Does it matter why we hack? – Exploring the impact of goal alignment in hackathons

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Abstract. Time-bounded events such as hackathons have become increasingly popular in recent years. During these events participants typically form teams, exercise fast prototype development, challenge themselves to innovate, practice new skills, collaborate with diverse team members, and compete against other teams. Hackathon organizers have a certain vision in mind about which outcome they would like to achieve and design the event based on this vision. Participants on the other hand do not necessarily share the same vision and come with their own goals and aspirations. While work in related fields suggests that it is important for goals of organizers and participants to align in order to achieve them this might be different in hackathons due to their unique setup. Drawing from literature we identified potential goals of organizers and participants and conducted a case study of three hackathons focusing on the alignment of goals between organizers and participants. Our findings indicate that the goals of organizers and participants did not align in all cases, that goal awareness on the part of the organizers appears may have a stronger impact on goal achievement and that hackathons appear to have inherent characteristics that can materialize even when not planned for.

Introduction

Hackathons are time-bounded events during which participants gather in teams and attempt to complete a project of interest to them (Pe-Than et al., 2019). Originating from coding competitions in the early 2000s, such events have garnered increased interest from both practitioners and researchers as evident by the large number of

global events taking place every weekend[1] and the emergence of academic events focusing on the topic (Pe-Than et al., 2018). This increase in interest has led hackathons to proliferated into various domains ranging from corporations conducting internal hackathons (Nolte et al., 2018) and higher education institutions (Kienzler and Fontanesi, 2017) to civic engagement groups (Hartmann et al., 2018; Henderson, 2015) and (online) communities (Angelidis et al., 2016). Within those domains, individuals organize hackathons with different goals in mind such as public engagement to raise awareness and advocacy (Taylor and Clarke, 2018), tackling civic and environmental issues (Baccarne et al., 2014; Porter et al., 2017), fostering innovation (Briscoe and Mulligan, 2014), creating technology (Stoltzfus et al., 2017), expanding or creating networks of interested individuals (Möller et al., 2014), spreading knowledge about technologies (Nandi and Mandernach, 2016) and others.

The aforementioned goals are often communicated to potentially interested individuals prior to the hackathon in the form of marketing material which contains a short summary of the overall theme of the hackathon as well as core organizational details such as place and time. More detailed information is typically delivered in the form of an introductory presentation at the event including *"an overview of the event, any rules and regulations, and themes and goals"* (Decker et al., 2015).

The reasons for participants to go to a hackathon, however, do not necessarily match those of the organizers. While participants might share similar goals such as learning, inducing social change, building a product and finding a team to work with, they sometimes also participate in hackathons for glory, free pizza, finding employment and winning prices (Briscoe and Mulligan, 2014). In the context of game jams for example, fun is a key reasons for (re-)attendance (Arya et al., 2013). This points towards a potential disparity between the goals of organizers and participants that has not been investigated in depth in existing work on hackathons. We address this gap by asking the following research question:

RQ1: How do the goals of hackathon organizers and participants align?

Moreover, it is not clear whether it is inevitably necessary for goals of organizers and participants to be aligned in order for both groups to achieve them and to perceive a hackathon as a satisfying experience. There are hints towards the necessity of goals alignment in the work conducted by Hou and Wang (2017) in the context of a civic data hackathon. They found tension between two intertwined goals: helping with data driven work and learning with the purpose of getting involved in the work of NPOs. Conflicts in this case were resolved by brokers. Literature on project management also suggests that goal alignment is important

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[1] Hackathons organized by the largest hackathon league alone register more than 65.000 students among more than 200 events each year (MLH, https://mlh.io/about)

for project success (Skulmoski and Hartman, 1999) and that goal alignment enables the achievement of performance outcomes (Stephen and Coote, 2007). Similarly, work in the context of work groups suggests that *"a basic coordination problem in the management of groups is to increase alignment of personal goals with the group goals"* (Zhang and Chiu, 2012), pointing out that it is important for individuals to share their goals with their group and achieve goal alignment to succeed. Correspondingly, goal misalignment has been found to cause conflict within groups in the context of joint software reviews where issue resolution can be affected by differences between goals of different reviewers (Kingston et al., 2000). These contexts however are considerably different from hackathons in that work groups members are bound by contracts and common social norms while this is not the case in hackathons where participants are not necessarily familiar with each other before the event. In addition, hackathons might have inherent characteristics that might foster certain goals simply due to the format, such as networking as pointed out by Drouhard et al. (2016). To further investigate this aspect, we will also ask the following research question:

RQ2: How does goal alignment influence goal achievement at hackathons?

