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A systematic literature review

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5. Open data hackathons and game jams: a systematic literature review[1]

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INTRODUCTION

Open data is a pillar of open government as it can provide transparency about governmental policies and accountability in government decision-making (Veljković et al., 2014). However, realizing these benefits can prove to be challenging. Despite regional variations (Vancauwenberghe, 2018), governments (van Loenen, 2018), companies (Arribas-Bel, 2014), and non-profit organizations (NPOs) (Hou & Wang, 2017) have started releasing open datasets to the public, often disseminating them through open data portals. Nevertheless, open data release initiatives have been shown to rely on faulty assumptions, such as that "open data will result in open government" (Janssen et al., 2012, p.266). In reality, further prerequisites are needed to realize the value of open datasets for open government goals: (1) datasets published need to be relevant to the purpose of making government more transparent and accountable, and (2) citizens need to be incentivized to actually engage with the datasets (Janssen et al., 2012). Regarding the first point, not all open datasets contribute to the goals of open government. Open data is a wide term and refers to any data with a license allowing free access and reuse (Open Knowledge Foundation, 2015). Open government data (OGD) is an ambiguous term (Yu & Robinson, 2012). OGD can refer to data that makes governments more transparent and accountable, in line with the principles of open government, as well as any dataset originating from governmental sources, even if irrelevant to open government principles (Yu & Robinson, 2012). Even when relevant datasets are published, citizens need to be incentivized to use them. To address this last point, our research focuses on two "accelerated design processes" (Falk, 2022, p.11): *open data hackathons* and *game jams*, since both events can contribute to citizens' capacity to reuse open datasets. Throughout this paper, we use the term *open data* to describe any dataset that is free for anyone to access, share, and reuse. This research focuses on hackathons' capacity to engage citizens in reusing open data rather than determining if certain datasets help achieve open government goals.

OPEN DATA HACKATHONS AND GAME JAMS

The term *hackathon* refers to a hacking marathon (Briscoe & Mulligan, 2014), during which participants hack (rapidly assemble) something together. Some hackathons have been criticized for being solutionist (Morozov, 2013), as participants tend to ideate purely technological solutions which ignore social complexities (Falk Olesen & Halskov, 2020). However, certain hackathons are moving away from techno-solutionism. For example, Lodato and DiSalvo

(2016) described two cases of "issue-oriented" hackathons, where the central element is a social issue rather than technology. During an open data hackathon, open data is one of the components used to assemble the prototypes. Falk Olesen and Halskov (2020) found that, in the context of a hackathon, open data is often "used to engage citizens and communities" (p. 1080), with open datasets playing an important role in empowering citizens "to participate in the governance process." We intend for the prototypes made at hackathons to be "physical manifestations of ideas or concepts" (Sanders & Stappers, 2014, p. 9), which can range from a sketch on a piece of paper to something resembling a product ready for use (Sanders & Stappers, 2014).

In addition to hackathons, we decided to include game jams in our research as there is a significant overlap in their design. Similar to hackathons, game jams have been used for collective reflection, "allowing the designer(s) to deeply investigate the concepts addressed by the game through the process of making the concepts concrete in the game's design" (Cook et al., 2015, p. 2). Hackathons and game jams are both "accelerated design processes" (Falk, 2022, p. 11) and share a number of similarities (Falk, 2022; Schouten et al., 2017). Briscoe and Mulligan (2014) refer to game jams as "hackathons for video game development" (p. 3). They both tend to happen over the span of 24–72 hours (Schouten et al., 2017), during which participants work feverishly on producing a prototype with few breaks in between. In the case of open data hackathons and game jams, participants are given open datasets that they can explore and reuse during the event. Participants often work in teams formed either prior to or during the event. At the end of a hackathon or game jam, participants present their results to each other, usually by hosting a short pitch and an open discussion. Crucially, both events can support "thinking by doing" (Schouten et al., 2017, p. 28) or "thinking through designing" (Mulder & Kun, 2019). In this sense, prototyping is used as a form of inquiry that can "raise questions, controversies and dilemmas" (Hillgren, 2013, p. 76). Thus, the outcome of a hackathon or game jam is not just the production of a working prototype, but rather the exploration and learning that takes place among participants. A clear difference between hackathons and game jams is that the latter is concerned with the creation of a game prototype, or at least a game concept. However, as argued by Grace (2016), hackathons and game jams do not only differ in the final product expected, but also in their process. According to Grace (2016), game jams are not simply a subset of hackathons but rather an adjacent, different type of event which supports participants being in a state of play, and which follows a more spontaneous and "unstructured" process (Grace, 2016, p. 2).

