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Issue-oriented hackathons as material participation

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Abstract
In recent years, intensive design and development events known as hackathons have become increasingly common. *Issue-oriented hackathons* are a subset of this trend that bring together ad hoc groups under the auspices of conceiving and prototyping technologies to address social conditions and concerns. In this article, we present ethnographic accounts of a set of issue-oriented hackathons that took place in the United States between 2012 and 2013, in order to explore how these events structure and express emerging forms of participation. Specifically, we propose that issue-oriented hackathons are sites of experimental material participation.

Keywords
Civic media, hackathons, issues, material participation, proto-publics, publics

Introduction

Hackathons are rapid design and development events at which volunteer participants come together to conceptualize, prototype, and make (mostly digital) products and services. The origin story of hackathons traces its inception to a Silicon Valley company, where purportedly they were first instantiated to quickly and nimbly address technical challenges. In recent years, hackathons have transitioned from being obscure, informal, gatherings to well-established, well-accepted, and well-funded events. The structure of most hackathons is similar: they occur over the span of day or two, challenges are presented to participants, teams form around these challenges, the teams engage in a fervor

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of activity to produce solutions of (varying completeness), and at the end of the event, the teams present their work, in some cases judges are brought in and awards are given.

Given their structure and intensity, hackathons present an interesting case study of contemporary sociotechnical arrangements, particularly with regard to design. To date, little has been written on hackathons. They do not fit neatly within any single literature, but rather find connections across multiple discourses. For instance, hackathons engage experts and non-experts alike and thus straddle the discourses on both expertise and amateur practice (Kleif and Faulkner, 2003; Kolko, 2010; Kuznetsov and Paulos, 2010; Wang and Kaye, 2011; Whalley, 1991). While hackathon participants often embody subjectivities such as those of tinkers (Faulkner, 2000; Waksman, 2004), geeks (Dunbar-Hester, 2008; Kelty, 2005), or even hackers (Perlman, 2004; Rosner and Bean, 2009; Soderberg, 2010), these subjectivities fail to define the events themselves. In yet other ways, hackathons expose trends in global innovation, capitalism, and labor under neoliberalism (Funahashi, 2013; Lukacs, 2013; Van de Poel, 2008; Van Oost et al., 2008).

Many hackathons are technically oriented: they focus on a specific programming language, media artifact, or platform, such as a javascript hackathon or a visualization hackathon or a mobile hackathon. Other events, however, are organized around social themes and conditions. For instance, from 31 May through 1 June 2013, the National Day of Civic Hacking took place as a series of simultaneous events across the United States. The National Day of Civic Hacking set out to develop "new solutions using publicly-released data, code and technology to solve challenges relevant to our neighborhoods, our cities, our states and our country" (http://hackforchange.org/). The National Day of Civic Hacking was a serial event, having taken place for two subsequent years. It was sponsored and led by a collection of global and national corporations, national foundations, civic technology organizations, and US government agencies, with support in individual cities from local businesses, universities, non-profits, and clubs. As events organized to address social themes and conditions, the National Day of Civic Hacking exemplifies what we call *issue-oriented* hackathons.

Calling out the issue-orientation of some hackathons is important for understanding and analyzing the work of these events—what they produce and how. Our argument, drawn from empirical research, is that while technological work is sometimes accomplished through these events, issue-oriented hackathons more significantly produce experiences of material participation. These experiences suggest new forms of social action, but fall short of constructing publics: groups committed to addressing a matter of concern.

What is meant by *issue-oriented*?

We use the term *issue-oriented* to distinguish a particular kind of hackathon. Commonly, hackathons are organized around technological formats or platforms, where technological exploration is the goal. In contrast, issue-oriented hackathons are organized around themes considered or cast as having a "social" quality, where social is used in the common, non-technical sense of denoting societal structure, relations, and effects. Our use of the phrase "issue-oriented" stems from work in Science and Technology Studies and

Design Studies that combines strands of American pragmatism and design to understand issue articulation and the formation of publics.

In particular, our interpretation of issues and publics is informed by the work of John Dewey (1927). For Dewey, an issue is a condition of concern. It comprises a multiplicity of factor and actors and their relations. Issues have consequences. These consequences may be in the present or they may be assumed future consequences of a current condition. Publics are called into being by issues—publics are formed around an issue, to attend to it conditions and consequences (Dewey, 1927). So, for Dewey, there is no singular general or generic public; a public is always associated by and through an issue. The articulation of an issue is key to a public forming around it. In a way this is commonsense: we have to be able to perceive a condition in order to be moved to, and know how to, take action on that condition. Issue articulation is the process of making the factors and actors of an issue known, such that they cohere together in a way that makes them coherent enough to act upon.

In earlier work, we examined what might be the roles of design in the articulation of issues and the formation of publics. This initially focused on the work of professional designers (DiSalvo, 2009) and then in subsequent research on how designers and community residents might work together in collective efforts of issue articulation (DiSalvo et al., 2011) and the formation publics (Le Dantec and DiSalvo, 2013). Other scholars have similarly looked at the role of design and participation in the construction of publics, with different orientation and context. Most closely aligned is the work of Binder et al. (2011), Björgvinsson et al. (2010) and Ehn (2008) who have brought the work of Bruno Latour into a conversation with design. This movie is not surprising since Latour (2005) himself has drawn upon Dewey in his conception of an object-oriented politics.

