Enchanting Fields:

Collective Events and Emotion as Value-Amplifiers during the Emergence and Institutionalization of the Maker Movement

ROUGH DRAFT

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Abstract

Recent research has shown that emerging economic fields, and their associated products, practices and organizational forms, often resemble social movements. This is because championing new and unrecognizable ventures is a risky business that deters opportunists—leaving social movement organizations and socially and politically motivated field pioneers to mobilize support for field formation. However, if field pioneers succeed in developing social and material support for new ventures, then the draw of legitimacy and more certain profits pulls opportunists into the field. These new entrants prioritize instrumental goals such as economic efficiency over value-rational goals associated with the early, movement-like field, that is, the field becomes "disenchanted" as it is legitimated and marketized. Applying this theory of institutionalization to the case of the maker movement, an education and open-source technology movement that has fueled a nascent field, we find that disenchantment—the trade-off of value-rationality for instrumental-rationality—is not a foregone conclusion in an institutionalizing field. Rather, organizations can use collective events to foster emotion, which in turn serves to maintain and augment the field's value rationality even as the field becomes institutionalized and marketized. This study identifies an emotional mechanism through which markets and organizations can sustain and recharge their values, providing conditions under which value-rationality and instrumental-rationality in a field are compatible.

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Over the past few decades, economic sociologists and organizational theorists have turned their attention to the role of social movement organizations and field pioneers in the emergence and institutionalization of new forms of production, organization and economic exchange. A rich stream of research in this area has found that new industries, sectors and organizational fields resemble social movements and often rely on allied third-party social movement organizations for resources and legitimation (Fligstein 2001; King and Pearce 2010; Soule 2012). These scholars argue that new forms of organization and collective behavior typifying emerging fields are risky and prone to failure (Aldrich and Fiol 1994; Stinchcombe 1965), deterring instrumentally-rational actors solely interested in efficiency or making a profit (Carlos et al. 2011).

Instead, novel and unrecognizable modes of organization and production are likely to be guided by field pioneers and social movement organizations driven by political and social values as well as economic goals (Sine, Haveman, and Tolbert 2005). Field pioneers and social movement actors mobilize frames and resources to develop support for formal laws, normative standards, and informal understandings that bolster the legitimization of an emerging field, in a way that is aligned with their own interests and values. Scholars have documented the many ways that field pioneers and allied social movements imbue new organizational forms (Schneiberg, King, and Smith 2008), practices (Lounsbury, Ventresca, and Hirsch 2003), modes of production (Carroll and Swaminathan 2000; Weber, Heinze, and DeSoucey 2008), and market categories (Khaire and Wadhwani 2010) with values. Yet few scholars have examined why some fields remain infused with values and social movement zeal, even as they become legitimate, viable, and attractive to opportunists, while others become disenchanted and lose their value rationality.

Theories of rationalization and institutionalization suggest that as new organizational forms and modes of production develop legitimacy, recognizability and commercial success, they increasingly attract instrumentally-rational actors more interested in efficiency and profitability than in the value-rational ethos of the social movement organizations and field pioneers who originally developed support for the fledgling form or industry practice (Hiatt, Sine, and Tolbert 2009). These theories, tracing back to Weber's (1920) work on the rationalization of religion, suggest that the value rationality that is often found during the early stages of field formation gives way to instrumental rationality through a process of disenchantment and displacement (Carlos et al. 2011).

Yet other scholars have detailed the numerous ways that values, self-interest and emotion intermingle in many taken-for-granted and institutionalized practices and forms of organization (Healy 2006; Zelizer 2005). These scholars suggest that "rational effectiveness" is not walled off and separate from "sentiment and solidarity," but rather is the result of a specific historically and culturally contingent relational work (Zelizer 2011:5). This work reconciles intimate and instrumental relations that are just as likely to be mutually constitutive as they are oppositional. Most of the work in this stream of research remains at micro-level, using ethnographic methods or small-scale datasets to shed light on interpersonal relations in the socio-economic sphere. Few scholars have examined how micro-level dynamics such as interpersonal interactions reconcile values and interests at the meso-level. More concretely, scholarship falls short in inquiring into micro-level processes that may lead to different configurations of emotions, values and instrumentality at the field level.

Why are some fields and organizational forms infused with meaning, while others are "just business"? Drawing on Durkheim (1912) and Collins (2004), we propose that the strategic

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use of emotion, fostered by collective events, can explain why some fields and their associated organizational forms, categories and practices revive, maintain and augment their value-rationality, while others do not.

In this paper we examine how a movement of socially oriented technology enthusiasts, the "maker movement," developed and institutionalized a new organizational form and gave birth to a legitimate field and profitable market while simultaneously maintaining and cultivating the values that sparked the movement. The maker movement, springing forth from a lineage of anti-authoritarian, techno-utopian hackers, has broadened hackers' reach by combining their irreverent approach to intellectual property and aversion to mass production with a much older hobbyist tradition of do-it-yourself (DIY) handicrafts, music and art. The maker movement champions an alternative form of production, organization and exchange in places known as makerspaces, hackerspaces or fablabs,[1] voluntary associations where technology enthusiasts share resources and ideas in efforts to repurpose technologies and prototype new inventions while maintaining an environment that is learning-oriented and fun. These spaces are not only places for new ideas but also for local production and prototyping of products. Over the past decade, as the number of makerspaces and hackerspaces grew to more than 1,400 worldwide, makers have migrated from a peripheral cultural phenomenon into a mainstream industry (Anderson 2012; Schulman 2013; White House 2014). Over the past few years, companies founded in makerspaces such as MakerBot, Instructables and Square have secured hundreds of millions of dollars in capital and achieved multi-million dollar valuations.

Our data suggest that the institutionalization and the marketization of the maker field did not lead to displacement and disenchantment in which instrumentally-rational opportunists

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[1] Although slight differences exist, we use these two terms - hackerspace and makerspace - interchangeably throughout this paper.

crowded out value-rational idealists. On the contrary, we find that growing value rationality accompanied field institutionalization. Connecting the classical theories of Weber (1978) and Durkheim (1912) with recent developments in neuroscience (Labar and Cabeza 2006) and psychology of emotion (Kensinger and Shacter 2008), we argue that organizations and movements may use emotionally-laden events to cultivate positive interaction rituals (Collins 2004) and recharge their morals, values and beliefs. We find that such events balance instrumental and value-rational orientations in the field, fostering a symbiotic relationship between social movement and economic market.

In the following sections, we first evaluate and extend current theoretical thinking on emerging and institutionalizing fields. We then trace the maker movement from its birth as an offshoot of the hacker movement to the present marketization of maker spaces, products, and firms to develop a number of testable hypotheses. Next, we describe our methodological approach and sources of data, and statistically model the relationship between institutionalization, collective events, emotion, and different forms of rationality in a field. We conclude by describing the implications of this research for the study of movements, markets and fields.

INSTITUTIONALIZATION, EMOTION & RATIONALITY

Organizational and economic sociologists have described the emergence of new fields, sectors, and industries—and the concurrent development and institutionalization of new forms of organization, production and exchange—as *political projects* often pioneered by social movements and social movement-like actors (Fligstein 2001; Fligstein and McAdam 2012; King and Pearce 2010; Weber et al. 2008). These scholars argue that new organizational forms and

economic practices often lack legitimacy, recognizability and coordinating mechanisms, and that these obstacles make new ventures too risky for most actors solely interested in maximizing efficiency and economic reward (Aldrich and Fiol 1994; Sine, Haveman, and Tolbert 2005; Carlos et al. 2011). These deterrents leave actors who have a value-rational orientation, that is, "a conscious belief in the value for its own sake of some ethical, aesthetic, religious, or other form of behavior, independently of its prospects of success" (Weber 1978:25), are often left to pioneer new organizational forms and economic practices. These pioneers may also have instrumental goals but choose to pursue risky ventures that do not satisfy a simple cost-benefit calculation due to social and political commitments.

