
CRAFTING IN A COMMUNITY OF PRACTICE: RESOURCE SHARING AS KEY IN SUPPORTING CREATIVITY

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ABSTRACT

People express their creativity through something that they enjoy doing. Through engagement in creative work, creators cultivate their identity, enhance problem-solving skills, and speak their thoughts and feelings. In this paper, we look into how a community of practice supports members in legitimizing their creativity. We conducted a user study with members of a home brewing community to understand their creative beer-crafting practice. We first interviewed 11 home brewers, nine of which are members of a home brew club and two who did not belong to any home brewing organization. We then observed club members as they participated in club activities. Our findings suggest that two types of resource sharing are key in supporting different aspects of creativity in a community of practice. Based on these findings, we propose design strategies for supporting sharing in a creative community of practice.

Keywords Creativity · community · resource sharing

1 Introduction

People have been brewing beer for centuries, making it one of the oldest drinks in the world. Although once considered as a core household chore much like sewing, cooking and cleaning, it gradually emerged as an artisan activity when monasteries began brewing beer for mass consumption around the 15th century [1]. Today, home brewing has made resurgence across the United States as a popular hobby. Approximately 1.1 million people engaged in the craft in 2017, 40 percent of whom began brewing four or less years prior [2]. Home brewers can be found across the country and make a variety of beer styles.

Individually, home brewers are exploring and expressing their creativity when they experiment with different beer styles. Participation in that creative process brings many benefits to creators such as development of personal sense of identity [3], improvement of problem solving skills, and a general sense of enthusiasm and joy [4].

Socially, the home brewing community is a vast network of practitioners who are connected to each other through their shared interest in the craft. Members engage with each other both online (e.g. home brewing forums, social media channels) and offline (e.g. in home brewing clubs), discussing various aspects of the craft and interacting with each other regularly, which we consider as an example of a community of practice [5]. In this paper, we consider all home brewers, whether they are in a home brew club or not, to be members of the home brew community.

Although studies in Human-Computer Interaction (HCI) have explored creativity in various topics, such as collaborative practices of hackers (e.g., [6] and of online crafters (e.g., [7][8]), we are still unclear how in-person communities of practice, specifically hobby groups, support members in legitimizing their creativity and doing creative work.

To investigate this, we conducted a user study with members of the home brewing community. First, we interviewed 11 home brewers, nine of which are members of a home brewing club of a medium-size city. Then, we observed the club members participating in club activities. We sought to answer the following research questions: 1) Which aspects make home brewing an example of a creative hobby, 2) How does the home brew community enable members to support each other to be creative in aspects of their work and 3) How can we design technology to support the creativity of members through the lens of communities of practice? Our study contributes to HCI literature in creativity and community by providing insights on how communities of practice utilize their resources to support creative work.

In the remainder of this paper, we borrow Teresa Amabile's definition of *creativity*, which she refers to as the production of original and useful ideas by individuals or groups involving expertise, creative thinking and motivation to create [9]. First, we discuss how prior research led to our current focus. Then, we describe our study method and findings. Our findings show that resource sharing plays a key role in supporting creativity in a community of practice. We conclude by discussing design opportunities to promote both unstructured and structured resource sharing.

2 Literature Review

Our work builds upon previous research in how creators (also referred to as makers [e.g. [10]], hackers [e.g. [11]], or crafters [e.g. [12]] are supported to do creative work. We first define community using Wenger's model of communities of practice, then discuss prior examples of digitally mediated creativity support. We then examine how individual members of a creative community support each other in being creative in their work.

2.1 Defining Communities of Practice

Community is a broad term with many meanings; over 100 have been identified by Lyon in *The Community in Urban Society* [13]. It is often difficult to write about the happenings in the community if we cannot define it clearly. Bruckman suggests that community can be more appropriately defined as a category of associations by groups of people, in other words, by its membership [14]. In our context, members are people who engage in the craft of brewing their own beer. We therefore consider the term *community* to encompass all of the people that share the practice of home brewing.

The home brewing community is an example of a community of practice [5]. In this model, the members of a community of practice engage in an activity and learn how to do it better through regular engagement with each other [5]. On one hand, an online discussion presence can orient inexperienced members into the skills and culture of the practice, while providing experienced members with new insights into their own work [15]. For example, a home brewing forum or a social media channel is an example of a *gathering place* for members of a community. On the other hand, hobbyists are able to meet and gather in-person at local home brew clubs. Together, the online presence and physical hobby clubs make the home brewing community what Wenger called as a *community of practice* [5].

2.2 Supporting Creativity Amongst Crafters

Online creative groups have attracted a lot of attention from HCI researchers and designers looking to learn how members of crafting communities support their creative processes in order to encourage innovation in the community [7][16][17]. Of particular interest to us are investigations into different ways that members receive support to be creative in aspects of their work. Researchers have developed and tested digital tools to this end. For example, Luther et al. evaluated a crowd-sourced web system to provide feedback on graphic designs in order to improve the creator's ideation process [18]. Another example is Rosner and Ryokai's Ssyn, a digital tool that supports knitters to embed digital memories into their physical craft in order to share their creativity with the recipient of the craft [12]).

Creative communities form through a connected system of resources, in-person interactions, hands-on experimentation, and failure [19]. Prior research has identified ways in which the crafters themselves promote their own creativity in their hobby communities. For instance, hacker space members supported their own creative sensibilities through re-purposing items into hand-made tools [11]. Members of another hacker space community leveraged each other through collaboration, cooperation and interpersonal support in order to further the creative goals of the maker space [10]. In another example, members of a do-it-yourself crafting community drew inspiration from online tools to facilitate creative tinkering of material artifacts such as IKEA furniture [17]. In beer making, many crafters choose to

utilize software to support their home brewing process (e.g. BeerSmith¹). These software systems make it easy for crafters to store their recipes and notes, and share this information with others.