In order to answer these two research questions, we conducted a qualitative case study covering three hackathons. Our results indicate that organizers and participants of the hackathons we studied shared some common goals such as networking and learning. Digging deeper, however, we found that the specifics of these goals to be different between organizers and participants e.g. related to being interested in learning different skills. We also found indication that goal alignment was not necessarily a prerequisite for goal achievement, but instead, goal awareness could improve goal achievement. We also found indications for the hackathon format having inherent characteristics which can contribute to the achievement of certain goals without explicit planning.

Hackathon goals

There are a number of reasons why individuals organize and participate in hackathons as pointed out in the introduction. Based on a review of relevant literature in IEEE Explorer, ACM Digital Library and Semantic Scholar, we developed a coding scheme that covers goals for hackathons in various contexts (c.f. Table 1 for an overview). These goals can be roughly divided into professional (A) and personal goals (B). We consider goals as professional when they can directly influence the career of an individual such as learning a specific skill this individual can use during her/his everyday work. In addition to the goals we identified from related work we discovered additional goals during our analysis. We will discuss them together in the following.

One goal commonly found in hackathons is networking (Briscoe and Mulligan, 2014) which can be broken down into professional networking (A3) with the aim to further an individual's career (A5) or into a personal goal to meet new people (B1). Learning is also often cited as a motivation for individuals to organize and participate in hackathons (Saravi et al., 2018) since hackathons have been found to support knowledge exchange (Ghouila et al., 2018) and foster collaborative learning (Porras et al., 2018). Learning can again be perceived as a professional (A4) or personal goal (B5).

Hackathons are also often organized in the context of entrepreneurship (Beltrán, 2017). It thus common for participants of hackathons to focus on creating a prototype (A1) and founding a start-up after a hackathon has ended (A2). Furthermore, it might be interesting for them to see what other participants are working on (A6). Moreover, individuals with a specific start-up idea in mind might also want to seek potential investors (A7) or individuals that are interested in working together with them (A8). All of the aforementioned goals are related to the professional development of the respective participants.

Hackathons are however not only a means of promoting individual careers and developing start-up companies. Participants also often come to a hackathon because they are fun (B4) events (Calco and Veeck, 2015), because participants are interested in the experience (B3), or they perceive it to be a personal challenge (B2).

Table 1. Coding scheme

A Professional Goals	Source
A1 Developing an idea into a prototype	Briscoe and Mulligan, 2014; Trainer et al., 2016
A2 Creating a startup	Cobham et al., 2017; Decker et al., 2015
A3 Networking	Briscoe and Mulligan, 2014; Nandi and Mandernach, 2016
A4 Learning	Briscoe and Mulligan, 2014; Ghouila et al., 2018
A5 Professional development	Cobham et al., 2017
A6 Seeing new ideas	Deducted from analysis
A7 Investment	Briscoe and Mulligan, 2014
A8 HR	Briscoe and Mulligan, 2014
B Personal Goals	
B1 Meeting new people	Komssi et al., 2015; Taylor and Clarke, 2018
B2 Personal challenge	Deducted from analysis
B3 Having a new experience	Deducted from analysis

B4 Having fun	Arya et al., 2013; Calco and Veeck, 2015; Saravi et al., 2018
B5 Learning	Nandi and Mandernach, 2016; Porras et al., 2018

Study setting

To answer the research questions described in the introduction we conducted a case study of three different hackathons in two Northern European countries (c.f. Figure 1 for some impressions). We selected hackathons that were similar in scope in terms of number of days, number of participants and type of audience (c.f. table 2 for an overview). The type of hackathon we studied was catalytic (Drouhard et al., 2016). The style of the work environment was competitive, and teams could win prizes that would allow them to continue working on their projects after the hackathon had ended. However, didactic talks, professional development and the pursuit of impact were also part of the hackathons.