On the other hand, Falk (2022) argues that hackathons and game jams tend to overlap and have no clear boundaries. For example, characteristics typically associated with game jams, such as playfulness and fostering creativity, can also be found at hackathons, depending on their specific setup and participation (Falk, 2022). For this reason, we agree with Falk (2022) that, rather than drawing boundaries between the two terms, it is more fruitful to study them together as accelerated design processes, which is why this systematic literature review includes studies using both terms. Our research includes both hackathons and game jams, as they share a similar structure and format, which sets them apart from other design processes. Table 5.1 summarizes the features of hackathons and game jams.

Previously, Medina Angarita and Nolte (2020) systematically reviewed the literature on hackathons to connect the design of the event, its outcomes, and the sustainability of these outcomes. Among their findings is that longer hackathons (48 hours) allow participants to develop more elaborate prototypes, and there is limited research on the learning outcomes of

Table 5.1 Features of hackathons and game jams based on previous literature

Feature	Hackathon	Game Jam
Production of a prototype under a short time constraint	·	·
Participants working in interdisciplinary teams	·	·
Prototype related to a specific theme or technical requirement	·	·
Prototype presented at the end of the event	·	·
Focus (Grace, 2016)	Solution-driven	Process-driven

Source: Authors' own.

these events. In another, broader systematic review of hackathons, Falk Olesen and Halskov (2020) discussed how and why hackathons have been used in research over the last ten years and found that we lack studies on how the setup of a hackathon influences its outcomes. At the same time, many studies do not document hackathon setups, but only their outcomes (Falk Olesen & Halskov, 2020).

In contrast to previous research, we only included a specific subset of hackathon events that use open data, included the term "game jam" in the search strategy, and aimed to provide a categorization of the prototyping activities and data collection methods used to study the events.

RESEARCH APPROACH

In conducting this systematic literature review (SLR), we applied the guidelines by Kitchenham and Charters (2007). We aim to give an overview of these events, as well as investigate: the objectives of open data hackathons (RQ1), the prototypes produced during these events by participants (RQ2), and the methods used to record the events (RQ3).

RESEARCH QUESTIONS

1. What are the objectives of open data hackathons and game jams?
2. What types of prototypes do participants produce during open data hackathons and game jams?
3. Which data collection methods have been used to describe and assess open data hackathons and game jams?

SEARCH STRATEGIES

Using Boolean operators, we searched for articles containing any of the terms for hackathons and game jams, as well as any of the terms for open data, as shown in Table 5.2. We used the

Table 5.2 Synonyms used for hackathons and game jams, and for open data

Hackathons and Game Jams	Open Data
Game jam	Open data
Design jam	Open government data
Hackathon	Public sector information
Hackday	Public data
Datathon	Public government data
	Open public sector data
	Open public data
	Big open data
	Big open public sector data
	Open public sector data
	Open public sector information
	Open government information

Source: Adapted from Purwanto et al. (2020).

term "hackathon" and some of its synonyms, such as "hackday" and "datathon" (data hackathon). The search terms for open data are the same as the ones used by Purwanto et al. (2020). We used Boolean operators and applied our search to the Web of Science Core Collection, Scopus, and ACM Digital Library. Search terms were applied to all fields.

INCLUSION AND EXCLUSION CRITERIA

This review only includes journal articles and conference proceedings in the English language. Furthermore, we only include accounts of open data hackathons and game jams that fit the definitions presented in Table 5.3. Our definition of an open data hackathon is inspired by Purwanto et al. (2018); however, we made our definition wider in order to include events organized by any type of organization, with any type of participant, and with any type of open dataset. We excluded events shorter than one full day or longer than three days. We excluded events where participants worked exclusively with closed datasets (datasets that do not have a free license). Furthermore, we only included events that happened face-to-face at a physical location.

Table 5.3 Definitions used to filter through the case studies

Phrase	Definition
Open data hackathon	event that brings together people to intensively work on the creation of a prototype over the span of 1–3 days using open data
Open data game jam	event that brings together people to intensively work on the creation of a *game* prototype over the span of 1–3 days using open data

Source: Authors' own.

