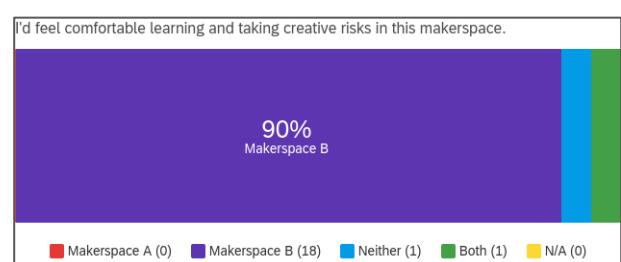
During their time in the VR makerspace, participants were instructed to express their thoughts, feelings, and gut reactions using the think-aloud reporting protocol. This

approach generated valuable data points, providing a comprehensive understanding of how students perceived inclusion in terms of visual, auditory, olfactory, and emotional aspects. The design interventions that participants commented on while experiencing the original makerspace were incorporated into the redesigned environment. The table below outlines the specific assets that were integrated as a result of participant feedback and observations.

Table 1 – List of assets students said signaled inclusion

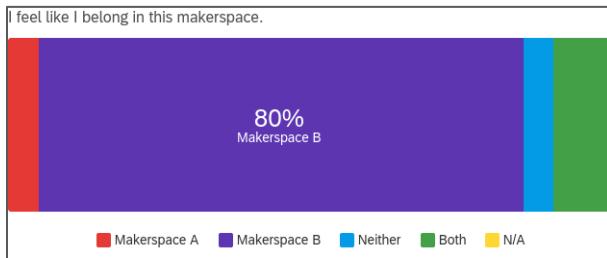
Asset	# of Participants (n=20)
Advocacy posters	13
Signage	11
BIPOC	10
Student work	9
Bright colors	8
More about staff	8
Soft furniture	6

The introduction of these assets into the redesigned makerspace yielded positive feedback from students, as evidenced by their preferences. When asked to choose between the two makerspaces, an overwhelming majority of 95% of participants expressed a preference for the redesigned environment. To gather more detailed insights into their preferences, participants were provided with a list of statements during the think-aloud observations. They were then asked to evaluate the accuracy of each statement based on their experiences in Makerspace A (the original makerspace) and Makerspace B (the redesigned makerspace). Participants also had the options to note whether those statements were representative of their experience in both environments or neither of them. The breakdown bar charts in Table 1 highlight the significance of including the aforementioned assets.



It's important to note here that 15 participants solely associated the redesigned makerspace with being a space for taking creative risks, while 4 participants associated both Makerspace A and Makerspace B with this attribute, totaling 19 participants. Participants had a remarkably different experience in the redesigned makerspace, and it was evident

in the sense that they felt comfortable taking risks and learning in the environment.



Furthermore, this second breakdown bar chart focused on participants' sense of belonging and their response to the statement, "I feel like I belong in this Makerspace." A substantial 80% of participants chose the redesigned makerspace, and when combined with the "both" data point, this totals 18 participants. The next section elaborates on what specific features were positively received by participants.

The Importance of Small Details and Cultural Cues

While this research program yielded numerous significant findings, the scope of this paper will focus on one particular aspect—the theme of "small details" within the makerspace. This prominent finding highlights a specific moment when participants acknowledged the profound impact of seemingly insignificant elements or details within the space. By recognizing the influential impact of these "small things," participants' experiences in the makerspace were enriched and their sense of belonging was enhanced. For example, a participant noted this about the redesigned makerspace, "That would be really cool. I feel like the space would encourage me to do a lot of things I wouldn't normally do, because it makes everything seem so fun. It's a very inviting space, with a very nice couch." This emphasis on the significance of "small details," such as a couch, serves as a key focal point in understanding the overall dynamics of the makerspace environment.

To explore the participants' sense of comfort, invitation, and inclusion, the researchers asked participants to articulate the specific features that signaled these emotions. Participants pointed out various features within the redesigned makerspace. This recurring pattern of "small details" highlighted a collection of objects that reinforced the participants' sense of belonging. For instance, approaching the Pride flag symbolized inclusivity, even for individuals not affiliated with the LGBTQ+ community.