Pioneers of a new field and their movement allies can act to mobilize resources to define and justify values and narratives that support a new organizational form (DiMaggio 1988:18; Clemens 1993). This form is the result of pioneers' building, validating, and maintaining boundaries around their work, such that a new category of organization is recognized and legitimated (Rao, Morrill, and Zald 2000: 243). If pioneers succeed in developing support for their innovative way of organizing production and exchange, then these once risky innovations become legitimate, recognizable and (in some cases) taken-for-granted (Schneiberg and Soule 2005:122). Legitimacy and recognizability decrease risk of entry into the field and attract opportunists that are less likely to have a value-rational orientation than field pioneers (Hiatt, Sine, and Tolbert 2009). Over time, the composition of the field changes as instrumentally-rational actors crowd-out value-rational pioneers and their movement allies (Carlos et al. 2011; Sikavica and Pozner 2013:627). Similarly, scholars have outlined how marketization can draw investors and firms with economic demands that challenge or undermine the social and political

goals that support field emergence (Sine and Lee 2009; McInerney 2014).[2]

Emotion and Collective Events

Movement and market scholars have recognized the role of both value-rational and instrumentally-rational action in the emergence and institutionalization of new fields and associated organizational forms and markets. However, they have elided the role of emotion, the non-rational form of action in Weber's typology of social action. Weber (1978) argues that affectual action, that is, emotional action, is distinct from value-rational and instrumentally-rational action in that it is reactive, making it non-rational. Yet, in practice, rational and irrational orientations are not ideal types: emotion can both be sublimated with and foster rational action. As Weber states, when "affectually determined action occurs in the form of conscious release of emotional tension…it is usually well on the road to rationalization in one [value-rational] or the other [instrumentally-rational] or both of the above senses" (1978: 25).

Both classical theorists and cognitive scientists argue that emotion can play a role in developing and maintaining solidarity and commitment to shared values. Durkheim's concepts of *collective effervescence*—a transpersonal emotional experience shared by a group—and *collective consciousness*— "the shared mental and moral orientations of society" —suggest a mechanism by which emotion may develop and maintain value-rationality (Coser 1997: xvii). According to Durkheim, communal gatherings that elicit feelings of exaltation and emotional release reaffirm social bonds and foster value-alignment within a group. More recently, Randall

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[2] As a field develops legitimacy and new organizational forms, modes of production and rules of exchange become institutionalized, organizations within the field may also develop instrumentally-rational bureaucratic systems as efficient administration and management becomes prioritized. Scholars have shown that as non-profits become rationalized and institutionalized, organizations draw more and more on a cadre of bureaucratic professionals (DiMaggio and Anheier 1990; Hwang and Powell 2009).

Collins revived the concept of collective effervescence and applied it to contemporary debates about emotion and solidarity by describing how positive interaction ritual chains produce emotional energy that develop solidarity and symbols of group membership (Collins 2004). The arousal of emotion can help form collective identity and enable groups to undertake costly actions that may have been unthinkable in less emotional contexts (Rao and Dutta 2012).

Emotional events "charge" normative and moral beliefs, and values, as feelings of arousal, make such beliefs more compelling (Durkheim 1912; von Scheve 2011). Psychological and neuroscientific research supports the link between feelings of emotion and renewed commitment to beliefs (Bless 2001; Bower 1991; Clore, Schwarz and Conway 1994; Kensinger and Schacter 2008; see also von Scheve 2011 for a survey of the literature). Neuroscientists have found that affective events "attain a privileged status in the brain," and that emotional events have memory enhancing effects (Labar and Cabeza 2006: 54). Psychologists have found that under certain conditions emotions can affect value judgments (Forgas 2000). Thus, taken together, emotions can have a lasting effect on value judgments. If emotionally effervescent events lead to the development of a "collective consciousness" that reaffirms the value-rational origins of a field, then we should expect to find that collective events reinforce the field's value-rationality, and that this effect is driven, in part, by emotion.

Hypothesis 1a: Collective events will increase a field's value-rationality.

Hypothesis 1b: Emotion mediates the relationship between collective events and a field's value-rationality.

Rationality and Institutionalization

Yet both classical and contemporary theorists challenge the use of ideal types separating sacred

value-rationality from profane instrumental rationality. Weber himself argued that pure forms of value-rationality, instrumental-rationality, and emotion are hard to find, and that these categories are often sublimated in real life (Weber 1978: 25-26). More recently, a rich stream of scholarship has taken issue with scholarship that separates "rational effectiveness" from "sentiment and solidarity" in a market setting (Zelizer 2011:5; see also Fourcade and Healy 2007). An advocate of this perspective, Zelizer has extensively argued that it is problematic to divide the world into two distinct arenas of social life and work, highlighting the role of morals and meaning in shaping the U.S. life insurance industry (Zelizer 1979) and the relationship between intimate relations and economic transactions in numerous settings (Zelizer 2005). As a solution, Zelizer has proposed that scholars examine the "multiple forms of mingling" between human values, intimate relationships and the market (2011:4; see also Zelizer 1978).

Building upon Zelizer's work, we propose that instrumental rationality does not necessarily crowd out value rationality in emerging and institutionalizing economic fields. Instead, we propose that certain types of fields, those with periodic collective emotional events, will feature the friendly co-existence, if not mutual reinforcement, of value-rationality and instrumental rationality. If institutionalization of an economic field leads to "market pull," as instrumentally-rational actors are attracted to the field and emotionally laden events charge the field with value-rationality, then we should find that institutionalization and marketization of these does not necessarily lead to disenchantment. The combination of institutionalization and effervescent events can sustain both value-rational and instrumentally-rational action and help foster a symbiotic, rather than zero-sum, relationship between movement and market values.

> *Hypotheses 2a and 2b:* A higher degree of (a) institutionalization and (b) marketization
> will be positively associated with both value rationality and instrumental rationality in
> fields that feature collective events.

If the data support our hypotheses, then it may be that certain types of markets and organizational fields do not follow the typical narrative of institutionalization and disenchantment in which the values of the movement give way to the calculation of the market. In these cases, instrumentally-rational action does not displace value-rational action, but rather complements it, as the emotional release of collective effervescence sustains the original values of the field even as increasing recognizability and legitimacy make the form more efficient and profitable. We propose that this theory delineates a case of *enchanted institutionalization* in which a field may become more profitable and efficient while maintaining or recharging its core values. We test our predictions in the maker movement research setting.

THE MAKER MOVEMENT

The maker movement sprung directly from the hacker community, drawing upon hacker values of openness, sharing, and repurposing technologies, while leaving behind anti-establishment and exclusionary dimensions of the hacker identity. Makers draw on the "hacker ethic," a set of moral beliefs and values associated with technology and education that originated at the Massachusetts Institute for Technology in the 1950s and 1960s, when students interested in model railroads and phone-switching networks would come and "hack" the supercomputer at the artificial intelligence (AI) lab by playing with its parameters and repurposing it in unexpected ways. The hacker movement had a number of generations and waves—notably, the second generation hardware hackers, personal computing enthusiasts that came together to create associations such as the Homebrew Computer Club in the 1970s, and the software "game hackers" in the 1980s (Baichtal 2011). These different forms of hackers shared an irreverence toward authority and conventions, and espoused a common belief that "essential lessons can be

learned about the systems—about the world—from taking things apart, seeing how they work, and using this knowledge to create new and more interesting things" (Levy 1984).

Hackers organized associations and non-profit organizations known as hackerspaces, physical locations based on the "hacker ethic" where hackers could find community and share resources. Hackerspaces with open membership and egalitarian values became popular in Germany in the 1990s with the rise of the Chaos Computer Club and c-base in Berlin; they then spread from Germany to other parts of Europe and North America throughout the 2000s, growing to over 1,000 spaces by 2012. Over the years, these organizations have evolved into open, community-based social environments where information, tools, expertise, and ideas are shared freely. Hackerspaces have developed into prominent places for technology enthusiasts in the United States to come together with the rise of spaces such as Noisebridge in San Francisco and NYC Resistor in New York (Schlesinger 2009). They are not just places where techies can learn about science and computers outside of work or school; they also provide resources and support for prototyping new inventions and hosted various technology related local gatherings (Intuit 2009).