We only included papers that contain a detailed account of individual events and their set-ups; for example, we excluded articles that only discuss hackathon outcomes (and not the process), literature reviews, and conference tutorial descriptions. We included articles discussing multiple events, but only where the features of individual events are discernible. We focus on events involving the reuse of open datasets, so we excluded any literature about hackathons or game jams that did not engage participants in using open data. Finally, we excluded accounts of highly technical events, such as academic hackathons focused on scientific data.

DATA EXTRACTION

Table 5.4 shows the data extracted for each article in our review. The search resulted in 320 articles from Web of Science Core Collection (n=222), Scopus (n=23), and ACM Digital Library (n=75). We first removed duplicates, resulting in 289 unique records. We then scanned the abstract and, where needed, the full text to assess the relevance of the publication, resulting in 43 publications. We then read the full text of the articles to assess whether the events described met our inclusion and exclusion criteria. A total of 20 papers were finally included for review. The different stages of our systematic review process and count of papers at each stage are shown in Figure 5.1.

Of the 23 articles excluded based on the full text read, nine were excluded because they focused primarily on discussing prototypes resulting from a hackathon but gave little or no detail about the events.

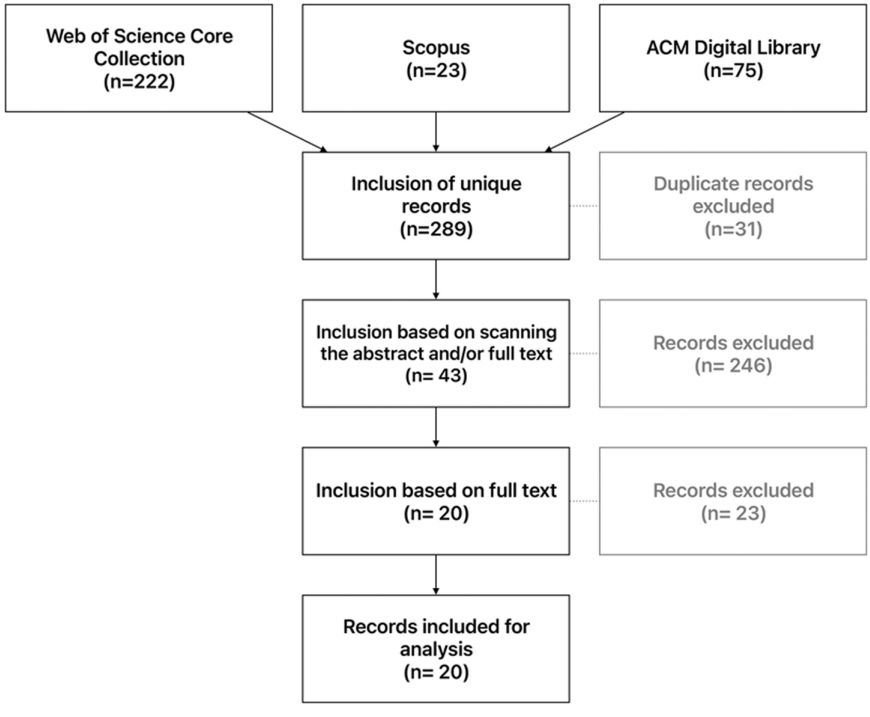
RESULTS

We reviewed a total of 20 studies and found 37 accounts of open data hackathons and only one account of an open data game jam. Table 5.5 gives an overview of the event names, the actual number of events described in the article(s) meeting the definition of an open data hackathon or game jam (and therefore included in our analysis), the cities where the events took place, the orientation of the events, and their domain. In Table 5.5, events are grouped together when they are part of the same series of events (i.e., Open4Citizens had 10 hackathons in different

Table 5.4 Data extracted

Section of Article	Data Extracted
Publication metadata	Title, authors, abstract, keywords, type of publication, outlet, year
Context of the study	Location, event name, domain, event orientation (public, NPO/social good organization (SGO), business)
Methodology	Data collection method (observations, interviews, surveys, etc.), number of cases described
Prototyping	Prototyping challenge given to participants, actual prototypes developed at the end

Source: Authors' own.



Source: Authors' own.