Our analysis of hackathons has been most influenced by the work of Noortje Marres (2005, 2007, 2012) who also draws upon John Dewey to characterize issues and positions issues as central to contemporary controversies. Marres updates the pragmatists' notion where it falters; two points are particularly important here. First, for Dewey, it seems that issues exist prior to intervention, that is, issues are given. For Marres, an issue, its consequences, and its boundaries are negotiated rather than given. Second, Marres points out that Dewey was committed to the notion that an issue could be settled, if not always fixed: they "conceived of public involvement in politics as being occasioned by, and providing a way to settle, controversies that existing institutions were unable to resolve." (Marres, 2007) But, as Marres (2012) points out, contemporary discussions of controversies (and more generally politics) suggest that "resolution," particularly when regarded as synonymous with "solution," may not be possible.

Ultimately, it is Marres' notion of how this participation in issues occurs that is important to our analysis of issue-oriented hackathons. For Marres, devices (i.e. designed things) structure and mediate participation because they structure and embody the ways publics and issues are and can be negotiated. For example, she highlights an energy use campaign that is accompanied by a poster with various everyday objects. "When objects like light bulbs, plastic bags or compost are used as 'poster objects' for public campaigns, they are *explicitly* attributed the ability to mediate engagement in public affairs" (Marres, 2012; original emphasis). What she means by this is that objects like the light bulb become a means to participating in a broader issue of energy conservation as they

are a *site* of that participation. This is accomplished insofar as one engages with the light bulb under the regime of conservation, therefore changing the relationship between a person and a light bulb into one of energy consumption/conservation rather than just power delivery. Material participation, then, is a means of (re)framing relations in terms of relevance, thereby distributing the sites of engagement with issues and expanding the scope of a public.

We label a hackathon issue-oriented, then, when it is motivated by and organized around a specific set of conditions and consequences with the intention of addressing those conditions and consequences. This does not mean resolving those conditions and consequences, but rather, after Marres, materially participating in negotiating the boundaries and effects of the issue, that is, participating in issue articulation. If, then, we accept the label of issue-oriented hackathon to characterize these events, does issue articulation actually occur in these events, and if so, how? Moreover, does this lead to the formation of publics?

From our empirical work, we argue that issue-oriented hackathons *are* sites of material participation, through which attendees collaboratively undertake the design and making of things—databases, application programming interfaces (APIs), interfaces, visualizations, maps, apps, and so on—that give form to the conditions and consequences of issues. Without a doubt, there are peculiar characteristics of this process and there are limitations due to the structure and experience of hackathons as events. Still, the issue-oriented hackathon do seem to enable, in distinctive ways, the articulation of issues. In what follows, we describe two issue-oriented hackathons and trace the process of material participation through them.

Two accounts of issue-oriented hackathons

As design researchers, we are interested in identifying and describing new modes of design practice and how these new modes of design practice contribute to public life. More specifically, we are interested in how new modes of design practice contribute to processes of issue articulation and the formation of publics. Hackathons are a compelling site for ethnographic study because they can be interpreted as a new mode of design practice, which brings together a diversity of participants (experts and novices, professionals, and amateurs) to conceptualize and develop new products and services.

As part of ongoing research, we have conducted participant observation at 12 hackathons over 3 years. In selecting these hackathons, we focused on events that presented the subject matter of the hackathon as pertaining to societal conditions or concerns. The hackathons at which we engaged in participant observation include EcoHack3 (New York City), EcoHack4 (San Francisco), Hack//Meat (New York City), Govathon (Atlanta), Mobilize Community (Atlanta), National Day of Civic Hacking 2013 (Atlanta and Los Angeles), and National Day of Civic Hacking 2014 (Atlanta). All of these hackathons took place within the United States, and moreover within cities, and as such they were contextualized to these locales. Rather than an exhaustive survey of hackathons, we present an in-depth examination of two: EcoHack3 and Hack//Meat. We selected these two because they focus on entirely different social conditions and concerns and thereby highlight the commonalities that cross issue-oriented hackathons as events.

That is, the commonalities are not due to shared specific conditions or concerns, but rather to a shared perspective of issue-orientation. Focusing on these two hackathons, then, allows us to make more generally empirically informed claims about the character of issue-oriented hackathons.

Setting the state for issues: the general structure and experience of hackathons

Most hackathons follow a similar structure: they take place in a designated locale for a set period of time, they begin with the presentation of challenges by sponsors or others proposing challenges, teams form to work on the challenges, and they end with the presentation of solutions conceived in response to those challenges. Oftentimes, the solutions are judged, with a winner being declared. Our focus in this article is on the work done on the challenges, as that is the primary site and time of material participation. But it is important to get an overview of the general structure and experience of these hackathons before the specifics of issue articulation.

Both of the hackathons discussed in this article took place in the late 2012 in New York City. EcoHack3 occurred over 2 days in early November in Brooklyn and focused on issues related to sustainability and ecology, such as deforestation, water runoff, protected lands, and habitat encroachment. Hack//Meat occurred in early December in Manhattan and focused on contemporary issues within the (United States) meat industry such as large-scale processing, access and distribution, and consumption patterns.