As of 2013, many hackerspaces remained steeped in the original, collectivist, hacker values. Gui Calvacanti, founder of the Artisan's Asylum stated that some hackerspaces have "tendencies towards collectivism, and radical democratic process as a method for decision making" (Calvacanti 2013). An interviewee who had previously worked at a hackerspace explained that a hackerspace "does not talk corporate… Hackerspaces have a fairly anarchist connotation, [people there believe] that everybody is equal and there isn't really leadership." Similarly, an entrepreneur who spent time at a hackerspace in San Francisco described an incongruity between hackerspaces and the needs of entrepreneurs: "people who are business-like

and people who want a certain order, they don't stay there because it's hard to 'get work done'"

(August 2013, interview #25).[3]

Makers

The term "maker" was coined in 2005 when Dale Dougherty, a technology enthusiast and vice-president at magazine publisher O'Reilly Media, a Bay Area publisher focused on information technology and programming books and courseware, started a new magazine that "recognized that hackers were playing with hardware and more broadly, they were looking at how to hack the world, not just computers" (Dougherty 2012). Dougherty wanted to publish a magazine for individuals who shared the Hacker Ethic but did not view themselves as hackers. Makers are united by a loose set of values, outlined in the "Maker's Bill of Rights," such as the right to easy-to-repair devices, non-proprietary tools, public schematics, and freely available device drivers. The Maker's Bill of Rights asserts the value of openness and transparency in innovation as well as the value of self-reliance in repairing or modifying one's own devices. In a similar vein, Mark Hatch, CEO of TechShop, the nation's largest for-profit makerspace franchise, released *The Maker Movement Manifesto,* a book that identifies making, sharing, giving, learning, play, participation, support, and change as core tenants of the maker movement (Hatch 2014).

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[3] Between November 2011 and September 2013, the first author, together with a research team, conducted 106 interviews with hackerspace and makerspace founders and members, Maker Faire participants, and other maker movement stakeholders. The initial 43 interviews focused on describing makerspaces and hackerspaces as a new organizational form. An additional 34 interviews aimed at illuminating participation in makerspaces and hackerspaces from the perspective of resource use and social norms governing resource sharing. Lastly, 29 interviews engaged a variety of stakeholders affiliated with the maker movement—such as authors, entrepreneurs, and business owners—in the interest of understanding the history of the maker movement in the United States and the values held by different types of maker movement participants—hackers, makers, tinkerers, artists, or entrepreneurs. The interview data, included in the case history, was used to ground and contextualize our research, and to highlight the values underlying the field as it became institutionalized.

Makerspaces and Maker Faire

Self-identified geeks and tinkerers who were growing increasingly enthusiastic about rapid prototyping software and tools, and forming communities to share and iterate their designs, welcomed the growth of the maker movement (Torrey et al. 2007; Kuznetsov and Paulos 2010). They developed community associations, similar to hackerspaces, known as makerspaces, and attended maker events, most notably Maker Faires. Maker Faires are two-day festivals where technology enthusiasts come together to present their inventions, participate in workshops and socialize with one another (Sivek 2011). The first Maker Faire took place in the greater San Francisco area in April 2006 and attracted over 20,000 visitors (Carmody 2011). This Maker Faire then became an annual event taking place in the San Francisco Bay Area every May, with a counterpart event called World Maker Faire taking place in New York City every September starting in 2010. By 2013 Maker Faire offshoots had spread to 100 cities worldwide with over 530,000 attendees (Merlo 2014).

As early as 2011, magazines and newspapers proclaimed that the maker movement had broken into the mainstream (Carmody 2011; Jeffries 2011), describing the "industrialization" of the maker movement (Anderson 2012) and the paradoxical growth of "big DIY" (Carmody 2011). As the maker movement grew larger and more legitimate, makerspaces and the maker movement drew more participants interested in entrepreneurial and profit-making ventures. The maker movement enabled economic markets in three different ways, through: (1) for-profit makerspaces, (2) consumer and corporate-facing commercial ventures, and (3) an eco-system of companies that make money selling tools and tips to makers. While hackerspaces had an anarchist or democratic collectivist orientation, makerspaces were more likely to be "structured along the lines of traditional businesses" (Calvacanti 2013).

TechShop is the oldest and largest chain of makerspaces with eight for-profit locations in six states. In 2012, TechShop earned $6.5 million in revenue, an 800% increase over the three year period between 2009 and 2012; in 2013, *Inc.* magazine named TechShop the #37 retail company in the United States. TechShop is not only a for-profit business, but also a place for makers who want to start their own for-profit businesses. As one entrepreneur and TechShop member explained, "what TechShop wants is to be able to show [that] people can make a business out of being TechShop members. We've made a business…We [can afford to] pay our fifteen employees" (August 2014, interview #25). Another TechShop member who designed and commercialized ergonomic office accessories shared his perspective: "TechShop was really how I was able to…advance my business along with all the things I needed to do" (August 2014, interview #29).

The maker movement is neither opposed to making a profit nor solely driven by profit. Rather, makers attempt to find new ways to reconcile capitalism with community and markets with meaning (Zelizer 2005). Makers want to make money: the 2012 Maker Market Survey (MAKE 2012) found that only 30% of respondents indicated that "[m]aking lots of money is not very important" to them. Many makers are drawn to makerspaces because of this commercial self-interest: 34% of respondents in the Survey "indicated a commerce or income-making activity related to their making," and nearly 17% of survey respondents said that making is or will be their full-time job (MAKE 2012). Moreover, over half (56%) of makers in the study have applied or plan to apply for a trademark or patent (MAKE 2012:21).

Many of these companies turned to crowdfunding as a first step in launching the business and a number of companies found success and are well-capitalized. For example, 3Doodler, a 3D pen company started in Calvacanti's Boston-based Artisan's Asylum makerspace, raised almost

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$2.5 million on Kickstarter. Square, a financial services company founded in 2009 by Twitter founder Jack Dorsey, developed its mobile point-of-sale product prototype in a Bay Area makerspace—as of January 2014, the company was valued at $5 billion (Calvacanti 2013). Similarly, Pebble, a company which sold over 85,000 smartwatches, and raised $25 million in capital in 2013, was started in a San Francisco area makerspace.

The maker movement not only fueled an industry of innovative products but also a self-contained ecosystem that includes educational opportunities, kits and parts for maker projects. One of the early ventures in this arena, Adafruit Industries, was created in 2005 as an educational resource and marketplace for maker products. Adafruit offers free tutorials on how to hack everyday products, while selling over 1,300 different products and add-ons for makers. Similarly, SparkFun Electronics, an online electronic parts store that is one of the main suppliers of parts for makers, recorded over $30 million in revenue in 2013.

Private enterprises are increasingly approaching makers to source innovation and new products. Approximately 19% of makers surveyed in the 2012 Maker Market Survey stated that commercial enterprises had approached them regarding their projects (MAKE 2012). Moreover, large corporations are building their own makerspaces to foster innovation and gain interest among makers. General Electric started a GE Garages initiative which created temporary makerspaces where individuals could prototype new inventions (Una 2013). In 2011, the publicly-traded corporation Autodesk purchased Instructables, an online repository of designs for makers, for $32 million. MakerBot, a company that makes and sells desktop 3D printers, a staple of any makerspace, was purchased by Statasys in 2013 for $403 million. Additionally, Maker Faires around the United States increasingly found corporate sponsors such as PepsiCo, Intel, and Redbull, suggesting a major departure from makers' hacker/anti-corporate roots (Carmody

2011; Jana n.d.).

Despite many indications of institutionalization, profit-seeking and instrumental rationality, makers suggest that the growing do-it-yourself industry remains infused with the "hacker ethic" and maker values. As *The Makerspace Playbook*, a guide for those hoping to start their own makerspaces explains, "we're not anti-commercial—makers sometimes start businesses and we celebrate that…but we don't make it a focus as it would change the spirit of the movement" (Makerspaces 2013: 2). A makerspace employee described the reconciliation of morals and markets within the maker culture as follows:

> [W]e don't believe in patents as like the be all, end all. We also feel strongly about open source and the fact that you can still make money on open source. You don't have to hoard it and patent ... It's [about] that ability to make a profit off things. There are many other ways that … leave you with a much better product. We're not big on [patenting]. We don't … discourage it. We're not against it. It's just not part of how we operate. It's not part of our culture. (September 2013, interview #33).

Thus, makers support commerce, but attempt to redefine and reconcile it with maker values. Makers want to make money and take part in commercial exchange but would rather transact with "someone [they] know than [with] a big corporation" (MAKE 2012).

The founders of the two main independent marketplaces for maker products, Nathan Seidle of SparkFun Electronics and Limor Fried of Adafruit Industries, expressed confidence in open source ideals. Seidle publicly stated:

> "SparkFun is a firm believer in the ideology of open source technology. We believe an open market is a healthy market and we open source all of our product designs. SparkFun subscribes to the belief that open source tech encourages innovation and creativity, while helping empower individuals to build the projects they want." (Sparkfun 2014).

Similarly, Fried said:

> "I'm totally a staunch capitalist. I just think that hardware hacking [and open

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source] are good business… I think of Adafruit as a cause, not as a company...
What we're trying to do is make electrical engineering exciting, cool, and fun."
(Fast Company 2011).