Figure 5.1 Stages of the systematic literature review process

cities) or when they were described in the same publication (i.e., Data for Good and Canadian Open Data Experience). We used all publications describing a certain event in order to record and analyze its features. All the events we included for review specifically mentioned the reuse of open datasets. In some cases, the issue addressed by the hackathon was defined broadly, e.g., public service design in the municipality of Rotterdam (van Waart et al., 2016). In other cases, organizers defined the issue very specifically, such as the delivery of timely information to residents of areas affected by public works (Molinari & Concilio, 2017).

As shown in Table 5.5, the domains of the hackathons had great diversity and included topics such as education, privacy, urban transformation, and food and nutrition. Most of the events we found were part of a larger series of events, such as the Open4Citizens hackathons or the Thessaloniki hackathons. The single case of an open data game jam was the Quantum Game Jam, which was also part of a series of five events over multiple years, with open data about galaxies offered during one of the events.

Table 5.5 Features of the events, associated literature, and orientation

Event(s) name	Count of Events for Analysis	Found In	Cities	Orientation	Domain
Brazil Chamber of Deputies hackathons	2	(Faria & Rehbein, 2016)	Brasilia (BR)	Public	Transparency in parliamentary work and legislation (2013), gender issues (2014)
Codethecity	1	(Taylor & Clarke, 2018)	Unspecified city in the UK	Public	History
Data for Good and Canadian Open Data Experience	3	(Anslow et al., 2016)	Calgary (CA)	Data for Good: SGO Canadian Open Data Experience: Public	Data for Good: crisis management Canadian Open Data Experience: generic, any open dataset on the Canadian open data portal
Hack de Valse Start	1	(Purwanto et al., 2018)	Amsterdam (NL)	Public	Education
Hackday Data of the Crowds and GovJam	2	(van Waart et al., 2016)	Rotterdam (NL)	Public	Hackday Data of the Crowds: wearables and IoT GovJam: public service design
Maribor hackathons	3	(Pogačar & Žižek, 2016)	Maribor (SI)	Public	Urban development
MobileMiner hackathon	1	(Pybus et al., 2015)	Unspecified	Public	Privacy, big data, and social media
NPO hackathons	2	(Hou & Wang, 2017)	Unspecified city in the US	NPO	NPOs (libraries, education, arts, health, nature)
Open Food Data Hackdays	2	(Tucci et al., 2018)	Lausanne (CH) Zurich (CH)	Business	Food and nutrition

Event(s) name	Count of Events for Analysis	Found In	Cities	Orientation	Domain
Open4Citizens	10	(Concilio et al., 2017; De Götzen et al., 2020; Jaskiewicz et al., 2019; Molinari & Concilio, 2017; Morelli et al., 2017)	Barcelona (SP) Milan (IT) Rotterdam (NL) Karlstad (SE) Copenhagen (DK) Aalborg (DK)	Public	Barcelona: urban issues and services Copenhagen: refugees and immigration Karlstad: healthy living Milan: transparency on urban transformation Rotterdam: self-management of parks Aalborg: tourism
OSM hackathons in Brazil	2	(Gama et al., 2019)	Recife (BR)	Public	Blue economy (sea resources) and OpenStreetMap data
Quantum Game Jam	1	(Kultima et al., 2021)	Turku (FI)	Public	Physics
Slightly Dystopian hackathon	1	(Whitney et al., 2021)	San Diego (US)	Public	Privacy and state surveillance
Thessaloniki hackathons	6	(Kamariotou & Kitsios, 2022; Kitsios & Kamariotou, 2019, 2022)	Thessaloniki (GR)	Cases 1, 2: public cases; 3, 4, 5, 6: business cases	Case 1, 2: city services Case 3: tourism Case 4: education Cases 5, 6: not specific

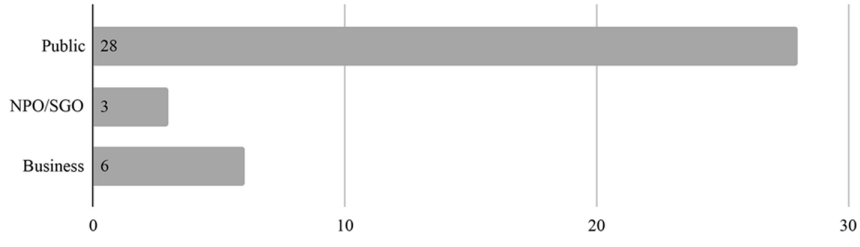
Source: Authors' own.