2.3 Sharing Amongst Members of Maker Communities

Helping each other and sharing information are key attributes of a community of practice [5]. Members of the community build relationships with each other through engaging in a wide variety of sharing, both online and offline. Online sharing has risen in prevalence in recent years as a way for members to informally share resources such as knowledge with each other [20]. Online, community gathering spaces can host portals in which creators can upload how-to documentations for various aspects of their craft. This is one way that the community of practice can support creators to increase the capacity for resource sharing amongst themselves, especially around knowledge sharing [21]. Online platforms such as freecycle.org, can facilitate offline sharing in a community of practice [22].

Another way that has been explored to promote sharing resources among other members of a community is through time banking. Time banking is a system where time dollars are earned and spent by people in the community when they provide goods or services for and receive them from others [23]. However, the support and maintenance of the time bank on the community is a time-consuming task and the requirement to keep track of time spent 'giving' or 'receiving' may deter participation rather than encourage it [24]. Trust, coupled with a sense of community and social control may adequately fulfill the function of the time dollar [23], suggesting that a less formalized recognition based system might be more beneficial in supporting informal sharing between members of a community of practice.

While prior work has investigated tools to support creativity within creative communities as well as various ways that members of a group share with each other, it is still unclear how a community of practice, such as members of the home brewing community, support *each other* to be creative in their work.

3 Study Context

Home brewers partake in the activity of creating and experimenting with different beer styles, usually from scratch. This community is a good example of Wenger's definition of a community of practice: members are practitioners of the craft with a shared interest in making beer; and they engage in joint activities and discussions, and support each other to produce their craft beer [5].

To understand how a community of practice can support individual creators to legitimize their creativity, we chose to study subsets of the home brewing community of practice population: 1) home brewers who were members of a local home brew club and 2) home brewers who were not in a home brew club.

Home brew clubs are not unusual to any specific location as they are prevalent in many locations across the United States. Most home brew clubs are open, inviting and encourage people of all skill and interest levels to join. They often promote an educational component structured by their members, regular face-to-face meetings, tasting events of members' products, and participation in festivals and competitions. In this study, we picked a local home brew club which is representative of home brewing clubs located in similarly populated areas in the United States. It was founded in 2012 in a mid-sized city in the Eastern United States. It has a Facebook group with over 300 members, of which approximately 30 to 45 members attend the regular group functions (e.g. monthly meetings). While anyone can join the Facebook group, a yearly membership fee provides full access to the perks of the club. Members range in experience levels from beer enthusiasts who are curious about home brewing to professional brewers. Members are elected to take on leadership positions (e.g. president, treasurer, secretary). In addition, the club showcases member's home brew at local festivals, holds community outreach events, and provides its members with exclusive benefits like equipment rentals. The members of the club are creative with their work. For example, they demonstrate this through creating unique beers for themed home brewing competitions, and by making interesting beers to share as a demonstration of how specific ingredients contribute to the flavor of the beer. Members are enthusiastic in offering advice, expertise or tools to support their fellow home brewers create better beer.

4 Method

To investigate our research questions, we conducted a study which included both interviews and a series of participant observations. All participants were members of the home brewing community of practice. They were either current, active home brewers or former home brewers who were still currently active members of the home brew club.

¹<https://www.beersmith.com>

4.1 Interviews

We interviewed 11 home brewers recruited from two sources: the local home brew club and through snowball sampling. We chose those two recruiting strategies because we wanted to understand both home brewers who belonged to a structured club and those who didn't belong to a club. To recruit from the home brew club, we first built rapport by joining the group's Facebook page and attending a monthly meeting. From there, we received further invitations to observe future meetings and home brew pouring events. Participants who did not belong to a home brew club were recruited through snowball sampling. All of the interviewees (see Table 1) met the following criteria: they 1) are at least 21 years old, 2) are active in the home brewing community, and 3) were willing to voluntarily participate in an interview with a member of the research team. No incentives were provided for participation.

Among the interviewees, 10 were males and one was a female. They were between 21 and 65 years old. They all had a wide variety of brewing experience ranging from less than a year to more than 30 years. Of all the interviewees, two (P7 and P8) were new to home brewing and were not part of any home brew club, and the other nine interviewees all belonged to the same home brew club. Each interview lasted between 60 minutes and 90 minutes and took place in a location convenient for the participant (e.g. the participant's home). In one case, an interviewee showed the first author his personal home brewing system in his home.

Table 1: Participant Demographics

Participant	Gender	Age	Years home brewing	Club Membership
P1	Male	30s	10+	Yes
P2	Male	40s	10+	Yes
P3	Male	60s	20+	Yes
P4	Male	60s	30+	Yes
P5	Male	40s	15+	Yes
P6	Male	50s	30+	Yes
P7	Male	20s	1	No
P8	Male	20s	1	No
P9	Male	30s	10+	Yes
P10	Female	30s	10+	Yes
P11	Male	20s	5+	Yes

All interviews were transcribed and coded iteratively using the constant comparative analysis method [25]. To begin, one researcher coded the first four interviews to develop the initial set of codes. Next we cleaned up the codes and generated a new list to re-coded the first four interviews and the remainder of the interviews. We incorporated additional codes as new themes emerged in the data. Finally, we grouped all the codes into themes. Although our analysis surfaced many themes, we chose only to present themes that are relevant to answering our research questions.