These quotes suggest that entrepreneurs and for-profit business models arising from the maker

movement maintain a strong allegiance to the open-source values that fueled the movement,

while also feeling that these values can be reconciled, and even enabled, by the market.

RESEARCH DESIGN, DATA AND ANALYSIS

In the following section, we analyze the relationship between institutionalization, and emotion,

value-rationality and instrumental-rationality in the maker field in two stages. First, we employ

computer-assisted text analysis to inductively assess changes in language patterns over time in

the discourse pertaining to the maker field. Second, we use statistical modelling techniques to

quantitatively assess the hypothesized relationships.

Our theory posits two related mechanisms: (1) when a field features collective events,

these events foster emotion, which serves to reaffirm the value-orientation of the field; and, (2)

as such a field becomes institutionalized, instrumental rationality grows together with value

rationality, rather than displacing value rationality and "disenchanting" the new field. We focus

on changes in public discourse surrounding the maker field to capture the field's emotional and

rational orientation of the field over time.

Mass media coverage represents an ideal lens for examining changes in public discourse

for two reasons. First, media plays a central role in facilitating the public's meaning construction

processes (Kennedy 2008), in the cognitive legitimation of new markets (Aldrich and Fiol 1994),

and in the visibility and diffusion of a message in the public realm (Andrews and Caren 2010;

Koopmans 2004). The meaning-construction and message-diffusion facilitated by the media can

in turn affect the development of social movements and industries by attracting new members, customers, investors and entrepreneurs, thus altering the distribution of participants in this space. For example, if the organizational actors covered by the media espouse purely instrumentally rational views, the field and its associated market would become known as such, and subsequently attract opportunists. Second, news stories contribute to sense-making by adding coherence to emergent categories (Kennedy 2008). If the new field becomes increasingly dominated by opportunists, the media may converge on discussing the instrumental aspects of organizations in a new field, and this would further cement the field as "disenchanted."

Media Coverage Data

The core of our data consists of all Factiva articles (870) published in English between February 2005 and December 2012 containing one or more of the following terms: *makerspace*; *hackerspace*; *maker movement*; *MAKE magazine*; or *Maker Faire* (including spelling variations). This start date was chosen to coincide with the first publication of MAKE magazine, the publication that gave rise to the term "maker" and the associated maker movement. These 870 articles contain approximately one million words and span a wide geography, from Australia, New Zealand and Singapore, to the UK, USA and Canada. Nearly half of these articles (48.5%) were published by U.S. based newspapers and media sources; 15.06% appeared in specialty or trade journals such as AutoWeek, Progressive Grocer or Manufacturing Engineering; and the remaining 36.44% were published by international, English-speaking media, mainly in the UK, Australia, and Singapore. Among the U.S. publishing sources, we have distinguished by geographic distribution between national-circulation media—Wall Street Journal, New York Times, or NPR—and local newspapers such as Pittsburg Post Gazette, Charlotte Gazette, Austin

American Statesman or The Detroit News (see **Table 1** for a geographic and annual article breakdown). We differentiate between local newspapers national newspapers because we suspect that local papers may focus more on the embedded, communal aspect of maker events than do national papers.

Insert Table 1 about here

Method of Analysis

In examining our data, we begin with inductive computational techniques that serve to describe patterns in media coverage of the maker field. Our approach is motivated by concerns regarding the accuracy and reliability of human coders in imposing structures on text data (Biernacki 2012; Mikhaylov, Laver and Benoit 2012) raised by researchers who are calling for a more transparent and reproducible process of analysis. In response to such concerns, other social science researchers have increasingly turned to unsupervised machine learning techniques, shifting away from manually and subjectively identifying the themes and sub-themes in each document, and towards interpreting the topics produced through reproducible algorithm-based methods (DiMaggio et. al 2013). We address this concern in a similar manner by employing an unsupervised computer-assisted inductive method—topic modeling—to reveal latent themes in media coverage of the maker movement.

Topic modeling algorithms assume that the documents in a text corpus cover a mixture of topics, where each topic is a list of weighted words that appear in the documents. The top-weighted words for each topic represent the content of that topic; documents are classified into topics based on their word content. Topic modeling thus reduces documents to common patterns,

identified through groupings (or clusters) of words (Blei, Ng, and Jordan 2003), similar to the way other quantitative methods such as multiple correspondence analysis (MCA), factor analysis, and multi-dimensional scaling (MDS) use statistical methods to reveal groupings of data that are otherwise difficult or impossible for a researcher to identify (Nelson 2014).

Our methodological approach consists of using a Latent Dirichlet Allocation (LDA) statistical model for topic modeling to quantify the relationship between individual documents and topics (Blei 2012; Mohr and Bogdanov 2013). LDA is a simple statistical model compared to recent developments in the field of computational text analysis. However, research based on large-scale user studies suggests that topic models based on more complex algorithms may infer topics that are less semantically meaningful for humans than the LDA model (Chang et al. 2009). For the purposes of our analysis, we performed a sensitivity analysis and examined the distributions of words using a mix of goodness-of-fit measures (such as the harmonic mean estimator) and visual examination of semantic similarity among top words in each topic when setting the number of topics between 5 and 35 topics, and identified 18 as the ideal number of topics covered in media articles on the maker movement.

Dependent Variables

The dependent variables in our study consist of measures of instrumental rationality, value rationality, and emotion in media coverage of the maker field. We used both inductive and deductive techniques for operationalizing these concepts. First, using the topic modeling procedure described in the previous section we surveyed the media topics to identify those topics that consisted primarily of words associated with maker values such as "open," "sharing," "nonprofit," "community," and "movement" as well as topics associated primarily with

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instrumental rationality, including "company", "industry," and "profit."

Yet research has shown that topic models produced by machine-learning algorithms are most likely to be comparable to those produced by experts if they are manually refined using human expertise (DiMaggio et al. 2013; Mimno et al. 2011). For this reason, we combine word classifications based on topic-modeling techniques with the manual classification of all terms that occur more than 10 times in our article database to produce a coding scheme for language consisting of 271 words[4] related to our three themes of interest: value rationality, instrumental rationality, and emotion. In this category scheme, instrumentally-rational language consists of words associated with resources and commerce ("cash," "budget," "finance," "loan," "buyer," etc.), organizational roles ("CEO," "chairman," "entrepreneur," etc.), and means/ends thinking ("exploit," "pragmatic," "logic," etc.). Value-rational language consists of terms related to maker values ("open," "sharing," "grassroots," "movement," etc.) and solidarity ("togetherness," "friendship," etc). The emotion category consists of language describing feeling ("delight," "excited," etc), release ("cheer"), and spectacle ("magic," "wild," "spectacular"). A list of categories, sub-categories, and a sample of associated words can be seen in **Table 2**.

Insert Table 2 about here

The codebook containing categories and words was then applied to all the articles in the dataset using automated text analysis. Using the R Statistical environment (R Core Team 2013),

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[4] In creating these categories we followed the example provided by the LIWC dictionary (Tausczik and Pennebaker 2010) and associated value-rational and instrumentally-rational labels based on the main meaning of the term and not on connotation. For example, "community" or "intricate" may connote "love," or, respectively, "admiration" but they are not inherently associated with an emotion so we have not included them as emotion-related terms.

we pre-processed each article by removing punctuation and by stemming[5] words, and created frequency counts for value-rational, instrumentally-rational and emotional words, as well as mentions of Maker Faire events in each document. This process generated measures of frequencies of instrumentally-rational, value-rational and emotional words in each article, relative to the length of the article, and a dummy indicator coded as 1 if the article mentions a Maker Faire event. The results of the automated coding process were then checked manually against randomly chosen text samples to verify the accuracy of the word counts in each article. We used these variables to operationalize and analyze changes in instrumentally-rational, value-rational, and emotion-related language over time as the new field became increasingly institutionalized.

Independent Variables

Collective events. We operationalize collective events using a dichotomous variable that equals one for articles that are talking about a Maker Faire or other similar event, and zero otherwise. Because large public events such Maker Faires are often used as reference for public awareness and also represent a source of news about events in a field, we find that 44 percent of our articles mention such event.