EcoHack3 and Hack//Meat were each part of a series. EcoHack3 was the third in a series of events focusing on sustainability and ecological issues. Hack//Meat was also the third in a series of hackathons organized by the lead organization, Food + Tech Connect. The previous events were broadly interested in food system issues, though not the meat industry in particular. Alongside the lead organizations, both events had a variety of co-sponsors and co-organizers. At EcoHack3, these additional organizations included several web start-ups related to mapping and information systems—CartoDB and MapBox, both web-based mapping software; Vizzuality, a design studio often working with CartoDB; and REDD Metrics, a software company focused on large spatial dataset processing. At Hack//Meat, the various co-organizers and co-sponsors included a variety of food- and sustainability-related companies—GRACE communications, an advocacy organization raising awareness about the interconnectedness of food, water, and energy systems; Applegate Farms, a relatively large organic and natural meat company; and Food and Water Watch, a non-profit research organization tracking the health and safety of food and water access in the United States.

The character of hackathons is, in part, determined by the venue and the resources available to participants. EcoHack3 was a low-budget affair in many ways. The event was free to participants, and most of the food and drink was either donated or paid for by the organizers. Hosted within a recently repurposed Pfizer Pharmaceuticals building that housed a variety of small organizations and businesses, the event took place in an unused common space that was a yet-to-be renovated cafeteria. As the building was still being renovated, the building owner did not charge for the space in the hopes of encouraging

more events in the future. In contrast, Hack//Meat was hosted in a modern, membership-based collaborative work space for freelance and mobile workers in overlooking Park Avenue. Unlike the Pfizer building, the space was set up for group work and fast-paced collaboration. Two glass-walled conference rooms were available, each with white-boards, cork boards, and a large table. A presentation area, holding approximately 50 chairs, an overhead projector, and a speaker system occupied another portion of the venue. There was a coffee station, art on the white walls, and a large typographic display with the space's motto "Work Liquid." The event costs US$10. The food and drink included an opening meal of artisanal meat, organic pickles, and a variety of locally sourced cheese. Unlike EcoHack3, Hack//Meat was set up more like a competition with a US$2500 prize to develop the best idea further.

As much as hackathons are cast as work-oriented events, they are also social gatherings. Occurring (most often) on the weekends, hackathons compete with the free time of attendees. Many of the participants are leveraging skills typically used in a professional setting, whether that being their own employment or not. This hybrid of work and leisure resonates with discussions of "inventive leisure practices" (Wang and Kaye, 2011), hacker communities (Faulkner, 2000; Soderberg, 2010), and technology hobbyists (Kleif and Faulkner, 2003). For instance, Wang and Kaye (2011) note that such communities are deeply dependent on a technically oriented sociality, where skill sharing, project-based trial and error, and the politics of self-making constitute the unifying ideology. Likewise, while hobbyists may also be professionals in, say, robotics to use an example from Kleif and Faulkner (2003), their leisure activities are partially an exercise of engaging their professional skills with "more latitude and control" than available in a professional setting. These parallel discourses offer insight into the motivations of how attendees come to devote a weekend to engage similar activities to their work.

Oftentimes, the line between the socializing and the work of the hackathon is blurred. For instance, at EcoHack3, I spoke with Kathryn, an entomologist from the American Museum of Natural History, over bagels and coffee as we both arrived early Saturday morning. Kathryn used the conversation to find out more about my background and pitch her project. Since we both had a shared interest in global climate change, she explained her project mapping an entomology database in such terms. Kathryn explained that while entomologists understand the need for the database, her colleagues still struggle with what to do with it. Data-driven conclusions, as she further explained, are outside the typical scientific practice of entomology. Even a rudimentary visualization could garner more immediate financial, social, institutional, and cross-domain support for the project. She argued that the particular patterns of insect maturation might indicate changes in climate. And she implied that my knowledge and skills in design and development might be of particular use in helping achieve her goals for this hackathon.

Presenting issues as problems

It is the challenges that give content to the form of issue-oriented hackathons. Through the challenges, issues are first presented as problems. These presentations have dual purposes. The first is to communicate the conditions and consequences of an issue, such that it can generally be understood. The second, building upon the first, is to make the

prospect of attending to that particular issue enticing, to rally attendees to participate with the issue.

At EcoHack3, the challenge presentations began with Jeremy, a designer at Vizzuality, introducing the event. He explained the broader concerns of EcoHack3 and plugged various sponsors and organizers. Twelve presentations followed, 10 of which were related to challenges,[1] such as geographic datasets, satellite imagery, and wetlands building permits. Four presentations came from professional scientists from research institutes such as the American Museum of Natural History and academic institutes such as City College of New York. Seven of the challenges dealt specifically with the environment and ecology (e.g. deforestation, sewage runoff, and fauna extinction), while the other three focused on secondary or indirect impacts on the environment (e.g. bike transportation, farming practices, and post-hurricane recovery). One of the presentations was a project carried forward from EcoHack1. Not surprisingly, these presentations had a distinctive ecological character in which they described, for example, the relationship between sewage runoff, household water usage, the operating standards of water treatment plants, downpours, bacteria, and waterways. But more than simply presenting an issue, the issue has to be presented in a way that was tractable—that is, it needs to be made into a problem. This can sometime come in a roundabout way, such as proposing a solution and then shifting the problem to one of producing that solution. For instance, in the case of the EcoHack3 challenge concerning sewage runoff, the presenter suggested that a citizen-led water monitoring program might be a way to attend to the issue of sewage runoff. Through this move, the issue of sewage runoff was transformed into a design problem: how to conceptualize and produce a suite of digital tools to coordinate citizen sensing.