EVENT ORIENTATIONS

To answer our first research question ("What are the objectives of open data hackathons and game jams?"), we categorized events into three main groups: public-oriented, business-oriented, and technology-oriented. Of the 37 cases we analyzed, 28 had a public orientation, three were oriented towards NPOs/SGOs, and six were oriented towards business. These three orientations reflect three different objectives for hackathon events, namely to address social issues and freely provide the products of the hackathon to the public, to help NGOs and SGOs in their activities, and to ideate new business ideas. The count of cases in each category is shown in Figure 5.2.

Public-oriented events used open data to address societal issues such as gender inequality (Faria & Rehbein, 2016), educational policies (Purwanto et al., 2018), and privacy (Pybus et al., 2015; Whitney et al., 2021). The results of public-oriented events are usually intended to be freely shared without a clear business purpose. For example, in the Milan Open4Citizens hackathon, the winning team tried to donate the online service they had developed to the local municipality (Molinari & Concilio, 2017). Another example of a public-oriented event is the "Slightly Dystopian" hackathon (Whitney et al., 2021), in which participants intended to use the demos they produced to shape policy in local administration meetings. In another public-oriented event, Codethecity (Taylor & Clarke, 2018), participants tried to produce a historical business directory dataset with plans to make it freely available after the event. Events oriented towards NPOs or SGOs combined open datasets with internal data from the organization. Here, the main objective was to help these organizations, which often have limited resources, analyze their own data and answer their research questions. Finally, business-oriented events aim to facilitate the emergence of new business models and startups. For example, the Open Food Data Hackdays were specifically aimed at reusing open data for business purposes and made funding and incubation available to selected teams (Tucci et al., 2018).

Across the three categories of events we identified, hackathon organizers often included the presence of a jury to motivate participants. For example, in the Thessaloniki hackathons, winning teams were selected and awarded monetary prizes, startup funding, or the opportunity to participate in further events (Kitsios & Kamariotou, 2019). Other events did not award prizes, such as the NPO-oriented hackathon described by Hou & Wang (2017). In this case,



Source: Authors' own.

Figure 5.2 Event orientation distribution

participants were mostly motivated by the learning opportunities offered (such as practicing data analysis) and by their willingness to help NPOs (Hou & Wang, 2017).

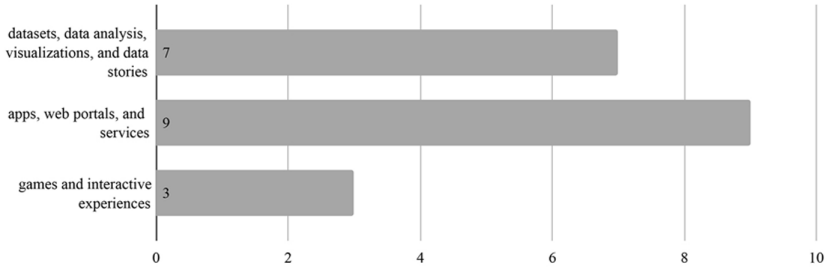
PROTOTYPING

In this section, we answer our second research question: "What types of prototypes do participants produce during open data hackathons and game jams?" We distinguish between different types of prototypes produced at open data hackathons and game jams based on their level of development, from more conceptual (sketches and drawings on a piece of paper) to higher-fidelity ones (a working proof of concept or piece of code). These more or less conceptual prototypes are intermediate steps toward different types of final products, which can be categorized based on their level of interactivity. In Table 5.6, we labeled the prototypes produced during each group of events according to three categories, from least interactive to most interactive: (1) datasets, data analysis, visualizations, and data stories; (2) apps, web portals, and services; (3) games and interactive experiences. Figure 5.3 shows the distribution of prototypes across the event groups, with each bar representing the count of events for a given category. For example, in Hack de Valse Start (Purwanto et al., 2018), participants created

Table 5.6 Overview of the event groups, the challenge given to participants, and final prototypes

Event(s) name	Datasets, data analysis, visualizations, and data stories	Apps, web portals, and services	Games and interactive experiences
Brazil Chamber of Deputies hackathons	-	**X**	**X**
Codethecity	**X**	-	**X**
Data for Good and Canadian Open Data Experience	**X**	**X**	-
Hack de Valse Start	**X**	-	-
Hackday Data of the Crowds and GovJam	-	**X**	-
Maribor hackathons	-		-
MobileMiner hackathon	**X**	**X**	-
NPO hackathons	**X**	-	-
Open Food Data Hackdays	-	**X**	-
Open4Citizens	**X**	**X**	-
OSM hackathons in Brazil	-	**X**	-
Quantum Game Jam	-	-	**X**
Slightly Dystopian hackathon	**X**	**X**	-
Thessaloniki hackathons	-	**X**	-

Source: Authors' own.