Institutionalization. Proper operationalization of institutionalization and marketization is crucial for testing our hypotheses. We use three different measures for institutionalization and one measure of marketization in our analysis. First, consistent with prior research in this area, we use organizational density as measured by the number of organizations in the field each month to

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[5] Stemming is the process for reducing inflected (or sometimes derived) words to their stem, base or root form. Here the stemming method used was based on Porter's (1980) algorithm, a widely-used natural language processing algorithm whose effectiveness has been widely shown.

operationalize the field legitimacy (Carroll and Hannan 1989; Rao 2002). The initial list of US-based hackerspaces was annotated and refined through extensive web searches for information about each space listed on the site (Hackerspaces.org 2012).

Second, we also measured institutionalization by counting the number of Google search queries for "makerspace" and "hackerspace," as reported by Google Trends. Since Comscore has consistently placed Google to be the top search engine that processes more than 60% of all the online queries in the world (Comscore 2014; Lardinois 2012), the volume of queries submitted to Google has the potential to approximate people's interest in and understanding of this organizational form over time—a proxy for the cognitive legitimation, and thus institutionalization of the new field (Aldrich and Fiol 1994). We have labeled this variable "Google 'maker' search." Third, we measured the institutionalization of the new field by counting the total number of articles at any given point. Since media coverage is a signal of public visibility of an actor, social movement, or organizational form (Andrews and Caren 2010), we expect total media coverage to serve as a proxy for the institutionalization of the maker field.

Fourth, to measure marketization, we calculated the volume of advertising in MAKE magazine, the maker movement's flagship magazine.[6] The first author, together with a team of research assistants, manually coded all the advertisements in MAKE magazine between 2005 and 2012—counting both the number of pages and the total number of advertisers in each issue. The total number of pages of advertisement reflects the income derived from advertisers, and the number of advertisers accounts for the number of commercial actors interested in the new field. From these numbers we subtracted advertisements for MAKE magazine itself (subscription discounts, for example) and related enterprises—Maker Faire, Maker Camp (an online venue for

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[6] We assume that the volume of advertising is a proxy for the interest of commercial firms in the maker field.

educational summer projects) and MakerShed (an online marketplace for maker tools and product kits). Since the number of advertisers and pages were highly correlated, we included only the number of advertisement pages in the analysis.

Unsurprisingly, the three measures of institutionalization (organizational counts, Google searches, and the number of media articles) are highly correlated, because they reflect similar aspects of institutionalization (and associated legitimacy): they measure the recognizability of the maker movement by the general public.[7] These three measures of institutionalization are not correlated with marketization, that is, commercial awareness and interest in the maker movement.

Control Variables

Our analyses include controls for the type of publication classified by Regional, National, Industry, and non-US audiences. By separating US Regional, US National, non-U.S. and trade journals we can account for stable differences among different types of media outlets over time, such as the fact that local news outlets provide more local and less national news coverage, acting as complements for national-circulation media sources (George and Waldfogel 2006).

We have also included a control variable for the date of publication of each article in our dataset, to account for time trends in the data. Additionally, we control for article length; even though our dependent variables are fractions representing the percentage of words in the article belonging to a certain category, we are mindful that very short or very long outlier articles may affect our findings. Lastly, we control for articles that mention entrepreneurs or entrepreneurship. We expect that articles discussing this subject may inherently contain more words related to

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[7] Ideally we would also include the number of participants at Maker Faire events, but these numbers are not publicly available in monthly increments.

instrumental rationality, and we would like to account for this difference when examining the relationship between collective events, emotions, and value-oriented rationality, as well as the relationship between institutionalization and forms of rationality.

Model Specification and Estimation

All of our hypotheses concern the relative frequencies of words associated with value rationality, instrumental rationality, and emotion in media discourse. We computed word counts for all media articles and counts of terms in the predefined categories as a ratio of words in the category to total words, so all our dependent variables are in the [0,1) interval. For this reason we use a fractional logit model to estimate predicted probabilities (Papke and Wooldridge 1996).[8] Concerns have been raised about proportions data containing zeros or ones (McDowell and Cox 2001) because observations at the limit (zero or one) could be caused by a different process than non-censored observations, leading to sample selection issues. However, in our case we expect similar behaviors to generate zero and non-zero observations, such that use of generalized linear model with logit link function and the binomial distribution represents an appropriate choice (McDowell and Cox 2001; Papke and Wooldridge 1996).

In order to evaluate the mediation effect of emotion proposed in Hypothesis 1b, we examine changes in the coefficient size of collective events after introducing emotion as an independent variable in the model that predicts value-orientation. Additionally, we evaluate whether the mediation is statistically significant and estimate its magnitude using. In testing hypotheses H2a and H2b, we construct interaction terms for value-orientation and

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[8] As a robustness check, we test all our hypotheses using linear probability models, and zero-inflated negative binomial models with word counts from each rationality category as dependent variables. These analyses produced similar results to those discussed here.

institutionalization (and, respectively, marketization), and examine their marginal effect on instrumental-orientation in media discourse related to the maker movement.

RESULTS

Topic Models

Topic model analyses produce two distinctive outputs: (1) a table containing one list of words for each topic, with words rank-ordered based on their frequency in that topic, relative to all other topics; and (2), a table indicating, for each document, the proportion of words in each topic (adding up to 100%).

Table 3 shows the top 20 words for each of the 18 topics resulting from the analysis of 870 media articles published between January 2005 and December 2012. In order to simplify the visual representation of these topics over articles across time, we present a lowess smoothing graph including only four categories of themes: business and corporate interest (topics 1 and 5), open and sharing (topics 7 and 15), technology and entrepreneurship (topics 2 and 13), and collective events (Maker Faire and other events, topics 11 and 17). The language of openness and sharing stands out within a particular topic; openness emerges faintly in topic 7 in relation to open source hardware (championed by the online electronics store Sparkfun) and in topic 15, in relation to public sharing for educational purposes. However, neither of these two topics constitutes a clean measure of openness and sharing discourse. Similarly, the technology and entrepreneurship theme contains topic 2 in relation to technology, design, and innovation competitions, and topic 13, in relation to start-ups, innovation, and funding.

Insert Table 3 about here

Figure 1 illustrates the changes in media coverage of these themes over time. We notice the sharp growth in Maker Faire and other collective events around 2005-2008, followed by a stabilization in media references; fluctuating coverage in business, entrepreneurship and technology coverage, with a recent slight growth in entrepreneurship references; and the growth in coverage related to openness and sharing, with a pronounced upward trend between 2008 and 2011 as hackerspaces and makerspaces, from the birth of the first organizations until the birth rate reached a peak in early 2011. This descriptive analysis provides support for Hypothesis 2, that instrumental and value-oriented language need not be crowding each other out; instead, they become intertwined as the new field is increasingly legitimated.

Insert Figure 1 about here

As mentioned above, it is rather difficult to fully isolate themes of interest, such as instrumental, value-oriented, and emotional narratives using an exploratory analysis such as topic modeling. For this reason, we further examine the hypothesized relationships by employing deductive dictionary methods to measure the proportion of instrumental, value-rational, and emotion-related words in each article, and statistically modeling the relationship between emotion and forms of rationality in an institutionalizing field.

Statistical Analysis of Media Coverage

Table 4 presents summary statistics for the variables used in our multivariate analyses. As expected, we see high correlations for our measures of institutionalization (organization density, news coverage, and Google 'maker' searches). We also note a low (and negative) correlation of institutionalization measures with our measure of marketization (MAKE magazine advertisement pages). This is a coarse measure of marketization; we expect that as the maker movement evolved, institutionalization increased and MAKE magazine expanded its scope, creating a marketplace for selling maker products, more Maker Faires, and sponsoring other events. All were advertised in its magazine, which may have reduced remaining advertising space for corporate actors (or measure of marketization). **Table 5** and **Table 6** present the multivariate analyses examining the relationships among the three forms of rationality, and with collective events and field institutionalization as proposed in the hypotheses outlined above.