In such moves from issues to problems, parameters are set which both make possible an immediate move to design and also foreclosing inquiry into the issue. For instance, the presentation of the sewage runoff project elides an investigation of relationships among various components of the issue—rivers, rain, policies, and sewage—and instead moves immediately to transform that issue into a problem, so defined that the solution is already determined: a proposed data analysis of rainfall and instances of overflow. In this rapid transformation of an issue into a technical problem, there was no room left to construct alternate explanations of sewage in the East River.

Similar occurrences transpired at Hack//Meat. The kick-off presentations began with an introduction from Destin, a co-organizer from GRACE communications. She started, "the meat system is broken" and went on to highlight consolidation, antibiotics, and environmental issues as the core indicators of such. She continued, "[t]hankfully there are solutions and we're all here to come together to start […] innovating new solutions." Danielle, head of Food+Tech Connect, followed and explained the purpose of Hack//Meat was to "look at the unique challenges for food and [start] off with better ways to understand the problems and innovate solutions." When they finished, six challenge presentations followed. Four presentations came from consumer-centric organizations and two came from industry stakeholders (Applegate Farms and a farming organization from Vermont). Consumer Union, for example, requested clearer labeling on meat products. Applegate Farms wanted an application developed to better match grocery store's offerings with the neighborhood needs. The Vermont Working Group asked for help matching small farmers with small slaughterhouses.

The subsequent presentations situated their challenges within complex networks of relations, though quickly simplified matters by asking for a particular outcome. For instance, the Food and Water Watch presenter spoke of the relation of personal consumption, expansive farm consolidation, governmental policies, and ecology. Without debate, the presenter simplified these relations into a specific problem and solution: industrialized farming negatively impacts local economies and environments, and better awareness can change this. Like Destin's claim that "the meat system is broken," the challenge presentations took a particular stance with regard to meat production and consumption: industrial farming is the problem, and with some thought (and technology), this problem can be remedied.

Ironically, then, in an attempt to enable addressing issues, the complex, complicated, and negotiated character of the conditions and consequences comprising an issue are transformed into goal-directed and self-interested requests for work. In other words, a *dynamic* field of relations and causalities is cast into a problem, that is, a *static* set of relations and causality. As we will see, while issues may be simplified during the course of the presentations—removing their complexity in an attempt to offer productive ground to act—the ad hoc character of the working groups at hackathons forces the underlying conditions and consequences back to the surface. The next section begins to show how issues reemerge as working groups question and often change the problem at hand and doing so re-expose the issue as a messy contested space.

Orienting toward issues

In the case of both EcoHack3 and Hack//Meat, the challenge presentations occurred the evening prior to the first full day of work. The following mornings, as attendees gathered, groups began to coalesce around various topics. These processes of grouping (and regrouping and ungrouping) around the various challenges shed light on how attendees re-instantiate problem as issues.

At EcoHack3, the 10 challenges were presented as distinct topics on Friday evening, requiring attention and detail all their own. Saturday morning, groups and challenges intermingled as attendees with similar interests or complementary skills sought each other out. For example, two challenge presenters spoke about rasterized satellite imagery: one with regard to animal extinction in Madagascar; the other, global patterns of deforestation. For these challenge presenters, the technical similarities inevitably trumped the subject matter differences because the technical similarities offered a promise at arriving at something closer to a general approach, if not a specific solution. So, these groups were initially separate, yet over the course of the day, these two topics and participants merged as they had similar technical concerns. This technical similarity led to a co-mingling of workflows between the projects. As tasks needed to be sequenced, members had downtime allowing them to switch between the groups. Ultimately, this resulted in the articulation of a new problem/solution space organized around and through the issues related to the use of imagery to monitor global climate change, born of the technical complexities of raster image manipulation.

While some groups coalesced around emergent conjoint issues, others splintered as issues unfolded into multiple sets of conditions requiring attention. For instance, one

group focused on mapping a bike share program in New York City split into three smaller working groups. The majority of people who identified as designers at the event gravitated to this group as the presenter was a designer himself and a colleague of some. The topic offered a variety of approaches, and after a large group meeting, subgroups formed: one group focused on information design, another group worked on the hardware, and the last group developed a map for bike riders. The split followed skill areas, where, for example, many of the designers, feeling excluded from the technical tasks, worked on information design. Here, tasks were less sequential, allowing the map subgroup to work on different parts at the same time and the whole group to work in parallel, only to reconvene at the end. As a collective, these subgroups presented the concerns of the bike share program as the interplay among technical concerns (what *can* be collected?), sociocultural practices (what data are *worth* collecting?), and technological constraints (how will people *access* this information?).