4.2 Participant Observations

Participant observations were done through the home brew club and occurred over eight months between January and August of 2018. We conducted six monthly meeting observations and two festival observations. All observations occurred by invitation from a club member. The monthly meetings included between 15 to 30 home brewers and the first author observed and interacted with them as opportunities arose. The two local beer festival observations included three to five club members who were pouring their homemade beer for festival attendees to taste. We were invited to participate by assisting with pouring. During the observations, we engaged in casual conversations with the club members about home brewing, how they made creative decisions and other topics related to the hobby. All participants gave consent to be included in the study. Note that some interviewees were also observed at various times during the six monthly meetings and in the festivals.

The first author took extensive field notes during and after each observation. Field notes were used to corroborate participant's stories from the interviews. During the festival observations, photos of the event were taken with permission.

5 Findings

Our interviews and observations point towards the many ways that our participants shared how they were creative in their work. The aspects of creativity include different brewing techniques (which we refer to as process), unconventional use of tools, and creation of different beer formulas (which we refer to as recipe). Importantly, we found that not only are they creative, but that their creativity is heavily supported through resource sharing within the club. We have identified two forms of resource sharing: *unstructured resource sharing*, which takes place when creators offer or receive resources from their peers, and *structured resource sharing* which are resources supported by the structure of the home brew club. We describe these themes in detail in the following sections.

5.1 Creative Aspects in Home Brewing

Our participants demonstrated creativity through their *process*, their *unconventional use of tools*, and their *recipes*, which we refer to as the aspects of home brewing creativity. These three aspects are not necessarily independent of each other. They could be complementary to each other. We found that although some participants identified strongly with one aspect, situations sometimes arose where creativity was required in another, less-preferred aspect. Some participants mentioned that they enjoyed experimenting holistically as part of their creative identity. For example, they tweaked the brew time (part of the brewing process) and used an unconventional ingredient (in their recipe) simultaneously.

5.1.1 Process.

The basic process of making beer is fairly standard. First, grains are added to water and boiled. When the mixture is cooled down, yeast is added to begin fermentation. When fermentation finishes, the mixture turns into a concept we are familiar with, beer, which will be bottled or kegged. P6 shared his view that creativity lies in the technique that the creator chooses to use as part of the making process. For him, his creativity emerges through manipulation of step-by-step process details.

"I focus more on my process and how I actually do things. I like trying to find little tweaks to my process... I think that a basic recipe is pretty straightforward. It's how you brew that makes a difference. Some of us try little tweaks. I'm a fan of this, and I believe that the more comfortable you are with your process, the better your beer will be." (P6, male, brewing for more than 30 years)

In another example, P8 shared his views on enforcing a scientific structure in his home brewing process to produce an artistic product.

"As it pertains to beer, your goal is to find a flavor that you enjoy. So you are producing that in a structured way, an experimental way, that in the end will lead to an artistic piece which is the expression of what your palate likes." (P8, male, brewing for one year)

In another example, P9 self-identified as a home brewer who expressed his creativity by following the standardized brewing style guidelines to make his product as close to on-style as possible. When asked to describe his inspiration for brewing, he mentioned the importance of the process of his home brewing over experimenting with ingredients.

"It's more like, when you want to do this, add this kind of sour culture for this many days at this temperature. I don't look at many recipes these days. It's all process stuff." (P9, male brewing for more than 10 years)

Our participants shared how they consider experimentation with the steps in the brewing process to be an integral part of creativity in home brewing.

5.1.2 Unconventional use of tools.

Our participants established ways to use or modify everyday items to brew good beer. A common issue in home brewing is the difficulty of maintaining the beer at a stable temperature while it is fermenting, which often requires professional brewing equipment like a big enough refrigerator. In absence of a large refrigerator, P6 re-appropriated an old T-shirt to cool his beer.

"I still use a T-shirt. Put the beer in a tote with water and put a wet T-shirt on it... You can get 4 degrees maybe, of cooling on that. If you put a fan on it, it'll get even cooler. I've even put a fan on a temperature controller." (P6, male, brewing for more than 30 years)

In another example, P9 shared how he transformed a common household cooler into a vital piece of home brewing equipment.

"We bought a cheap cooler from the store, did some work on it put the stainless steel braid in, put the valve on it and plumbed it together. I used that for a long time." (P9, male, brewing for more than 10 years)

Although commercial items were available, his creation saved money and the result was comparable to those made from commercial tools. As our participants have demonstrated, turning ordinary household items into beer brewing equipment was a process to cultivate and craft their creativity.

5.1.3 Recipe.

We use the term recipe to refer to the ingredients and ratios that make up the beer. Many participants told us about the interesting flavor combinations that they experimented with in their recipes. For example, P2 replaced standard sugar with Sour Patch Kids² and Swedish Fish³ in two batches of beer that he made. P10 enjoyed experimenting with herbal adjuncts such as lavender and chamomile in the beer that she made with P9. Thai food provided inspiration for P11 to construct a recipe for a Thai green curry pale ale.

"But it's also just random things that you might think of. Like the green curry IPA. I was drinking a pale ale and eating that at the same time, and was like I should just kind of put these two together and see what happens." (P11, male, brewing for more than five years)

Besides unconventional flavor, a majority of participants (8 out of 11) mentioned that they preferred to add a twist through experimentation with more traditional brewing ingredients such as hops, yeast, and malt. They considered slightly twisting the traditional way as a form of expressing creativity.