Table 2. Hackathon anatomy

Hackathon	H1	H2	H3
Duration	48 hours	48 hours	48 hours
Number of Participants	~40	37	36
Participants	Researchers, students, entrepreneurs	Students, entrepreneurs	Students, enthusiasts

The theme of hackathon 1 (H1) was to develop innovative bio-technical products with the possibility of winning prizes that would allow teams to continue working on their projects after the hackathon. This weekend long event was attended by more than 40 students, researchers and entrepreneurs. It started with design workshop held by the organizers before the participants began working on their ideas and prototypes. Hackathon 2 (H2) focused on sustainability and ecological impact. This weekend long event hosted 37 participants including students and entrepreneurs who developed prototypes and competed for prizes that would allow them to continue working on their projects. Hackathon 3 (H3) was part of a larger effort in that similar hackathons with the same theme organized by the same group of people took place simultaneously in over 100 locations. H3 aimed to solve data visualization, hardware and other prototyping challenges related to space exploration. During this weekend long hackathon, 36 participants including students and enthusiasts gathered in teams and collaborated with each other to develop technical solutions for the aforementioned challenges. Each hackathon thus had the development of a technical artifact at its core.

Figure 1. Stills of hackathon 1 (top right), hackathon 2 (left), and hackathon 3 (bottom right).

Research methods

We conducted semi-structured retrospective interviews with organizers and participants at each aforementioned hackathons. This approach appeared to be feasible since we are interested in studying the perception of participants and organizers of hackathons on their individual goals and whether or not they have been achieved. Similar designs have been successfully applied in other exploratory studies on hackathons (Page et al., 2016; Nolte et al., 2018).

For the interviews we developed an interview script focusing on goal alignment and goal achievement. The themes of the interview were:

- Goals: The aims of hackathon organizers and participants related to their careers and their personal interests (e.g. *What were your professional goals for this hackathon?*)
- Goal assessment: The metrics participants and organizers applied to assess their goal achievement (e.g. *What goals did you achieve?*)
- Technology: The tools participants used to cooperate with each other. (e.g. *What tools did you use to collaborate with your teammates?*)
- Hackathon attendance: How many times participants have been to a hackathon before (e.g. *Is it your first time at a hackathon?*)
- Hackathon sustainability: Whether participants are planning to continue working in their projects after the event has ended (e.g. *Do you think you will continue working on your idea?*)
- Background information: Educational and professional history (e.g. *Tell me about your educational background.*)

The interview script was piloted with one hackathon participant and one organizer. Based on this pretest we adjusted the interview script to ensure the

feasibility, flow and appropriateness of the questions. We selected at least one organizers and multiple participants for our study. The selection of suitable participants was based on their background (students, entrepreneurs), hackathon experience (first timers and experienced hackathon participants), locality (individuals that live in a place for a long time and individuals that recently moved) and whether or not they pitched an idea at the hackathon (c.f. Table 3 for an overview).

Table 3. Demographic profile of the participants and organizers

Hackathon	Students	Entrepreneurs	First timers	Locals	Idea pitched	Organizers
H1	P1,P2		P1			O1
H2	P3	P1, P5, P6, P8	P2, P3, P7	P2, P4	P6	O1, O2
H3	P1, P2, P4		P1	P3, P4		O1

After transcribing all interviews one of the authors manually coded the interviews using the coding scheme we derived from literature (c.f. Table 1). We followed a deductive coding procedure starting with the pre-defined codes adding categories if necessary (e.g. *Personal challenge* (B2) in Table 1).

Goal alignment and achievement of hackathon organizers and participants

During the course of this section we will first elaborate on the goals of hackathon organizers (O) and participants (P) of each hackathon (H1, H2, H3) based on our coding scheme (c.f. Table 1). We will then elaborate on their alignment within one hackathon (RQ1) and the potential impact of the alignment on whether or not goals were achieved (RQ2). Overall, we found that organizers and participants did not interact with each other on a regular basis. The organizers mainly focused on the operation of the hackathon making sure that e.g. the planned schedule would be followed. Interaction between organizers and participants during the event was limited to participants asking individual organizers specific questions e.g. about upcoming activities. Organizers mostly reached participants for coordination purposes during the event personally (H1, H3) and used Slack (H2).