Similar grouping and ungrouping occurred at Hack//Meat. There I sat with the Food and Water Watch working group. During Friday, the challenge stakeholder, Kelly, presented a report produced by Food and Water Watch. She explained that the report provides a multi-sited, multi-industry study of the long-term local effects of consolidation and industrialization of agriculture across the United States. She wanted help communicating the study, which was comprehensive, but inaccessible to audiences outside of policymakers and experts. Kelly asked the group to tailor a portion of the report—the information and data related to pig farms—to be more accessible to a broader audience.

After a presentation about how to structure ideation from a group called Design Gym, a group of approximately 12 people sat with Kelly for a discussion. Kelly rehashed the presentation for the previous night. Here, she expanded on her challenge, asking the group to make the report more actionable. By actionable, Kelly explained that consumers often do not understand the broader impacts of their purchasing decisions. She wanted the working group to communicate both these hidden impacts and provide a means for individuals to, say, change their purchasing or inform others. In this way, the challenge shifted focus from information access to information use. As Kelly spoke, group members asked for clarification. Questions ranged from particular aspects about the available data to broader concerns about what types of purchase decisions were good ones. With the group was a representative from Design Gym, Patrick, whose aim was to guide the group through an ideation process. After 20 minutes of discussion, Patrick instructed the group to break up into smaller groups for brainstorming.

My subgroup was composed of three other members, all of whom self-identified as developers. This subgroup's task was to reflect and pull out themes from the discussion. To do so, we were to supposed to write on sticky notes and place them on the wall, eventually grouping them into meaningful categories. As we talked, Patrick occasionally interrupted to direct our discussion away from particular outcomes. For instance, two notes were placed on the wall that read "network graph" and "interactive visual tool." Patrick explained that the group should not frame ideas in terms of a given skill set; these notes were subsequently removed and set aside.

Although Patrick understood these tabled ideas as framing the problem in terms of a given skill set, my observations pointed to a different interpretation. While offered as potential outcomes, these early ideas seemed fully formed prior to any discussion

whatsoever. The two developers in question expressed an interest prior to brainstorming in these outcomes. They selected the Food and Water Watch challenge not because of a topical interest in the issue but because they viewed this challenge as fertile for the technical outcomes they were interested in pursuing. Thus, this challenge groups formed, in part, due to attendees' perceptions of what type of work and skills would be useful. In other words, the self-selection process at the individual level and the grouping process at the collective level can be understood as a type of bottom-up resource management. By selecting a group, attendees had already opted to prioritize certain skills. As such, different working groups were endowed with different, particular, potentials. This was made even more evident when these members left the working group altogether when they felt its direction did not serve their desires. Instead, they worked together on an interactive visual tool.

Iteration through (technical) issues

As became apparent early on, working groups quickly arrive at technical tasks and through this, problems are reformulated. Issues continue to be negotiated and articulated, albeit often through the filters of technical capabilities. These capabilities refer *both* to the skills of the participants and to the capacities of a given technical system. Moreover, the technical tasks are rarely easily executable; they often require expert knowledge access to multiple platforms. As such, these tasks are often aspirational, leading groups to scale back on their initially intended outcomes to more manageable, and often altogether different, technical tasks, which in turn, iteratively, refactors the problem and issue.

At EcoHack3, I worked with Brian mapping Kathryn's entomology database. Her initial request focused on being able to place various data points on a map based on collection date and being able to modulate the display of points based on the maturation of the collected specimen. We decided to use the CartoDB mapping platform since it was free and its developers were present for support. Immediately, we ran into its limitations. The raw dataset was ~150 MB; CartoDB could only accept 100 KB chunks of data at a time (and a maximum of 5 MB for a free plan). To meet these requirements, Brian simply compressed the dataset (~20 minutes) at first. Once completed, I uploaded it (~40 minutes), only to receive an error from CartoDB that the dataset was too large. On the subsequent attempts, Brian began by asking Kathryn which columns or rows could be removed without compromising the map. Kathryn, who scanned through the dataset on her computer, told Brian which parts were less important (e.g. additional contextual notes, name of collector, and entries without location information). This dataset proved to be still too large. In discussing the situation with Kathryn, she explained that aphids were good indicators of climate change due to their maturation cycle. So on the second attempt, Brian exported a smaller dataset of just aphids. However, this subset was still too large. The trial-and-error process of shrinking the dataset occurred several more times, each taking close to an hour. During this time, Brian and Kathryn over and again discussed what could be removed, shrinking the database in the process, and iteratively negotiating and redefining the boundary conditions of the issue and how the issue was to be expressed.

Several hours into working and after multiple failed upload attempts, I approached an organizer, Jeremy. After explaining our issues, he gave our group access to a shared premium account that he set up earlier for another group at EcoHack3 who struggled with similar upload limitations. This account had higher tolerances for data upload and storage, rendering much of the previous work Brian, Kathryn, and I did unnecessary. When I returned to discuss the upgraded account with Brian, we decided to upload an earlier, larger dataset as it was more comprehensive of aphids—once again changing the boundaries of the conditions of the issue that had previously been negotiated.