"My next beer is going to be an IPA. I will probably try my first New England IPA... So I'll probably do something with 85 percent pale malts, some oat malts and from there a whole bunch of hops at the end." (P9, male, brewing for more than 10 years)

Our participants' unique approaches in home brewing through *process*, *unconventional use of tools*, and *recipe* suggest that the brewing practice is innovative. In our study, we also identified resource sharing as the influential factor to our participants' creativity. Through sharing knowledge and resources with those who have a similar interest, home brewers support each other to be more creative. This type of sharing is often *unstructured* and spontaneous. The organization and culture of the home brew club also facilitated brewers to become better at their craft, supporting them overcome barriers to reach the full expression of their creativity. This type of sharing is often *structured* and well-organized. In the following sections, we discuss the importance of unstructured and structured resource sharing to facilitate creativity.

5.2 Unstructured Resource Sharing

All of our participants who belonged to the home brew club (9 of 11) mentioned that it was beneficial to join the club to meet other home brewers and engage in brewing-related conversations. Information and resources sharing often take place during those conversations in an unstructured way. This type of sharing is often voluntary and initiated through peer-to-peer contact, which does not occur through a set procedure made specifically for this purpose. We identified three types of unstructured resource sharing among individual home brewers from the study: *equipment shares*, *knowledge shares*, and *location shares*. Each supports creativity in a specific way.

5.2.1 Equipment shares.

Equipment shares are the sharing of permanent equipment, tools, or materials (including consumable ingredients) that support creators in their creative work. From our study, we found that our participants often borrowed or exchanged ingredients for their recipes. Additionally, sometimes they lent specific pieces of equipment to support their peer's beer brewing activity. This type of equipment sharing occurred both in-person and online. In person requests often occurred informally between people who were already engaged in conversation with each other.

"I've gone to the club and mentioned that I wish I had this, or whatever, and because were having a conversation about it, someone will say 'oh I have that, come over to my house whenever you want and use it, I don't even have to be home.'" (P11, male, brewing for more than five years)

²A soft candy with a sour sugar coating

³A fruit flavored chewy candy

Besides in-person conversations, home brewers also reached out to each other via online messages or forums to gather equipment, tools, or brewing ingredients. For example, P1 offered other home brewers specialty grains for their brewing through the home brew club's Facebook group. P2 and P5 responded to his post to receive the grains that they wanted to use in their home-brewing.

Unstructured resource sharing is another way for creators to participate in the craft without investing in their own equipment. For example, P10 preferred to brew her beer through collaboration with with other home brewers by utilizing others' equipment.

"I never owned my own equipment personally... I've never brewed 100 percent on my own and it's always been a social thing. I used borrowed equipment for a long time." (P10, female, brewing for more than 10 years)

In other cases, members who knew each other felt comfortable reaching out privately with requests. For example, P5 told us that he felt comfortable lending equipment to other home brewers who contacted him through private conversations.

"I've had people message me for stuff, ring me, message me on Facebook, and then people will come around. 'Yeah sure, I've got that hop'. And they'll come around." (P5, male, brewing for more than 15 years)

Sharing excess perishable resources also helped the giver to use up something that would otherwise go unused and wasted. Four of our participants (P5, P6, P9 and P11) mentioned that they sometimes had ingredients deteriorate when their supply exceeded their demand. They were happy to share those ingredients with other brewers, so they could support their peers and maximize the use of perishable resources.

When resources were inexpensive or when they had more than enough for their own use, our participants were open to sharing equipment with others without any monetary return. They often gave those resources to their fellow brewers for free.

"Although you tend to be like, okay I'll give you the money for that, or I'll buy you a replacement, sometimes people will say 'I wasn't using it anyway, just have it'. So people do give you stuff, and you give stuff out. You know, I've got multiple packs of that yeast, I got it from a particular show. You just take it." (P5, male, brewing for more than 15 years)

But home brewers did not always give materials to others without charge. Sometimes, they chose to sell their brewing materials on social media websites like Facebook. This usually occurred when someone was replacing old equipment with new or moving to a different place.

For some participants, informal equipment sharing has deepened their connection to the craft and the home brewing community. For example, P11 mentioned that he was able to experiment with beer-making more frequently after becoming part of the community and sharing equipment with other brewers.

"Since joining the home brew club, I brew so much more, and became so much better at it. Also, you have all these resources. It's kind of cool because you don't feel like you're in it by yourself, and you don't have to spend \$5,000 on equipment. Some guy has the other half of it." (P11, male, brewing for more than five years)

Borrowing, lending, and exchanging brewing equipment, tools, and materials (e.g. ingredients) were common practices among our participants who were part of the home brewing community. Within the community of practice, sharing those resources enabled our participants to innovate and brew in ways that they couldn't before. This suggests that the home brewing community facilitates a culture of resource-sharing which helps creators express their creativity.

5.2.2 Knowledge Shares.

Sharing information plays an important role in relationship building amongst members of a community of practice [5]. All of our participants mentioned learning from others as a way to increase their repertoire for creativity. The more experienced brewers (excluding P7 and P8) told us that demonstrating the beer-brewing process or passing on knowledge to novice brewers helped them to be reflective and creative in their own practice. This could take place both physically and virtually through social media. For example, P11 considered his beer making process as a creative part of his brewing. He liked to invite other home brewers to his house and show them how he tweaked the standard process. By doing that, P11 strengthened his own understanding of his making process and found inspirations to further modify the traditional way of brewing beer.