Participants would approach the Pride flag, followed by the Pokémon ball and boba cups, among other details. These cumulative details left positive impressions on the students, shaping their overall perception of the space. The presence of familiar objects in the space, as previously observed, served

as affirmations and encouragements, confirming participants with the sense that they were in the right environment.

One participant compared the redesigned makerspace to the original, by noting how the space communicates inclusion to them: "I guess it's more like this drink here. People's book bags in places, like the staff wall, the bulletin board, the LGBT flag. I can see it more as a comfortable space after walking around. A space that I would feel comfortable walking around and doing things with on my own time and in my own independence rather than, oh man, am I supposed to be here? I don't know anything. Now I feel good about coming in and asking. I feel comfortable asking for help and getting and learning how to do something."

The Role of Signage in Facilitating Engagement

The importance of "small details" was evident with participants' reception of the signage in the redesigned makerspace. Signage emerged as a key factor in encouraging engagement within the makerspace. Participants highlighted the importance of signage as "cultural cues" that provided historical context about the space and its designers. These signs went beyond offering immediate encouragement and served as compassionate guides for both first-time users (particularly during the already stressful experience of using the space for the first time). Participants expressed appreciation for signs that explicitly communicated the availability of supplies and created a more comfortable and accessible environment.

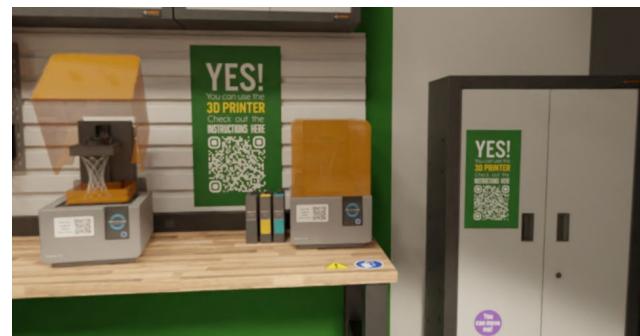


Figure 3 – Signage at the 3D printing area in the Redesigned Makerspace

As one participant expressed, "Oh, this [sign] is pretty cool. 'Yes, you can use the supplies.' I feel like they're kind of reading my mind. Because yeah, I feel like if I just stumbled upon this, I wouldn't know if I could just use stuff. So that is nice."

Regarding signs, a majority of participants commented on the map displayed on the floor, which encouraged them to follow its guidance upon entering the makerspace (the map is seen in Fig. 2). One participant stated, "Yeah. And the walking in and seeing the welcome immediately was like, oh, I should go there." By providing clear instructions and conveying permissions, signage helped to reduce decision fatigue, imposter syndrome, and overall stress associated with

entering a makerspace. These findings underscore the significance of attending to small details, such as cultural cues, and providing clear signage within makerspaces.

Conclusion

This research study sheds light on the significance of small details in makerspaces to create inclusive and welcoming environments. The findings demonstrate that elements such as cultural cues and clear signage play a crucial role in shaping participants' perceptions and sense of belonging. Integrating these small details can foster a comfortable and inviting atmosphere, welcoming individuals from historically excluded communities to engage in makerspace activities and seek assistance when needed.

By recognizing the impact of small details, makerspaces can bridge the gap between their marketed ideals of inclusivity and the actual experiences of users. This study highlights the importance of going beyond the surface-level design of makerspaces and considering the subtle elements that contribute to a sense of comfort and belonging.

Moving forward, further research is needed to explore additional strategies and interventions that enhance inclusivity in makerspaces. This could involve investigating the role of interpersonal interactions, community-building initiatives, and ongoing support mechanisms within these spaces. By continuously refining the design and operation of makerspaces, we can foster environments that empower all individuals, irrespective of their background, to actively participate and thrive in the maker community.

Acknowledgement

The research reported in this article was supported by the National Science Foundation (NSF) under Grant No. 1942930. Any opinions, findings, and conclusions or recommendations expressed in this article are those of the authors and do not necessarily reflect the views of the NSF.

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