Since upload limits were no longer constraints, we shifted away from scaling down the dataset. Instead, we focused on reformatting the dataset for requirements of CartoDB; this took several attempts. CartoDB required specific columns (latitude, longitude, date, timestamp, and identifier/text field), each of which needed to be properly filled in to produce a map. Still to this point, our task was to get data simply displayed on the map. In an attempt to produce a time series, however, Brian and I shifted focus on the date column, choosing to ignore the other aspects of the dataset.

Many of the primary-source bug notes were undated or dated only with the year, leaving their digital record without a day-month-year timestamp. Rather than removing these entries (Kathryn thought these entries were important), we assigned those without dates the earliest recorded year (1700); those entries with only years (including those we just assigned 1700) were given the date of 1 January of their year. We realized these formatting issues only after subsequent uploads and reformatting took three attempts (close to 3 hours). With the help of Jeremy, we eventually uploaded a dataset with properly formatted entries.

Now that the dataset could be viewed on a map, Jeremy showed us a plug-in to allow the data points to appear as an auto-progressing time series. Due to the limitations of the data and the limitations of the mapping software and plug-in, the time-series map offered a much less granular and much less able to be manipulated view of the data. Kathryn, however, still thought the resultant map showed something of interest with regard to the collection patterns of entomologists over time. So, throughout these negotiations, the end result was an artifact that engaged with an aspect of the issue that motivated the initial problem, but with different conditions than had been initially proposed. This process of negotiation exemplifies the dynamic trade-offs made "in the moment" at hackathons, between the capabilities of a technology and the desires of an actor or actors striving to express an issue through that technology. The design solution is often far from optimal either with regard to the technology or the standards of domain (e.g. entomology) but instead is "good enough" for communicating some aspects of the issue.

At Hack//Meat, I sat with a group exploring options for using visualization techniques and forms to amplify the data provided by Food and Water Watch. The group had already begun working on a clickable, web-based infographic intended to present the data through a sequential and sensational reveal. The initial whiteboard sketches presented showed a series of five screens which progressively revealed "hidden costs" associated with different types of pork chops. The first screen sketch showed three pork chops raised under various farming practices (e.g. industrial, small scale, and organic), one of which would be clicked. The next sketch showed a series of charts and graphs demonstrating how the cost of that pork chop was distributed to, say, the farmer, the distributor,

and the company (in the case of an industrial farm), and how that farming practice impacted the local community's economy. The subsequent screens showed different graphs and charts, ending with the contact information of a local government representative, provided a cue and affordance for "taking action"—contacting a governmental representative to register one's opinion.

During the pre-lunch presentations, Kelly from Food Water Watch liked the final screen that allowed users to send a Twitter message to the legislators in their district. In discussing the design of the infographic, she warned against extrapolating the data for rhetorical effects, as it was important for the Food and Water Watch to communicate grounded claims and not unduly sensationalize the issue. By afternoon, the infographic became a vertical scrolling webpage that dramatized the narrative of the report and highlighted sections to provoke action. As one scrolled through the different sections, a sidebar allowed the user to easily send out location-aware and topical Twitter message, thereby enhancing the functionality Kelly wanted. This simple act of shifting emphasis transformed the project. Initially, the problem had been how to communicate the conditions and consequences of a given issue. In the new form, the project transformed to addressing concerns about how to enable engagement among various actors within the issue.

Across these examples of the entomology database and map from EcoHack3 and the clickable infographic from Hack//Meat, the decisions and practicalities of working with technical artifacts unpack actionable problems as issues. Kathryn attended EcoHack3 because she wanted to show what data visualization can offer entomology in the hopes of encouraging entomologists to engage in this work themselves. Her goals were thus both practical for her own project and aspirational for her field. The barriers for Kathryn were at the intersection of the standards for her professional practice as an entomologist and the capabilities of the database technologies used at the hackathon: mapping the insect database required data standards that were different from the historical practices of entomologists. In a similar way at Hack//Meat, the working groups initially proposed ideas that were aspirational. Kelly's input aligned these ideas more with the Food and Water Watch mission of providing fact-based reporting. This mission, as Kelly explained, was not just an ethical stance, but a legal one too. In response, the group shifted focus, trying to use the report to encourage action, while also being respectful of the Food and Water Watch's position within their domain and their desire not to unduly sensationalize the data.

Prototype "solutions"

While we have emphasized the processes of issue-oriented hackathons, we would be remiss not to mention the outcomes as well—the solutions presented at the end of the hackathon. At the close of EcoHack3, groups showed much less developed projects than at Hack//Meat. This is most certainly due to, at least in part, the shorter time frame for the event. But time was not the only difference between the events. The close of Hack//Meat included a showcase of the various projects before judges. Projects were openly evaluated and later the "best" projects were announced with the winning group receiving US$2500. In this regard, Hack//Meat had a wholly different goal than EcoHack3, emphasizing the polish and completeness of prototypes as plausible products or services. Nonetheless, both events included final presentations of prototypes. Below are five

selected descriptions of these presentations (two from EcoHack3 and three from Hack// Meat, respectively) which provide an overview of the kinds of solutions arrived at through the course of the hackathon.