"I've had a couple people over to my house to watch me brew. It helps so much to talk through everything you're doing while you're doing it. (P11, male, brewing for more than five years)

For novice brewers, they often learned new creative techniques for their brewing process from more experienced brewers by observing how they produced beer. For instance, P9 explained how a new member could learn from experienced brewers like himself.

"I had a new person who wanted to see what brewing was all about, so I said, come on over and you can watch the way that I brew. I've definitely had that, where it's like oh come over and join me for brew day." (P9, male, brewing for more than 10 years)

Sharing knowledge can open up new possibilities for home brewers to experiment and be creative in their making. Our participants introduced each other to new ingredients or niche styles of brewing. In one instance, P11 shared a recent interest in a type of yeast to make a special beer style with P1.

"He brought me a bottle of that, it's called Kveik. I bought couple strains from the producer after his recommendation, and learning from him what the parameters were for fermentation. So we did experimentation with that." (P1, male, brewing for more than 10 years)

During club meetings, members would bring their home brew to share with the group. We often observed that members would request the recipe from the maker when they were interested in producing a similar beer style. People were generally happy to share their recipes, which often served as a source of inspiration for others to brew. In P11's case, he explained how sharing his own unique recipe could support others to be innovative.

"I like to hear that people have thought through something, they've thought through their own process or ingredients before they just go, give me your recipe so I can brew it. You like to know that they're not just taking it because they liked it and they want to re-create it." (P11, male, brewing for more than five years)

Sharing knowledge also supported home brewers to identify and be more focused on creative aspects of their process. For example, P3 explained how he could narrow down his unconventional choices for making beer by discussing with another home brewer. He considered the discussion helpful in determining where he wanted to be creative in the brewing process.

"They'll give you ideas of the grains that they use or the hops. Give you an idea of an IBU or an alcohol content, and you just kind of play around with it." (P3, male, brewing for more than 20 years)

In addition to the sharing that occurred locally through the home brew club, our participants also actively shared through the home brewing community of practice's online resources. Online resources, such as home brewing forums, Reddit threads and YouTube channels exposed our participants to other brewer's creative ways of making. They also provided another form of gaining or sharing knowledge our participants. For example, experienced home brewers (e.g., P2 and P9) often answered beer-related questions online or gave feedback to others' brewing recipes in order to support other brewers to improve their process. Most (8 out of 11) of our participants mentioned that they benefited from online peer support or resources of the home brew community. For example, P11 used the internet to look up scientific information about brewing. Novice brewer P7 used information from the Reddit home brewing thread to choose ingredients.

"That's a really great resource because a big thing that they do is they tell you the direction that certain ingredients go. For example, what kind of beers they go in or what flavor profiles do those beers make. Also the ratios of everything and general guidelines" (P7, male, brewing for one year)

For P7, although it was useful to have the online information available, it was still difficult for a novice brewer like him to apply the instructions to his own beer making. Especially, the online resources became less useful when P7 and another inexperienced brewer P8 could not figure out how mistakes were made during the brewing process. For this, P7 was thankful that he knew of an experienced brewer that he could bring a sample to for diagnosis.

"They told me about certain flavors, since it's kind of hard to diagnose what you do wrong and the symptoms of that, so I brought a beer to them and asked what their input was. We weren't sure if we needed something to chill the beer faster, or the wort faster. I didn't think it came out perfectly and I wanted to see what they thought. They told me that although it wasn't chilled very fast, the flavor that was produced was pretty natural for brewing in general." (P7, male, brewing for one year)

For novice brewers such as P7 and P8, online resources were not sufficient to fully grasp the brewing process when it came to diagnosing issues in their craft. Instead, reliance on in-person support provided the information that they needed to understand their specific beer.

Prior research shows that sharing knowledge is a common practice among hobbyists (e.g. [26][8]). Our study further points out that knowledge sharing frequently takes place during peer-to-peer casual conversations. This informal and unstructured sharing is instrumental in supporting knowledge gains that facilitate exploration and creativity in the making process.

5.2.3 Location Shares.

Home brewing can take up a lot of space, depending on personal preference for the amount of specialized equipment and the capacity of the equipment. One challenge that home brewers often face is the limited space when brewing at their own home. From our study, we found that brewers shared their brewing space with others when had access to a large brewing space. This type of sharing enabled home brewers to experiment in beer-making without the constraints of a limited space. In particular, three members who belonged to the same home brew club let others to use their spacious brewing area when they had access to one.

Most of our participants had a dedicated area for their home brewing set-up (e.g. space in the garage or basement) in which they were able to perform their daily brewing processes. However, sometimes they wanted to try something that required additional large equipment or greater capacity than what was available in their own set up. For example, P11 told us that another club member would offer his spacious brewing area to others who wanted to brew on a greater scale.

"Our friend in the club has a pretty decent size garage. That's usually the place of choice. We usually gather there. He has the capability to do two batches of the size that I do at my house at the same time at his house." (P11, male, brewing for more than five years)

By going to the other member's house to brew on the his stationary equipment, P11 felt supported to experiment with more flavors by breaking a double batch into multiple smaller batches.

"If we're doing a split batch, if we want to do the same beer and do two different things to it, then will do that there." (P11, male, brewing for more than five years)

Sharing a spacious location to brew together also enabled discussions over the making process. This provided the opportunity to bounce ideas off of one another while each person engaged in their own creative work. For instance P11 shared that he and other club members would gather at a member's house and brew separately on their own portable equipment. They saw each other's brewing process and shared tips and techniques and share their brewing processes and techniques.