Insert Table 4 about here

Collective events, emotion, and value-orientation (Hypotheses 1a and 1b). Model 1 in **Table 5** evaluates the relationship between emotion and collective events. The results indicate that emotion-laden (affectual) language is significantly and positively correlated with Maker Faire events coverage in the media, suggesting support for the baseline hypothesis that collective events are infused with emotion. Additionally, we note that emotion-laden language is negatively correlated with national coverage of maker movement news. Model 2, a baseline model estimating value-rational language, suggests that value-rational language linked to the maker movement increased over time in media coverage. Model 3 introduces the Maker Faire article

dummy as an independent variable. Results suggest that Maker Faire media coverage has a statistically significant and positive relationship to value-rational language. An article mentioning a Maker Faire is 32.05 percent (β=exp(.278)-1) more likely to contain value-oriented language than an article that does not refer to Maker Faire events. Model 4 introduces emotional language as an additional independent variable in order to assess Hypothesis 1b regarding the mediation effect of emotion on the relationship between collective events and value-oriented language. The results indicate support for this hypothesis: emotional language is statistically significant and positively correlated with value rationality, leading to an increase in value-oriented language, and the addition of emotional language in the model decreases the strength of the relationship between Maker Faire coverage and value-rationality to 18.6 percent. At the means, this effect translates in 21.7 value-related words in Maker Faire articles high on emotion (75th percentile) versus 11.5 value-related words in Maker Faire articles low on emotion (25th percentile) for an average length article (1,071 words), and 12.2 value-oriented words in Maker Faire articles with average emotion score versus 10.3 value-oriented words in non-Maker Faire articles with average emotion score.

In order to precisely estimate how much of the relationship between collective events on value orientation is mediated by emotions, we have computed the direct and indirect coefficients of interest using seemingly unrelated regression models in STATA, and calculated the ratio of indirect to direct effect. This analytical strategy relies on the assumption that the estimates of the indirect effect are normally distributed. However many estimates of indirect effect tend to be positively skewed and have high kurtosis, so we re-calculated the standard errors of our estimate using bootstrapping, and examined the bias-corrected confidence intervals. Our results indicate that the direct and indirect effects are positive and statistically significant, and that emotion

mediates 39 percent of the relationship between collective events and value-orientation.

Insert Table 5 about here

Value-oriented and instrumental rationality, and organizational density (Hypothesis 2).

Model 1 in **Table 6** presents a baseline assessment of the relationship between value rationality

and instrumental rationality. The results suggest that the two are statistically significant and

positively correlated in media coverage of the maker movement. In Models 2 through 5 we

introduce measures of new field marketization and institutionalization, and interactions between

these measures and value orientation, in order to test Hypothesis 2.

Insert Table 6 about here

In Model 2, we use the organizational population size (organization density) as a measure

of institutionalization, and find that the relationship between value-oriented and instrumental

rationality increases with organizational density. Since the logistic regression model is not linear,

such that the interpretation of interaction effects is highly dependent upon covariates (Ai and

Norton 2003), we examine marginal effects of these variables. This is graphically represented in

Figure 2, which includes the marginal effect of value-oriented rationality framing on the

predicted mean of instrumental rationality framing at two different levels of organizational

density. We observe that an increase in organizational density corresponds to an increase in the

strength of the positive relationship between value and instrumental rationality, such that, at the

means, at an organizational density of 23 organizations and a value-rational language of 5

percent of the words in an article, we expect to see 0.83 percent instrumental language, but at an organizational density of 202 and value-orientation language of 4 percent, we expect to see 2.1 percent instrumental language.

Insert Figure 2 about here

In **Table 6** Models 3 and 4 we employ two other measures of field institutionalization— Google searches for "makerspaces" and "hackerspaces," and the total monthly media coverage of the maker movement and affiliated actors—to evaluate the relationship between value-oriented and instrumental language as the new field becomes legitimized. The interaction between each of these two measures and value-oriented language is positive and statistically significant, and the visual representation of marginal effects of value-oriented discourse on the predicted mean of instrumental rationality framing at two different levels of institutionalization suggests that greater institutionalization strengthens the association between the two types of rationality (see **Figure 3,** Google searches for "makers" as a measure of institutionalization).[9] Taken together, our three measures for institutionalization— organization density, Google searches, and news articles—are associated with an increased correlation between value-rationality and instrumental-rationality, providing support for Hypothesis 2a. Our one measure of marketization, MAKE magazine advertising volume, shows a non-significant and negatively correlated effect in interaction with value-orientation, while the main effect of advertisements is positive. Thus, higher levels of marketization are correlated with instrumental rationality but not with value rationality; the marginal effects indicate that the positive relationship between value-

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[9] For brevity, we only include the graphic representation of marginal effects based on Model 4; the graphic representation based on Model 5 is consistent with the prior representation and is available upon demand.

oriented and instrumental language is attenuated in the presence of high levels of advertising. Thus we can reject hypothesis 2b. This suggests that institutionalization and marketization have different effects on the relative value-rationality and instrumental rationality of the field: increasing institutionalization is associated with an increase in both instrumental and value-rationality; increasing marketization has the opposite effect.

Insert Figure 3 about here

In summary, our findings support our hypotheses that: (1) collective events are associated with an increase in the field's value rationality in media coverage, (2) emotion mediates this relationship, and (3) that organizational density moderates the trade-off between value-oriented and instrumental rationality in an enchanted field that features emotional and effervescent collective events.

DISCUSSION AND CONCLUSION

Our research proposes an alternative to the theory of displacement and disenchantment commonly found in accounts of field institutionalization and marketization. We show that emotional events can be used to maintain and develop value rationality even as greater legitimacy and recognizability associated with institutionalization create incentives for actors that are solely motivated by profits. Yet our data also suggest that as a new organizational field gains legitimacy, value rationality and instrumental rationality action become more closely coupled as value-rational beliefs that are not hostile to, but rather compatible with, the instrumental pull of institutionalization.

These findings suggest that as institutionalization takes place, legitimacy and profitability may attract more instrumentally rational actors without leading to the disenchantment of the organizational form or industry. Instead, emotional events can be used to maintain the values that sustained the organizational form or sector in its beginnings, while also providing the fuel for instrumental action and future growth, and leading to the institutionalization of an enchanted field. While not all industries or organizations are strongly rooted in movement values, examples of organizations using collective effervescence for both transcendental and instrumental purposes are common in many fields. For example, each year the business press describes the "pilgrimage" to Berkshire Hathaway's Annual Meeting, the so-called "Woodstock of Capitalism," where Berkshire investors congregate to listen to the "Oracle of Omaha" and reaffirm their belief in Benjamin Graham's principles of value investing—even when such beliefs cause investors to miss out on the heady returns from the latest investment fad or tech bubble (Matthews 2008). Similarly, each year "evangelical" Apple consumers come together at MacWorld and the Apple Worldwide Developer's Conference, giving rise to websites and media outlets such as "TheCultofMac" (Kahney 2002). In recent years, Chipotle has sponsored "Cultivate" festivals, where consumers can congregate to listen to music, view art and reaffirm their commitment to "sustainable, wholesome and delicious food" (Chipotle 2014).

Our project challenges theories of field emergence and institutionalization by showing that the institutionalization of a field may not lead its disenchantment when that organizational form is linked to emotionally-charged collective events. Rather, the collective effervescence of these events maintains, and may even rekindle, the values that gave birth to the field. In so doing, we reconcile Weber's typology of social action and theories of rationalization with Durkheim's theories of social solidarity and collective effervescence to show how emotion may be used in

service of reconciling rationality.

In addition to drawing upon and combining the work of classical theorists, this project adds to contemporary theories of social movements, organizations, markets, and institution-building projects. We show that emotional events can play an important role by mediating the effects of institutionalization and that fields, and their associated markets and organizational forms, may remain value- rational even as they become legitimate, efficient, and profitable. This suggests that social movement theory may remain relevant for the study of institutionalized fields when such fields feature events in which emotional energy is released. In such effervescent fields, we expect to find institutionalization leads to the co-evolution of movement and market rather than the displacement of movement by market.

Table 1. Distribution of Media Coverage by Media Type and Year

Year	US Regional	US Industry	US National	World	Total
2005	6	4	14	6	30
2006	9	10	17	15	51
2007	13	15	31	19	78
2008	22	10	19	21	72
2009	10	6	20	29	64
2010	12	19	38	50	119
2011	33	32	47	74	186
2012	47	35	75	103	270
Total	161	131	261	317	870

Table 2. Rationality Categories and Sub-Categories

Rationality Category	Sub-category	Sample words
Instrumentally-rational	Resources Commerce	Cash, credit, budget, finance, buyer, business, commercial
	Organizations / roles	Chairman, entrepreneur, job, owner
	Calculation (means/end)	Exploitation, logic, pragmatic
Value-rational	Generic	Grassroots, ideal, imagine, gift
	Togetherness / friendship	Friend, together, friendship
Emotion	Feeling	Admire, cheer, delight, excited
	Spectacle	Spectacular, magic, wild

Table 3. Top 25 Words for 18 Media Topics.

