



Defining Makers Making: Emergent Practice and Emergent Meanings

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Introduction

Makers are an emerging community of self-described DIY-enthusiasts, tinkerers and hobbyists. Popularized by the quarterly magazine MAKE¹ and annual Maker Faire² events, this work seeks to examine and better understand the context of their activities, particularly in informal engineering education and tinkering activities. Makers embody characteristics from the *Engineer of 2020*³, and in particular practical ingenuity, creativity, and propensity toward lifelong learning; making is of particular interest to the field of engineering and to engineering educators.

We explore what it means to make. A review of definitions was undertaken via two methods. The first was convergent, relying on a literature review spanning several academic disciplines. The second means was divergent, collecting definitions via an ad-hoc, grounded, in-situ approach at a recent Maker Faire event. Respondents were provided with post-it notes, posed with the question *How Do You Define Making?* and asked to contribute to a shared, public wall of multiple definitions. Both approaches yield information that can be used to characterize perceptions of making and contribute to its definition.

The review showed several common terms and perceptions that can be used to define making. Words such as *maker*, *hacker* and *hobbyist* appear in several varying contexts, from education to history, and in the context of the maker movement. The open-ended question activity also had interesting trends. Many responses described *building* or *making* of *something* from a creative viewpoint. These methods helped to characterize making in a manner that can be useful to a larger study investigating the educational pathways of makers.

How is Making Defined?

The literature review looked at several articles in order to determine how terms for *maker* and *making* appear and in which context. The initial search was conducted using common terms that are already known to be associated with makers or that have similar meanings. These include *maker*, *hacker*, *tinkerer*, *DIY (do-it-yourself)*, and *hobbyist*. Some of these terms appeared in the context of a growing maker movement, but many were terms in common usage to describe people as makers and the activities around making.

Maker

The term *maker*, being the topic of the primary research project, was examined first. It was primarily found in articles concerning the maker movement itself. Dale Dougherty, founder of MAKE Magazine¹ and Maker Faire festivals,² and identified as a thought leader in a growing maker movement, is quoted as describing a maker as someone who “looks at things a little differently.”⁴

The term maker and its meaning seem to have originated in the context of the maker movement and the do-it-yourself world. McFedries⁵ calls the maker:

“[A] high-tech tinkerer who lives to take things apart, modify... them to perform some useful or interesting task, and then (sometimes) put them back together.”⁵

Several of the reviewed articles that had mentioned makers in the context of the movement also referred to it in an educational context. In one of Dale Dougherty’s articles he describes making as “learning by doing.”⁶ The article goes on to discuss advantages of hands-on learning as opposed to teaching to a standardized test using diagrams. He specifically mentions a case where students were asked questions about microscopes from an image, as they would be on a test, rather than using the actual instrument.⁶ *Maker*, in this context, refers to an interactive approach to education – someone who learns by building and trying rather than from a book.

Hacker

The term *hacker* appeared very frequently in contexts related to making as well as computing. It appears as a term that has become almost synonymous with maker in the context of the maker community. This is different than the common perception of a hacker as a malicious computer user. Honey and Siegal⁴ describe hacking activities:

“[I]nformal groups are collaborating to create innovative software and interactive devices, many of which are freely shared through open source licensing agreements”⁴

Hackers innovate or modify for some purpose and then share the ideas with the community. Hacker also appears in the context of do-it-yourself manufacturing, where individuals create devices to suit their own unique purposes. Sangani⁷ talks about a new modular electronics product that would allow users to customize their own hardware similar to what those who took part in the open source software movement had done. It makes it simple for someone with little technical experience to construct custom electronics. Sangani calls this model “open-source, old-school hacking.”⁷ In this context, hacking means something similar to open-source, focusing on giving users the ability to modify something to fit their personal needs and purposes.