Source: Authors' own.

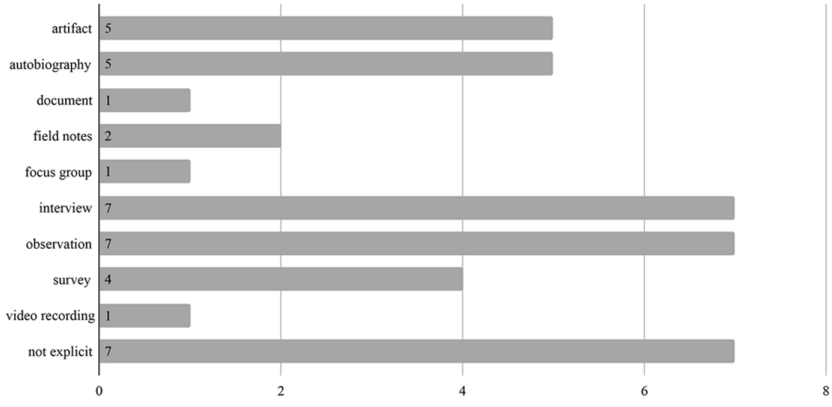
Figure 5.3 Event prototype distribution

a slide deck showing a data visualization of national exam scores against "school advice" (low interactivity). On the other hand, in Codethecity (Taylor & Clarke, 2018) participants attempted to produce a VR experience (high interactivity).

We found that in most open data events, participants engage in the production of an app or service prototype. In nine of the event groups we reviewed, participants engaged in prototyping web or mobile apps, web portals, or services. In seven of the event groups, participants also produced new or improved datasets, data visualizations, and data stories. In only three event groups, participants tried to produce some type of game or interactive experience. In the Quantum Game Jam (Kultima et al., 2021), participants were asked to produce a game and were given open data about the galaxies. In Codethecity (Taylor & Clarke, 2018) participants worked to produce a VR experience based on historical data. Finally, in the second Chamber of Deputies hackathon in Brazil, participants produced (among other prototypes) "educational games about gender" (Faria & Rehbein, 2016, p. 570).

DATA COLLECTION METHODS

To answer our third research question, "Which data collection methods have been used to describe and assess open data hackathons and game jams?" we recorded the data sources used by each article. Figure 5.4 shows the distribution of data collection methods, with each bar showing the count of articles using a given data collection method. While most articles use a combination of different methods, the most prevalent data sources were interviews (n=7) and observations (n=8). Surveys were only used in four studies to inquire about the expectations, experience and satisfaction with the event, and usefulness of the projects produced (Hou & Wang, 2017); to record the demographics and motivations for attending (Tucci et al., 2018); and to record the self-assigned roles of participants and their expectations (Jaskiewicz et al., 2019). One of the most detailed accounts of hackathon learning outcomes is provided by Jaskiewicz et al. (2019); the authors relied on surveys before and after the events, and interviews, observations, and artifacts produced during the event to discuss the learning outcomes of the Open4Citizens hackathons. However, we found limited use of quantitative data in assessing open data hackathons and game jams.



Source: Authors' own.

Figure 5.4 Data collection methods distribution

DISCUSSION

Hackathons used to be spontaneous meetups of coders and tech enthusiasts, mostly focused on tinkering with technology and software (De Götzen et al., 2020), and existing as a tool to engage a wider audience in co-creation with open data. However, in recent years, hackathons have started moving away from their focus on technology and have been used to explore and discuss social issues (De Götzen et al., 2020). At the same time, hackathons have started welcoming a wider and more diverse community of participants made up of activists, designers, and problem-owners, as shown in the Open4Citizens experience (Jaskiewicz et al., 2019). We analyzed a specific subset of hackathon events, one of which was concerned with reusing open datasets. We found that the open data solutions produced at these events are mostly oriented towards the public. The open data used spans a variety of domains, such as food and nutrition, refugees and immigration, and parliamentary data.