Corporate Topic 1	Tech Start Up Topic 2	Media Topic 3	Misc Topic 4	Business Topic 5	Hacker Space Topic 6	Open Community Topic 7	Public Institutions Topic 8	MAKE Magazine Topic 9	Consumer Robotics Topic 10
develop	technolog	show	now	busi	hacker	electron	digit	make	robot
creat	design	editor	way	compani	space	open	host	magazin	toy
world	tech	old	hand	take	work	commun	invent	media	product
africa	announc	life	home	cultur	internet	diy	time	chang	market
softwar	innov	camera	know	printer	comput	engin	citi	list	print
use	today	make	live	place	time	element	librari	talk	shop
app	nation	think	peopl	ever	hackerspac	Store	start	program	small
compani	challeng	artist	set	play	system	sparkfun	colleg	publish	wire
start	museum	becom	economi	better	hack	movement	free	oreilli	tech
microsoft	winner	everi	guid	citi	help	sourc	age	togeth	hit
media	showcas	silicon	easi	center	project	support	mean	power	come
applic	inc	food	everyth	innov	man	enthusiast	peopl	project	generat
person	name	local	network	year	data	verticalnew	tool	held	lab
tool	calif	part	fri	gun	group	collabor	anyth	video	consum
competit	entrepreneur	exhibit	long	learn	want	grow	parti	blog	line
arduino	alibr	reader	fun	word	big	sunday	year	point	perfect
get	win	technolog	highlight	electr	offic	knowledg	announc	touch	video
part	citizen	home	tuesday	hill	expand	join	giant	want	cut
respons	becom	stori	billion	north	among	heck	great	innov	ipod
receiv	introduc	use	seri	practic	plan	firm	motor	scene	programm
region	discuss	appl	team	social	popular	global	run	subscript	downtown
tri	educ	note	accus	move	forc	partner	smith	includ	launch
autodesk	valley	afford	oper	seek	satellit	week	big	stuff	right

Maker Faire Topic 11	Misc Topic 12	Funding Innovation Topic 13	Education Topic 14	Topic 15	Industrial Revolution Topic 16	Event Festival Topic 17	Arts and Crafts Topic 18
maker	releas	idea	build	littl	industri	creativ	art
fair	ford	confer	school	made	look	web	craft
scienc	student	detroit	high	need	manufactur	event	game
world	car	gadget	geek	book	mani	festiv	hous
area	issu	tinker	scientist	share	best	interact	peopl
mateo	univers	even	turn	watch	revolut	famili	inventor
weekend	future	live	still	educ	good	across	part
bay	follow	built	learn	public	chris	lead	find
counti	comput	see	california	cnn	experi	present	presid
annual	next	innov	crowd	give	focus	annual	show
workshop	texa	startup	give	technolog	project	site	thing
bring	aAmerica	complet	meet	devic	entrepreneur	award	gift
hall	research	differ	top	fix	million	newcastl	big
return	door	fund	econom	guru	money	celebr	imag
offer	connect	share	group	head	street	kick	photo
behind	expert	park	interest	build	welcom	sciencefest	obama
featur	vision	person	center	call	morn	globe	white
provid	collect	might	class	cool	mass	march	solut
visitor	consid	scout	model	day	movement	prnewswir	christma
camp	home	hobbyist	night	help	save	holiday	fire
skill	septemb	manag	organ	peopl	time	intern	see
technolog	eye	base	bit	compani	middl	sxsw	washington
queen	human	include	set	event	mind	come	attent

Table 4. Descriptive Statistics for the Analysis of Form of Social Action

Variable	Mean	SD	Min.	Max.
Instrumental rationality	0.008	0.008	0.000	0.078
Value rationality	0.012	0.009	0.000	0.081
Emotion (affect)	0.004	0.004	0.000	0.044
Maker Faire article	0.440	0.497	0.000	1.000
Entrepreneurship article	0.153	0.360	0.000	1.000
Industry coverage	0.151	0.358	0.000	1.000
National coverage	0.300	0.459	0.000	1.000
Regional coverage	0.185	0.389	0.000	1.000
World coverage	0.364	0.482	0.000	1.000
Org density	125.7	77.00	8.000	211.0
News coverage	435.5	251.3	1.000	870.0
Google 'maker' search	39.655	32.499	0.000	100.0
MAKE Mag ads	13.75	3.086	7.750	20.75
Article date	7.399	0.775	0.000	7.961
Article length	1,071	1,288	150	12,604

Note: These statistics are based on 870 media articles.

Statistics for the Analysis of Form of Social Action (continued)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
al														
	0.37													
	0.19	0.56												
e	-0.04	0.18	0.13											
ur.	0.18	0.04	-0.03	0.00										
	0.02	-0.03	-0.02	0.02	-0.06									
	-0.07	-0.10	-0.08	0.04	-0.01	-0.28								
	-0.01	0.08	0.02	-0.03	0.02	-0.20	-0.31							
	0.06	0.05	0.08	-0.03	0.04	-0.32	-0.50	-0.36						
y	0.09	0.15	0.03	0.07	0.16	-0.02	-0.07	0.00	0.08					
age	0.10	0.16	0.03	0.06	0.17	-0.03	-0.07	0.02	0.07	0.96				
aker" search	0.08	0.15	0.03	0.04	0.13	-0.04	-0.06	0.02	0.07	0.95	0.92			
	-0.03	0.02	0.03	0.04	-0.06	0.05	-0.02	-0.01	-0.01	-0.32	-0.29	-0.40		
e	0.03	0.15	0.03	0.15	0.12	-0.01	-0.07	-0.04	0.10	0.76	0.76	0.67	0.00	
gth	-0.22	-0.31	-0.19	-0.06	0.06	-0.01	0.18	-0.11	-0.08	0.03	0.03	0.03	-0.10	0.00

Table 5. Mediation Effects: Emotion and Value-Oriented Rationality, and Maker Faire Events

|	Emotion		Value rationality	
	Model 1	Model 2	Model 3	Model 4
Maker Faire	0.278***		0.245***	0.171***
	(0.074)		(0.048)	(0.044)
Emotion				49.463***
				(6.270)
Entrepreneurship	0.010	0.019***	0.022***	0.017***
	(0.009)	(0.005)	(0.005)	(0.004)
Industry	-0.167	-0.073	-0.088	-0.031
	(0.108)	(0.074)	(0.071)	(0.059)
National	-0.178*	-0.012	-0.031	0.047
	(0.085)	(0.062)	(0.062)	(0.056)
Regional	-0.085	0.081	0.081	0.125*
	(0.106)	(0.064)	(0.063)	(0.054)
Org. density (OD)	0.000	0.001	0.001*	0.001
	(0.001)	(0.000)	(0.000)	(0.000)
Article date	-0.021	0.101**	0.062	0.067*
	(0.059)	(0.037)	(0.034)	(0.032)
Chi2	57.32	142.1	172.6	379.2
Deg. Freedom	8	7	8	9

Note: * $p<0.05$, ** $p<0.01$, *** $p<0.001$ (two-tailed t tests). Standard errors in parentheses. N=870. Constant term and control for article length omitted. Baseline category for geography of the source is non-U.S. news