"Every once in a while people in the club will get together, like three or four of us, and will brew and cook food at the same time... everyone is bringing their own equipment and brewing separate beers, just in the same place... we're always talking to each other about how we're brewing, that kind of stuff. It's all good fun." (P11, male, brewing for more than five years)

Sharing a spacious location to brew has many benefits. Our participants were enabled to brew in higher capacity batches, which allowed for more experimentation. In addition, it enables collaboration and discussion of creative ideas which supports home brewers to iterate and refine their experimental brewing processes or techniques.

The sharing types discussed above all took place in an informal and unstructured way to support the brewing process. Equipment shares provided receivers with the resources that they needed for their creative process, while helping givers to maximize the use of excess supplies. Knowledge shares enhanced our participants' expertise and repertoire for creativity in the activities they were interested in. Location shares enabled larger scale experimentation and collaboration among home brewers.

5.3 Structured Resource Sharing

The three types of unstructured resource sharing suggest that informal sharing in a community of practice supports the creative making process. In this section, we discuss how a home brewing club provides another layer of support for creativity through organizational activities. The club offers equipment for its members to use, constructs dedicated time for members to make beer or learn about brewing, and hosts outreach events to showcase the home brewer's creative products to a larger audience. These forms of creative support differ from unstructured resource sharing because do

not take place in impromptu way, but are instead organized by the club and provided to its members. These structured resources are publicized by the club and are visible both online and offline to home brewers who are members of the club.

5.3.1 Collaborative equipment use.

Participants who belonged to a home brew club told us about how the equipment purchased with club funds were made available for members to use. For example, during a monthly meeting the club members decided that they wanted to experiment with a process called barrel aging. The club had access to pre-used oak bourbon barrels and purchased a large, 50-gallon barrel for the club. The club then started a barrel fill program where the barrel was rented out to club members free of charge.

"So these large barrels are a collaborative effort where about 10 members will brew five gallons each. They'll put 50 gallons into the barrel, leave it in the barrel for a year, and then everybody gets their share back." (P4, male, brewing for more than 30 years)

The participants in this activity would taste the product in order to determine when the beer was done. Once the barrel was emptied, the next 10 people would be able to refill it with the recipe of their choice. During his interview, P4 discussed how each person's contribution influenced the flavor of the beer as it aged in the barrel.

"We are interested to see how it turns out because they all brew the same beer, but they're brewing it with their own systems, so there's a little bit of difference. But over that one year it does get mellowed out" (P4, male, brewing for more than 30 years)

Club-provided resources such as the 50-gallon bourbon barrel empower home brewers to collaboratively experiment with processes on a scale that is hard to do on their own. Working together to create a recipe, fill the barrel, and determine the optimal finishing time supports the creativity of the participating home brewers.

5.3.2 Dedicated time.

Our analysis uncovered that the home brew club dedicated time during monthly meetings for activities that were designed to promote creative thinking. In particular, the club held quarterly themed challenges that cultivated the home brewers' creativity to an advanced level by requiring unique challenge criteria. P2 explained how one of these challenges inspired him to continue to experiment with unconventional ingredients after the competition ended.

"We had a club competition and the theme was alternative sugars. We had to use different forms of sugar in our beers somehow. I was trying to find one that would be interesting, and thought candy would work. So that was the first one, and I used Swedish Fish. And it worked. People liked it so I later tried a Sour Patch Kids one, which tasted about the same." (P2, male, brewing for more than 10 years)

Besides continuing the exploration in using unconventional ingredients, P11 shared how participating in themed challenges with other brewers in the community supported him to try new beer-making techniques.

"It's a mix between a friendly sense of competition and also having more exposure to stuff. You'll talk to someone and they're like, oh I did this and you think oh wow I could do this at home. I want to try that now." (P11, male, brewing for over five years)

In another example, the club holds a monthly educational session where home brewers volunteer to create a beer using a certain variety of hops, one of the main ingredients in beer. The club chooses the hop parameters (e.g. hops from New Zealand) and the basic recipe, which is mild-flavored enough to highlight the nuances of each hop variety. Brewers choose a hop from the hop parameters, brew the chosen recipe using that hop, and bring it to the meeting for a blind tasting. Most (7 out of 11) of our participants joined in on the tasting and P2, P5 and P11 also volunteered to brew.

"People taste those beers and write their impressions and then it'll be explained to them. So it's a learning process for the brewers and also the tasters." (P4, male, brewing for more than 30 years)

Our participants told us that they thought the sessions were useful to enhance their understanding of how to create an interesting beer and that the group discussion afterwards helped them decide whether or not they want to use certain hops in their beer-making.

"It wasn't that I learned that this hop tastes like this, or that hop tastes like that. It's more about learning the things you have to consider when you design a beer." (P2, male, brewing for more than 10 years)

A dedicated time, which the beer brew club enforces, encourages experimentation to explore facets of the beer brewing process and supports our participants to identify new ways to be creative in making beer.

5.3.3 Outreach events.

We noticed that members of the home brewing community were interested in sharing their creations with the local community. One way they could do this was through participating in a local event organized by the home brew club. The club partnered with festival organizers to organize a space for home brewers to pour their beer at local events. Ordinarily, individual home brewers were not invited to pour their beer at those festivals. As an organization, the home brew club was able to provide this resource to home brewers. At the time when we conducted the study, the club had organized four festival pourings over the course of the observation period.

The festivals provided a unique opportunity for home brewers to share their creative work with craft beer lovers. For one festival, P9 told us that he brewed his standard recipe and had his home brewing partner, P10, add an interesting flavor to the beer. P9 and P10 shared their beer in order to get feedback from event attendees, which helped them iterate on future home brews.