The hackathon cases we reviewed were not only aimed at building the individual skills needed to work with data, but also at creating a community around a given issue. In fact, one of the most cited benefits of open data hackathons is community building (Anslow et al., 2016; Faria & Rehbein, 2016; Jaskiewicz et al., 2019; van Waart et al., 2016). The value of hackathons is not in the prototypes produced per se, as most prototypes never become implemented products. Our results are convergent with Yuan and Gasco-Hernandez (2021), who found that, even for hackathons focused on converting initial ideas into implementable services and products, "results are insubstantial […] which limits significantly civic hackathons' contribution to idea diffusion" (p. 537). Instead, the public value of hackathons is in "encouraging conversation, deliberation, and mutual learning among public employees and participants to enhance democratic accountability and responsiveness," and in creating a space where citizens can state their needs and priorities in a dialogue with public service providers (Yuan & Gasco-Hernandez, 2021, p. 538).

Throughout the event, participants have the opportunity to mingle and learn from each other's perspectives. As a result, the objects and prototypes produced at hackathons can act as boundary objects to facilitate communication between co-creators (Jaskiewicz et al., 2019). This is convergent with the concept of "issue-oriented" hackathons (Lodato & DiSalvo, 2016) as environments for the articulation of social issues (Lodato & DiSalvo, 2016). In articulating social issues, the prototypes (both physical and digital) crafted can act as a probe for finding new dilemmas for participants and suggesting a deeper inquiry into the societal problems being addressed. At an issue-oriented hackathon, "prototypes can be all kinds of artifacts, as long as they enable the different stakeholders to collaboratively explore alternatives and to articulate different viewpoints" (Mulder & Kun, 2019, p. 230). By involving citizens in the production of tangible prototypes, these events enable "thinking through designing" (Mulder & Kun, 2019, p. 232).

However, these new priorities and objectives for hackathons also bring about new challenges for hackathon organizers. One of these challenges has to do with the choice of prototyping activities for the event; how do you choose the overarching task or challenge given to participants? This choice has a significant impact on the ability of participants without coding skills to participate in prototyping and, as a result, in group discussions:

> In terms of media, it should come as no surprise that moving away from code and electronics towards craft and physical prototyping meant that a wider range of attendees were able to take part in making. As some of the organisers pointed out, these forms of prototype were just as capable of fulfilling the roles that prototypes play at other hackathons. If the outputs will never be used beyond the hackathon itself and beyond their role as prompts for engaging in an issue, does it matter whether it is a functional prototype, a digital mock-up or a cardboard model that merely suggests certain technologies? (Taylor & Clarke, 2018, p. 10)

Taylor and Clarke (2018) argue that there is a conflict between ensuring the accessibility of the event and attending to participants who expect to develop something tangible. This is convergent with Jaskiewicz et al. (2019), who found that while low-fidelity prototypes are better at communicating ideas (they can be easily produced and understood by everyone), high-fidelity prototypes challenge participants to learn development skills, which are also needed to work with data. Therefore, an important part of scaffolding a hackathon event is deciding how much to prioritize low-fidelity and high-fidelity prototypes.

We also find it notable that most of the open data hackathons included in our review challenged participants to make app and service prototypes. We only found one case of an open data game jam, in which participants had to produce a game after exploring an open dataset. Kultima et al. (2021) studied a series of five game jams, one of which had a theme dedicated to open data about the galaxies. Kultima et al. (2021) found that game jams can offer "platforms for interdisciplinary collaboration" (p. 142); however, few of the games produced by participants were able to both depict the jam's subject and offer a compelling gameplay, with domain experts and game developers struggling to communicate (Kultima et al., 2021). However, in this case, the results of the open data game jam were analyzed together with the results of other events which did not mention the use of open data. As a result, it is hard to extract specific conclusions about the open data event.

Across the events reviewed, we found some variation in the fidelity of the prototypes produced. However, the final envisioned product seems to be more homogeneous and tends to be a smartphone app or a website. If the point is to learn about a social issue rather than "fix it"

with technology, why are participants challenged to make applications and services? Are there other prototyping challenges more suitable to facilitate learning about social issues?