Bike share (EcoHack3)

The bike share group spoke of their process primarily. Broken into three working subgroups, this group presented each subgroup's work in turn, discussing future plans to connect these parts. The first subgroup, composed primarily of self-identified non-technical designers, explained they spend the day brainstorming information architectures. They showed several lists of to-be-collected data. The next subgroup, holding a bike wheel, spoke of their work outfitting a bicycle with a prototyping platform (Raspberry Pi). They explained, in conjunction with the first subgroup, that data are typically collected only at the bike share hubs, excluding the space between. The outfitted bike would provide vital information about where people "actually ride." The third subgroup showed a JavaScript-based map. Their map queried a limit radius to help inform riders of nearby bike racks, shops, incident reports, and traffic issues. As no data existed, the group explained they used placeholder points and spent the day working on the immediate technical challenges of search radii.

Sewage runoff (EcoHack3)

This is the third iteration of this challenge (previously worked on at the preceding EcoHacks and run by Louis of PLOTS), this group spent the day looking at paper water reports. The group used the culled data to produce a static web-based graph of when water plants closed of their valves due to precipitation overflow. Louis explained that in combination with sensors already deployed but lacking data, the prediction graph will render incoming data more intelligible.

Carv (Hack//Meat, winner)

Coming out of a challenge focused on small and independent slaughterhouses and farms, Carv was a proposal for a networked scale to keep track of weights and cuts of meat in the slaughterhouse. One problem is tracking slaughtered animals as the systems are typically non-computerized. The current system uses a keypad and prints out a slip that is physically attached to the meat. This takes both time and effort on the part of slaughterhouse owners. Carv is a proposal for an Internet-enabled scale. The presentation included a prototype of a smartphone application which could upload a weight to a website using a digital scale.

Slot for Slaught (Hack//Meat, runner-up)

Coming out of the same challenge as Carv, Slot for Slaught was a web portal for farmers and slaughterhouses to track and schedule slaughter. The group showed a custom-built Wordpress theme which served as a scheduling portal for slaughterhouses and farmers.

Farmer can login, submit a form (a cut sheet), and pick from available dates. Likewise, butchers can login, report progress, and schedule availability.

Meat (Hack//Meat, second runner-up)

Coming out of the Applegate Farms challenge, Meat was a phone application to geolocate demand requests within specific grocery stores. Applegate wanted a better way to match their products with their customers. Meat integrates with location services from FourSquare to offer a smartphone application to locate request for products. The prototype was presented by the sole group member. He showed how customers could request a new product while in a store. Requests would be sent to the store manager who can make stocking requests. Other customers could submit duplicate requests to show demand.

Despite differences in domain and technologies used or proposed, these solutions share multiple qualities. First and foremost, they are all prototypes. By design, they suggest functionality and use, without fully providing that functionality or capacity for use. As prototypes, they are expressed and understood through narrative. The various interfaces, visualizations, apps, and databases, each at various scales of completeness, serve as props to explicate that narrative. These prototypes, then, are not solutions to an issue, but rather articulations of the factors, actors, and relations enumerated and negotiated in the definition of the issue. The prototypes give form to issues, instantiating them through representations of screens and enacting them through partial interactivity. Through this process of prototyping, participants in the hackathon are making an issue present and actionable by means of the contingent and partial formats of the model apps, maps, websites, and visualizations that are commonly seen as the outcomes of the event. But, in fact, it is the process of collaborative issue articulation through prototyping that constitutes the material participation that is the key product of issue-oriented hackathons.

Hackathons as issue-oriented events

Simply stated, EcoHack3 and Hack//Meat are issue-oriented because they are organized around a set of social concerns. But as is commonly the case with issues, the various factors that comprise an issue are not well defined at the outset. The process of negotiating the boundaries of an issue and giving it definition is the process of issue articulation; it is how issues come to be known, so that they might be acted upon. Our notion of articulation here is informed by the work of Stuart Hall (1996), for whom articulation is "the form of the connection that can make a unity of two different elements, under certain conditions" (p. 53). Issues are articulated, then, when the factors that comprise and issue are connected together in a way that allows one to perceive the potential consequences of the issue and identifies ways one might act on the condition. As suggested in the preceding section, in issue-oriented hackathons, this process unfolds through the activities of design*ing* and prototyp*ing* a technological artifact, service, or system.

However, if the prototypes work to give form to an issue more so than to actually address the conditions or consequences of an issue, in what ways and to what extent are the issues being engaged? As a starting point in questioning issue-orientation, it is worth noting that the issues are, by and large, not expressed as controversies. Indeed, the

underlying controversies that comprise issues are, more often than not, simply not made present in hackathons. For example, in Hack//Meat, the histories and trajectories of meat consumption are largely absent from the event. Industrialized meat is taken, unproblematically, as "bad," and any attempt to move away from this condition is seen as "good." With EcoHack3, being ecologically committed was taken as a generic, de facto position. Moreover, there was no exploration or even discussion of how any proposed solutions might have secondary effects. As has been argued by many design researchers interested in the role of design in the construction of publics (Björgvinsson et al., 2010; DiSalvo, 2012a), identifying, communicating, and enabling others to express and participate in the contestational aspects of issues is an important endeavor. This, largely, and ironically, seems to be lacking from most issue-oriented hackathons.