Similarly, P3 realized that he could go as creative as possible when demonstrating homemade beer styles in a local festival, as he did not have to consider how to sell their product like an actual vendor.

"I think the advantage we have as home brewers is that a professional brewer is going to take one or two beers that they know they can sell... whereas we can run the gamut. If I want to come up with something wild and crazy, I can brew it up and take it in. And they are usually the things that people like because they're not going to find them any place else." (P3, male, brewing for more than 20 years)

In a similar vein, P11 viewed sharing his home brew at festivals as a venue for experimenting with interesting themes. While brewing a beer for a festival in October, he thought about the Halloween spooky feeling that he wanted craft beer drinkers to get from his creation, and came up with a creative theme to support his vision.

"I just did a dark Norwegian farmhouse ale that was lightly soured and it was called Coffin Dweller. This is because it was dark and it had this flavor to it where you could imagine drinking it in a graveyard. So I drew this guy and he was laying in a coffin under a blanket smiling... Everyone really liked that. I also had a bunch of Halloween decorations that I brought with me." (P11, male, brewing for more than five years)

In another example, P6 mentioned that he enjoyed brewing for these events, but sometimes didn't realize how quickly the festival was approaching. He was inspired to be creative with what he could brew when he was working against the clock.

"If I brew intentionally for events, it's 'well the event is in two weeks, what can I do in 2 weeks'? Sometimes it's whatever I happen to have around that might work that I can play with, or whatever I can brew fast. What I've provided to those have mostly been fairly traditional styles of beer." (P6, male, brewing for more than 30 years)

Alternatively, pouring their home brew at festivals was a great way for some participants (P6, P9, P10) to use up extra beer. During the interviews, some of our participants mentioned that they had an idea in mind for their next beer, but that they couldn't experiment with it because they already had too much beer on hand. We observed that participants brought this extra handcrafted beer to the festivals. They mentioned that they chose to share their home brew with a large audience so they could make space available their home to brew another type of beer.

Our study shows that the club supports the home brew community in legitimizing their creativity through structured resources. When our participants collaboratively brewed beer and filled up a club barrel, they were supported in exploring a new technique without having to invest in the barrel itself or brew many batches of the same beer to fill it up. Having a dedicated time to learn aspects of beer-making empowered our participants to experiment with interesting ingredients or new styles. Outreach events, such as festival pouring, gave our participants an outlet for feedback, to try new things, to come up with a unique story for their beer, or to make room to experiment with making new types of beer.

6 Discussion

Our study reveals that in-person communities of practice actively support the creative making process in both a spontaneous and an organized way. The informal and unstructured resources sharing often takes place in peer-to-peer conversations or requests. This type of sharing is important to cultivate creativity, especially for individuals who do not have access to resources from established organizations, such as novice brewers who are new to the craft. A dedicated hobby organization, e.g., the home brew club, can provide organized and structured opportunities for its members to further partake in developing interesting beer. These two types of sharing support experimentation, iteration, and member collaborations, all of which our participants found beneficial to support their creativity.

The home brewing community legitimized each person's unique approach through informal sharing that happened in conversations between home brewers. Unstructured online resource sharing was prevalent amongst all of our participants. They benefited from resources in online gathering places such as home brewing forums or social media groups. Informal sharing also occurred in person amongst our participants who were members of the home brew club, a physical version of the online gathering place for the community. Many of the club members had been brewing for a number of years and were well integrated with each other.

Both online and offline, home brewers supported others to be creative through their lending and borrowing of equipment, exchanging knowledge, and providing each other with physical space in which to create. Our participants actively offered their resources to others when they realized there was a need. The nature of sharing was not reciprocal, but that didn't prevent people with resources from sharing them with people who didn't have anything to give back to them in return. Instead, we noticed that our participants gave where they could to whomever needed their resource, whether that be extra ingredients to someone who needed them for their recipe, or advice on how to fix a flaw in their product. Our study suggests that a strong community bond, such as that found in communities of practice, is key in fostering this type of sharing between people. Participants who were members of the home brew club (9 of 11) often engaged in informal exchanges with other local members. This may be because they had many opportunities to interact with their community both in person and online through the club's Facebook group.

We noticed that many less socially connected home brew members were unaware that informal resource sharing was going on in their local area. While well-integrated community members knew enough about each other to know who to go to for what, some home brewers in the community were less likely to participate. Two of our participants didn't know other local home brewers that they could go to for help, so they were heavily reliant on the extensive online home brewing community (e.g. home brew forums, sub-Reddits), which was insufficient in helping them diagnose where they may have strayed in their brewing process. Their only option was to look online to access information, recipes, and advice on how to improve their process, which may or may not be suitable for their home set up. One of the issues they identified was that they had no way of knowing if the information they sought was applicable to their situation, or if it would work for them. Since many problems in beer making can only be diagnosed through taste or smell, they had no way of getting the help they needed through the online resources.

Sharing was further supported through access to a structured club environment where members can interact with each other on a regular basis. The home brew club not only provided the context for informal sharing, but also provided a structured series of opportunities for members to receive support through club resources. Home brewers who were members of the club engaged in both informal sharing and structured sharing, suggesting that both were of value to our participants. Structured resources were highly visible to all home brew club members since they were discussed at club meetings and posted to the club's Facebook group. Through the club resources, our participants were able to find collaborators and work together to create a large-scale beer through collaborative equipment use which supported them to be creative in their work together. The club also introduced our participants to new ideas through educational sessions and encouraged them to think outside the box with club challenges. Club-sponsored events provided opportunities for our participants to get feedback on their creations and create unique experiences for others around their craft. We suggest that creative communities of practice can build a stronger sharing and creative practice through providing opportunities for members to share informally through a structured set of support both online and offline.