A traditional context where *hacker* is found is in reference to someone who finds ways to go around a product’s built-in securities. This context for hacker is still far from the malicious type found in movies and referenced in alarmist news programs. This type of hacker modifies products they own in order to be able to take advantage of a fuller potential. Kushner⁸ talks to a calculator hacker who belongs to an “engineering subculture” of those who take their products beyond their intended functionality. There were legal issues when a method was published for getting past a security key to access to the processor on the calculator. It allowed for modifications such as installing a different operating system. In this sense of the term *hacker*, a person makes the most use of what they already own. They become intimately knowledgeable about the workings of their possessions and help others to do the same.

It would also be beneficial to note the appearance of the term *hackerspace*. These are places where communities of makers can work on their projects and are often equipped with specialized tools, and knowledgeable members⁹.

Hobbyist

The term *hobbyist*, when referring to making in some way, appears in the context of DIY, making, and computing. McFedries⁵, describes hobbyists emerging as makers, being involved in much higher-tech DIY than in previous decades. The maker community is being populated by people that had previously been termed *hobbyists*, being the hobbyists now of the digital age.

Campbell¹⁰ talks of hobbyists almost as a precursor to makers. He reasons hobbyists are becoming makers with the help of easy-to-use open source computers such as the Arduino and similar products. Many of the products of the maker movement are enabling those who were simply hobbyists to become capable of making new and more complex artifacts. In an article in the *Economist*,⁹ hobbyists of today are likened to computing hobbyists of the seventies. They are spurring a new industrial revolution where manufacturing will be the realm of hobbyists.

Computing is another context where hobbyist commonly appeared. Kushner⁸ talks about the calculator hacker as a type of hobbyist. Another author describes DIY computing in Taiwan in the early years of the home computer.¹¹ Tinn refers to hobbyists as those who would build their own computers and end up using an array of parts fashioned together.¹¹ This portrays the definition of hobbyist to be similar to hacker in the sense that they went out to build something for their personal use, even going as far as to reproduce a cutting edge product.

Tinkerer

The term *tinkerer* may conjure images of experimentation. Interestingly, it is one of the few terms associated with makers that appeared in the verb form more often than the noun (though both were present). The noun form appeared in a variety of contexts, including legal issues, DIY, and the maker movement, while the verb form was found mostly in literature involving the maker movement or in education contexts.

In the literature, *tinkerer* refers to those who work on their own and, usually, for themselves (similar to the do-it-yourselfer). It has been paired with hobbyists in usage.¹¹ Kaye and Wang¹² and Campbell¹⁰ used the term to refer to those who make and modify. Tinkerer is very similar to maker, referring to someone who creates and invents to fill some need or want, or just for the sake of creation itself.

Tinkering and tinker were used in the verb form. These terms appeared in contexts specific to the maker community (as referred directly to the Maker Faire) or in an education context referring to a manner of hands-on learning. Dale Dougherty talks about the value of tinkering as a means of teaching kids:

“I see the power of engaging kids in science and technology through the practices of making and hands-on experiences, through tinkering and taking things apart.”⁶

This view is also expressed by Damour¹³ and Leopold.¹⁴ This context stresses tinkering as hands-on experimentation and as an effective means of learning.

Other Descriptive Terms

Several other terms appear in isolated instances worth mentioning. These may help to define *making* but are not common enough to be considered synonymous. Contexts where these less common terms appeared are discussions in the maker community and in a sociological context.

In the context of the maker movement Honey and Siegal⁴ used the terms *circuit bender*, *personal fabrication*, and *risk takers*. The Economist used the terms *enthusiasts*, *digital culture*, and *accidental entrepreneurs*.¹¹ These terms are a mix of terms that would be associated with inventing and entrepreneurship and those that would be associated with hobbyist culture. This would imply that making could be somewhere in between the two.

In the sociological context, Wang and Kaye¹³ use the terms *user modification* and *modder*. This is more aimed at the hobbyist side of making where existing products are modified to fit one's own needs rather than inventing something entirely new.