With a perceived focus on invention over contestation, it would seem that issue-oriented hackathons are quintessential solutionist events (Morozov, 2013)—seeking to operationalize and solve the conditions of a given issue. But the structures, participants, and processes do not, in fact, lend themselves to achieving solutions through invention. This was certainly the case with EcoHack3 and Hack//Meat. Consider, for example, the visualizations constructed from the American Museum of Natural History insect database at EcoHack3. These were partial and so merely a contribution toward another system. Likewise with Hack//Meat, what was produced were (barely) prototypes, not operational products or services. The winning project, Carv, was little more than a short description, a believable logo, and a simple prototype that uploaded a number to a database. The Carv project won not because it solved the issue of scaling small-scale agriculture in Vermont but instead because it demonstrated a claim concerning the possibility of designing technology for the small-scale meat industry. Likewise, the visualizations of the insect database were considered successful in that they might be used to support an argument for using data-driven scientific practice in a field with slow technological adoption.

With issue-oriented hackathons, then, the question of what is invented may be beside the point. The point is not whether, how, or to what extent an operational product, prototype, or code is created. Rather, what is important is how the event structures and allows for development of relations. Both Carv and #Meat demonstrated the potential alignment of desires, resources, and capacities between the plurality of stakeholders, technologies, conditions, and consequences that constituted the issue. The event was a temporary, ad hoc collective of sorts, suggestive of what might be enrolled and, in that process, what relations might be produced, to address the issue. One implication of understanding the hackathon as an event is that it shifts the analysis and judgment of the hackathon from material *production* to material *participation*, that is, what is important is not the inventiveness of a particular prototype product or service, but rather, how the event fosters opportunities for collaborative or collective issue articulation.

Two modes of material participation at issue-oriented hackathons

As a final analytic point, we can identify at least two modes of martial participation in issue-oriented hackathons. Recognizing these modes, and calling out their differences

from Marres' discussion of material participation, should contribute to our understanding of these events—what they produce and how.

In the first mode of material participation, individual groups create props for material participation, that is, objects, services, and systems that engage with issues. These props align with Marres' devices, but they are not fully designed things; they are prototypes targeting proposed end users in virtual scenarios. For example, the insect database and map, for Kathryn, was a necessary artifact to introduce other entomologists to the idea of data-driven approaches to her field. In doing so, she claimed entomologists could begin making connections with other domains like environmental scientists and ecologists who needed tangible examples of, say, climate change. These potential scenarios drove us to try to upload as much of the database into the mapping platform, so she could make broad arguments for such an approach. Moreover, the database itself served as a prop, where David's decision to exclude a series of columns at Kathryn's behest was not just database manipulation, but actions taken upon an ecological site: what indicates ecological change and what are just bugs. In this first mode of material participation, the sites of participation are objects themselves imbued with contextual meaning through the event.

The second mode of material participation concerns publics. These ad hoc collectives that comprise project teams in an issue-oriented hackathon fall short of constituting full publics. Recall that publics are said to form by negotiating the boundaries of an issue; they are brought into being through that process for the purpose of attending to the issue. In a sense, this *is* what occurs in issue-oriented hackathons. Designers, developers, content experts, and stakeholders join together to explore and express the conditions and consequences of topical domains of social concern. But it is worth emphasizing the partial and temporary qualities of this convening and making a distinction with regard to the character of the publics. The group formed to build the insect map and database ceased to exist at the end of the event. Likewise with the group formed to produce communication materials for the Food and Water Watch. Rather than consider these full or proper publics, we propose the term "proto-publics" to characterize these formations. Just as the various artifacts and systems construed through issue-oriented hackathons are suggestive and incomplete of the means needed to address the issues, so too are the publics that are constituted through these events.

Because of the tentative and contingent character of both props and proto-publics, we might consider these modes of material participation as speculative. Through the processes conceptualization and production, hackathon attendees undertake a collective imagination of how future users could themselves participate in an issue through the props attendees are constructing. Thus, more than making products or services or solutions, as modes of speculative material participation what these events do is contribute to our social imaginaries. This speculative quality of the material participation at issue-oriented hackathons provides yet another connection to design, through so-called speculative design. Speculative design is a kind of design that works to construct and communicate possible futures or alternate presents (see Auger, 2013; DiSalvo, 2012b; Dunne and Raby, 2013). Oftentimes, such work is intended to elicit and express a critical consideration of the trajectories of technology development or what Dunne and Raby call social dreaming: provocative "what-if" questions about the future and the present. Issue-oriented hackathons may function in a similar manner, in which the design

activities—the material participation—work to investigate and express the possibilities and potentials of action with regard to an issue or the formation of a public.

Conclusion

Issue-oriented hackathons cannot be distilled into what is typically discussed as their outcomes, namely, a handful of prototypes. Certainly, these prototypes are important, but we want to give what is made a more adequate weight among other processes of issue-oriented hackathons. Some of these processes are organizational, such as how groups are structured to accomplish tasks; others are compositional, such as who and what is present to enable work to be accomplished. We cannot be exhaustive of these questions, let alone even answer them here. Instead, we have provided an account of hackathons that focuses on how we might understand these as more than a black box churning out prototypes, but as events which draw together various interests, people, objects, and resources for the purpose of articulating issues, as a kind of material participation.

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Note

1. The remaining two presentations were pitches for technology platforms.

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