Limitations. We conducted 11 interviews with a physical community of practice. We recruited people who are active home brewers or former brewers who are still active in the community because we were interested in gaining an in-depth understanding of how our participants were supported in their creative work. We studied people who were successful in being creative within a community of practice, rather than people who were struggling with how to be creative. This was to better understand how communities of practice support creativity. While our participants talked about some of the online tools that they used to facilitate their creativity (e.g. forums, beer making software), we did not directly observe them doing so. This opens up opportunities for future research.

7 Design Suggestions

We've identified resource sharing as an important component to support creativity in a community of practice. Although our home brew club members were participating in resource sharing, it was more difficult for novice or less-integrated home brewers to participate. In P7 and P8's case, they were unaware that a home brew club existed in their town, which prevented them from contributing or benefiting from the in-person community. In order to increase participation in sharing and make it easier for less-integrated members to participate in this valuable community resource, we suggest the following three design implications: *make informal sharing more visible, distribute sharing, and recognize members who share.*

7.1 Make Informal Sharing more Visible

Informal sharing is important in a community of practice. Prior work has found that it occurs frequently in online interactions such as giving or receiving iterative project feedback [27] and through developing new skills by learning from and interacting with others [28]. This study also indicates that informal sharing is a frequent occurrence amongst members of the in-person community of practice, while also pointing out that less-integrated members are unlikely to participate because they are unaware that the sharing is happening. Participants gave away their extra ingredients or lent out their garage space in order to support the creative beer brewing practice of others. This suggests that people are open to and interested in sharing their resources with others and that other people are comfortable taking them up on it. Our study suggests that informal sharing is effective in supporting creative making. When designing technology to support informal, unstructured sharing, we put forward that by increasing the visibility of the sharing practice, it would encourage more people to participate in exchanges. For example, informal sharing could be modeled after the visible structured resource sharing that was initiated by the home brew club, where resources are well-advertised online and offline and people know how to find them. By elevating the level of visibility, designers can facilitate future sharing and promote interest in contributing to the body of community resources.

Resource sharing can be a personal experience for the parties involved in the exchange. One possible risk of making what is often an intimate experience more visible is that the exchange itself will lose meaning for the participants. If everyone in the community knows that someone has a certain resource to share, it might not be as much of an incentive for the person to share it if the act of sharing loses its personal touch. Designers should be aware of this, perhaps letting users choose the level of sharing that they are most comfortable with. Thoughtfully increasing the visibility around resource sharing is a promising way to build a creative community around sharing, and encourage more members to participate.

7.2 Distribute Sharing

A core value inherent in creative communities of practice involves open sharing amongst members [29]. We propose distributing informal sharing amongst members of the community of practice. This can be enhanced through the online component of the community (e.g. a club's Facebook group or a forum). For example, the design could borrow from the free cycle movement⁴ where people give and receive things to others for free in their local area. The design could encourage members of the community of practice to share by highlighting which items the community could benefit from having more of, or which items might be hard to come by but useful to others. The design could also support members who are looking for multiple resources to get them from multiple sources, thus including more participants in sharing.

In a community of practice, it is common occurrence that when one influential member (e.g. someone who shares frequently or has an important resource) leaves the community, the resource leaves with them [5]. Designs that encourage wider participation by more members of the community can help to alleviate this concern. However, we are still unsure how much of a role an individual's personality plays in resource sharing within a community of practice. Some of our participants shared often while others mentioned sharing infrequently or only with a trusted other (e.g. a home brewing partner). Incorporation of design elements in the online presence that allow for individuals to decide whether they want to only share, only receive, or both might be beneficial in encouraging wider participation. If the system identifies users who engage in highly unbalanced sharing, it can encourage the user to partake in the lesser used role in the exchange.

⁴www.freecycle.org

7.3 Recognize Members who Share

Earlier, we introduced the time banking system as a form of formal recognition of members who take an action that is desired by the community [23]. However, the formal nature of the time bank requires resources for upkeep and management that are far beyond the reach of most crafting communities of practice. Our study suggests that the giving role in resource sharing is key to not only making the resources available to the community, but in supporting creators in their creative-making process. We observed that participants shared without expectation of monetary payment. Instead, they were happy when the receiver expressed gratitude for the help. We thus propose that the design include an element of personal recognition for people who share their resources with others. This element of the design would visibly recognize the giver as having shared something with others. Through the recognition, it would also make the exchange more salient, which would support making informal sharing more visible to others in the community.

This concept is already in use in structured sharing. For example, the home brew club recognizes people who participate in structured resource sharing (e.g. winning a themed brewing challenge or donating beer to pour at festivals). Applying this to informal sharing, the design could denote a person's level of sharing through an icon on their profile in order to elevate the sharing behavior to other members in the community. The design could also support shout outs, where receivers of resources could publicly thank the giver through the system.

8 Conclusion and Future Work

In order to understand how members of communities of practice support each other in being creative, we conducted an interview and observation study of the home brewing community. Our findings suggest that resource sharing is key in supporting creativity in a community of practice. Members engaged in both informal, unstructured sharing and utilized the structured resources of the home brew club to enable their creative work. We suggest taking resource sharing into consideration when designing technologies to support creativity in hobby communities. In this study, we also found that our participants experienced problems and challenges during the creative process. In the future, we plan to explore these themes and implications for design in greater detail.

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