Table 6. Relationship between Instrumental, Value Rationality and Organizational Density.
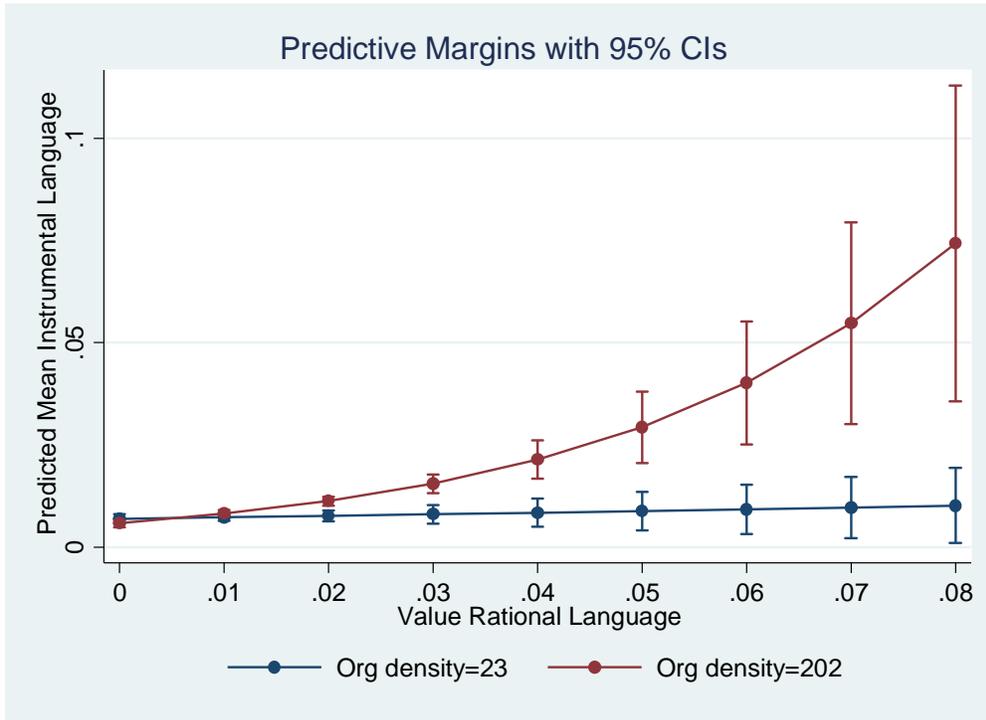
Instrumental Rationality	Model 1	Model 2	Model3	Model 4	Model 5
Value rational	25.6905***	1.2547	3.6346	7.5565	59.1057***
	(5.048)	(7.290)	(7.686)	(5.974)	(13.532)
Emotion	-5.8086	-14.5631	-12.419	-12.9084	-10.9776
	(10.139)	(10.683)	(10.663)	(10.499)	(10.424)
Org density	-0.0009				
	(0.001)				
Org density*Value	0.1556***				
	(0.042)				
Google "maker" searches		-0.0002			
		(0.000)			
Searches*Value		0.0390**			
		(0.012)			
Articles				-0.0034*	
				(0.001)	
Articles*Value				0.3300***	
				(0.078)	
MakeMag ads					0.0260*
					(0.013)
Ads*Value					-2.3920**
					(0.913)
Industry	0.0774	0.0541	0.0564	0.069	0.0945
	(0.082)	(0.082)	(0.083)	(0.082)	(0.083)
National	-0.0322	-0.011	-0.0238	-0.0098	-0.0055
	(0.072)	(0.069)	(0.069)	(0.070)	(0.071)
Region	-0.1337	-0.1478	-0.1582	-0.1478	-0.1416
	(0.089)	(0.086)	(0.088)	(0.084)	(0.086)
Article date	-0.0417	-0.0961*	-0.0913	-0.0485	-0.0515
	(0.034)	(0.045)	(0.047)	(0.041)	(0.034)
Maker Faire	-0.2167***	-0.1697**	-0.1709**	-0.1791**	-0.2075***
	(0.064)	(0.061)	(0.062)	(0.061)	(0.061)
Entrepreneurship	0.4789***	0.4357***	0.4377***	0.4462***	0.4581***
	(0.071)	(0.069)	(0.070)	(0.068)	(0.069)
Chi2	206.9	270.5	263.6	328.8	250.2
Deg freedom	9	11	11	11	11

Note: * p<0.05, ** p<0.01, *** p<0.001 (two-tailed t tests). Standard errors in parentheses. N=870. Constant term and control for article length omitted. Baseline category for geography of the source is non-U.S. news.
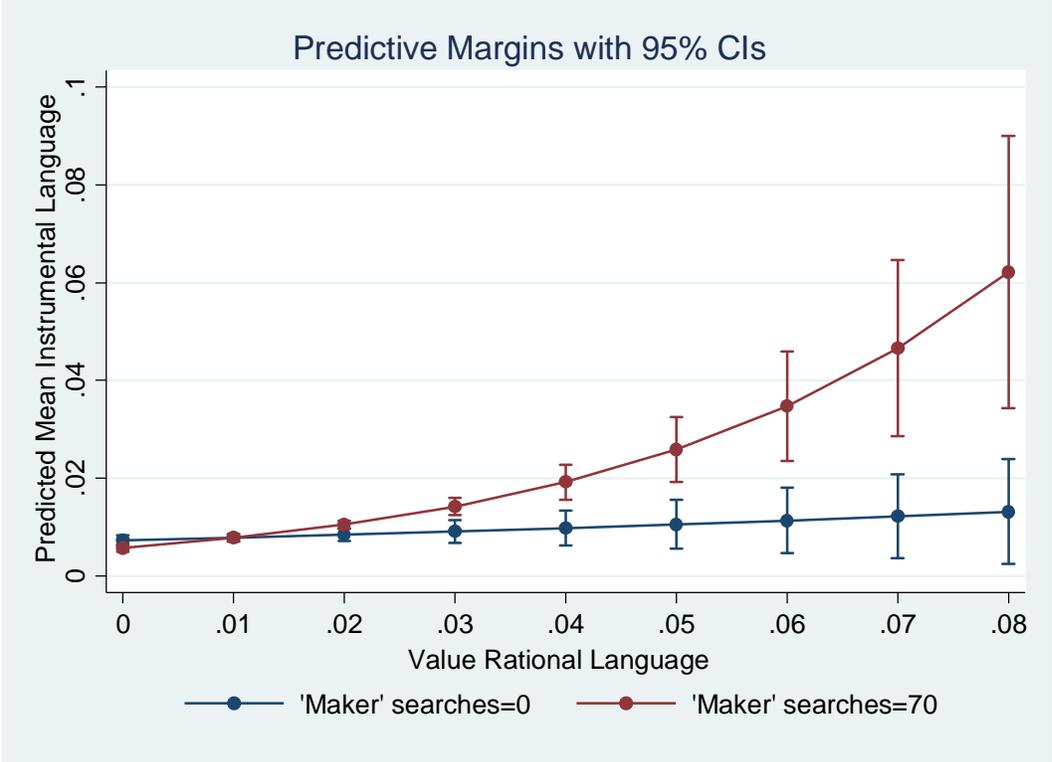
Figure 1. Lowess Regression of Maker Media Coverage Topics (2005-2013).
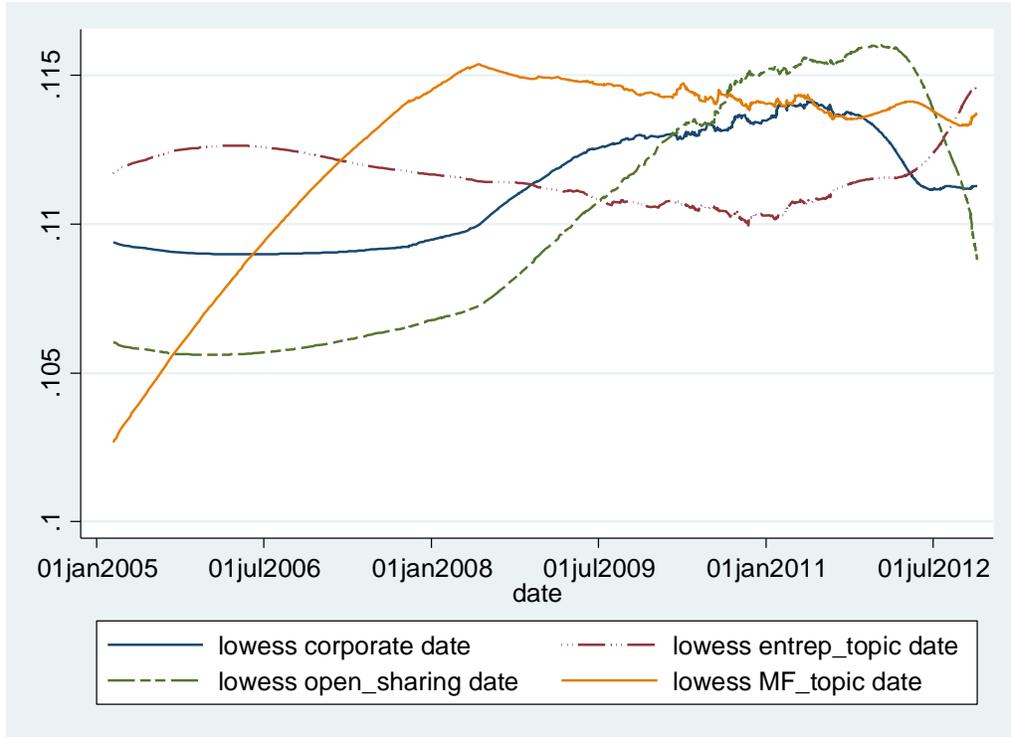
Figure 2. Value and Instrumental Rationality, and Organizational Density – Marginal Effects

Figure 3. Value and Instrumental Rationality, and Google 'Maker' Searches – Marginal Effects

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