Game-making could offer an alternative prototyping challenge to explore social issues. In the approach proposed by Schouten et al. (2017), game-making is used as "an effective ad hoc form of inquiry into complex contexts such as urban-scale issues" (p. 38). Making a game and testing its different iterations with other stakeholders can help game designers better understand complex issues (Schouten et al., 2017). Game development is no longer restricted to software developers and coders, and with proper structuring and guidance, game jams can welcome citizens who have never made a game before. Game jams can offer an environment where citizens articulate societal issues through game-making (Schouten et al., 2017). Schouten et al. (2017) argue that, in making the rules for a game, codesigners "tentatively model the general theoretical understanding of a given issue (e.g., urban empowerment) and connect it to a concrete representation (e.g., what takes place in the game)" (p. 30). This is convergent with the findings of Eriksen et al. (2020), who argue that game codesigning offers opportunities for agonistic confrontations. Game codesigning "acknowledges a plurality of individual positions and continuous struggles between adversaries" (Eriksen et al., 2020, p. 42), which is central to the concept of issue articulation as defined by Lodato and DiSalvo (2016). However, Schouten et al. (2017) did not test their approach in the setting of a participatory design event, and there is limited research on game-making as a process of inquiry into societal issues. Eberhardt (2016) describes the experience of a "purposeful game jam," having the goal to "engage participants in talking about the problem of pay inequalities" (p. 2). By exploring a dataset and making a game, participants were able to understand the issue with greater depth. We still need further experimentation to understand whether game-making or other prototyping formats are better suited to explore societal issues and facilitate learning in a hackathon setting.

Datasets that are relevant for government transparency and accountability have no value if nobody is reusing them (Janssen et al., 2012). Hackathons and game jams have the capacity to bring together a community of citizens, problem-owners, data experts, and civil servants around open datasets. However, we argue that the dialogue between these stakeholders, and progress towards open government goals, is limited by the invitation to produce technological fixes and (prototypes of) marketable products. Further research is needed to explore alternative prototyping challenges, such as game-making, which could motivate participants to engage in the reuse of open data to understand complex societal issues while avoiding the pitfalls of techno-solutionism.

LIMITATIONS

This review only analyzed 20 articles, describing a specific type of open data event. We acknowledge that most open data hackathons and game jams may not be described in academic literature. Furthermore, our analysis did not include gray literature. This study is further limited by the decision to only review on-site events; further research could include online events, such as the numerous online hackathons organized during the COVID-19 pandemic. There are also limitations in labeling and categorizing each of the final prototypes made at hackathon events; participants may not be inclined to share all of their results with others (Taylor & Clarke, 2018) thus making them harder to record. Additionally, most of the case

studies we reviewed provide limited details about the exact stage of development of the prototypes and do not seem to distinguish between, for example, working prototypes and mockups.

CONCLUSIONS

Open data hackathons are often seen as a promising way to incentivize the actual use of open datasets. Hackathons can, in theory, contribute to open government priorities by addressing the demand side of open data, both by inviting participants to create something meaningful from open datasets and by bringing together open data users and open data providers. However, the design of these events can ultimately determine whether or not the potential of open data is realized. Hackathon organizers face a number of choices in the design of the event. In order to realize the potential of open datasets to describe social issues, pressure cooker events need an appropriate scaffolding that can support issue articulation. In this chapter, we tried to understand how open data hackathons are actually structured, focusing on the different types of prototyping activities that participants engage in. Our analysis included 20 studies describing 37 events, all hackathons, with the exception of one open data game jam. Most of the events we analyzed were oriented towards the development of solutions for the public, with fewer cases of events that aimed to help NPOs and SGOs or that aimed to create new businesses. Across these events, we further distinguished three types of prototypes produced by participants: data analysis and visualizations, apps and services, and games and interactive experiences. The studies in our review used a variety of data collection methods to analyze the events but most often relied on interviews and participant observation. Previous literature (Jaskiewicz et al., 2019; Taylor & Clarke, 2018) found that low-fidelity prototypes facilitate communication and inclusion, whereas high-fidelity prototypes let participants improve their individual skills and produce something tangible. We add a further element to this discussion: the envisioned final product that the prototype is describing. In most of the hackathon events we reviewed, participants were invited to make smartphone apps or service concepts, and we only found one case of an open data game jam. By focusing on technological solutions, open data hackathons risk neglecting the social nature of the issues they intend to address. There is a need to further explore other types of prototyping, which might be better suited for learning about complex societal issues. Moreover, while hackathons have been evaluated in a number of different ways, the methods used are mostly qualitative.

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