How Do You Define Making?

Definitions were also captured via an ad-hoc, grounded, in-situ approach at a recent Maker Faire event. At the September 2012 World Maker Faire New York,² respondents were provided with post-it notes, asked How do You Define Making? and contributed their definitions to a shared wall shown in Figure 1.

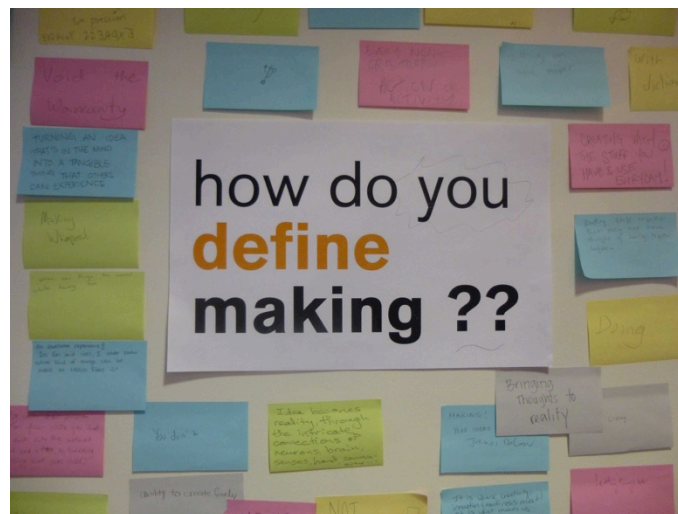


Figure 1. Wall of post-its offering definitions of making

The method of putting out post-its as an open forum for responses to *How do You Define Making?* allowed for a survey of common conceptions of the term in the Maker community. This

can shed light on the diversity of conceptions and personalities within the community as well as the common perceptions of “making” by its members. There seems to be certain aspects of the definition that are shared among the community, as well as certain ambiguities based on the language used in the responses.

Sample Responses

From two wall locations, 260 responses were collected. Of those, after removing 43 non sequitur submissions (scribbles, people writing their names, etc.), 217 responses remained. Example responses are listed in Table 1.

Table 1. Example definitions submitted

- Building, inventing, and loving it
- Something for you to do for fun
- Making is putting creativity and brain power to use to build or think of something
- Voiding warranties
- Creativity turning something from nothing

Word Frequency Analysis

The analysis focused on word frequencies from the sample. The reasoning was that words with higher frequencies were used in multiple posts by different people. Any patterns that arise in this type of analysis would show common perceptions between respondents. The analysis showed several patterns in noun, verb, and adjective usage as well as a pattern of ambiguous direct objects. Below, in Table 2, is a breakdown of the most common nouns, verbs, and adjectives.

Table 2. Word frequencies for definitions submitted

<i>Nouns</i>			<i>Verbs</i>		
<i>Rank</i>	<i>Noun</i>	<i>Freq.</i>	<i>Rank</i>	<i>Verb</i>	<i>Freq.</i>
1	Something (DO 25/27)	27	1	Making	22
2	Thing(s) (DO 10/13)	13	2	Doing	18
3	Brain	8	3	Creating	16
4	Creativity	8	4	Being	14
5	Imagination	8	5	Make	11
6	Reality	8	6	Create	7
7	Stuff (DO 5/7)	7			
8	Maker	3			
9	Creation	2			

<i>Adjectives</i>		
<i>Rank</i>	<i>Adjective</i>	<i>Freq.</i>
1	New	10
2	Creative	6

[DO: Used as Direct Object (Number of times)/(Total occurrences)]

Overall, responses tended to have to do with creating some new thing. The nouns that were used as subjects, rather than direct objects, were *brain*, *creativity*, *imagination*, *reality*, *maker*, and *creation*. These all have something to do with thinking in a manner that generates something new. The common verbs used are all action verbs, with the exception of *being*. This would imply that the perception of making is that of an action to be taken. Something that requires going out

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