Teams internally mainly communicated in person using other tools such as GoogleDrive or Facebook messages mainly to share files. Each team could decide on their own toolset with no interference by the organizers.

Goal alignment and achievement between the organizer and participants of hackathon 1 (H1)

The main aim for the organizer (O1) was "*to provide the platform for the people that work in this area, for them to get together*" (O1), by creating an environment for participants to work on their ideas. S/he also aimed for the participants to expand their network (A3) and to acquire new skills (A4).

The participants, in comparison, mentioned networking (A3) and learning (A4) as their main goals. For example, P1 mentioned that s/he wanted to "*meet people, speak to them, understand what their point of view is on problems*" (P1). It thus appears as if participants and organizer goals were aligned since both aimed for participants to expand their own networks and acquire new skills. However, when looking deeper into those two aspects we identified a number of differences.

For the organizer (O1), networking (A3) meant "*to connect students, just beginners, or early stage student teams with the local startup network*" (O1), and to boost the generation and implementation of ideas related to the theme of the hackathon. O1 particularly aimed to connect participants with specialists working at an entrepreneurial center where they could find advice and tools to continue working on their projects. For participants, however, networking was not linked to identifying individuals that would support them in continuing to work on their project. For them, networking was rather related to learning. P1 mentioned for example that s/he "*just wanted to learn new things from new people*" (P1).

Similar to networking (A3), we found that learning (A4) initially appeared to be a mutually shared goal for organizers and participants. However, when looking deeper we also found that the organizer and participants aimed for different learning aspects. For the organizer it was important that the participating researchers would learn how to pitch because s/he thought that "*researchers tend to be too complicated*" (O1). The organizer also aimed for the participants to learn about design thinking ("*this whole empathy creating with the potential user or customer*", O1).

Conversely, participants wanted to learn about the theme of the hackathon. P1 wanted to learn for her/his professional development "*there is some innovation in biology which I am searching for, and I really want to take part in it*" (P1); and P2 was interested in "*how we can, for example, improve our lives to be better and to live longer*" (P2).

From the previous analysis it becomes clear that there is a disparity between organizer and participant goals related to networking (A3) and learning (A4). This appeared to mainly affect goal achievement on the part of the organizer, since participants reported to have achieved their goals, for example, P2 was able to learn about patients with Parkinson's disease, "*for me, it was like a discovery that we can actually help these people*" (P2).

Goal alignment and achievement between the organizers and participants of hackathon 2 (H2)

For H2, the main goal for the organizers (O1, O2) was "*to connect [country1] and [country2] people who work in tech or in the topic, with the end goal of having more businesses run by both [country1] and [country2]*" (O1). In general, the organizers thus aimed for the participants to network (A3) by meeting new people (B1) and then form teams to develop an idea into a prototype (A1), which could potentially lead to creating a new startup (A2). To foster this last goal, they "*invite[d], like, angel investors, so yeah, we give them the tools and it's always up to the participants to like use those tools*" (O2) thus supporting them to find investors (A7).

The goals of the participants however were much more diverse. Most participants mentioned that they were interested in learning (A4), P5, P6 and P8 mentioned wanting to develop an idea into a prototype (A1), P1 and P8 were eager about seeing new ideas (A6). P1 and P5 aimed to find investing opportunities and investment (A7), P1 hoped to find potential future employees i.e. achieve HR (A8), P7 and P8 were looking for a new experience (B3) and P1, P6 and P8 participated for fun (B4). The aim of participants related to learning was generally to learn "*something new*" (P5) by working with teammates (P4) or by talking to people at the hackathon (P6). One participant also wanted to learn more about how to create a start-up (P2) and improve her/his presentation skills (P2).

All participants reported that they achieved their respective with a few notable exceptions: P2 reported that s/he did not manage to learn what s/he aimed to learn, P1 nor P5 did not find investment opportunities, not investors, (A7), and P1 was not able to achieve HR (A8) by finding potential employees. Finding investors and investing opportunities – a mutually shared goal between organizers and participants – was thus not achieved.

Most participants mentioned that they were partially able to achieve their learning goals while pointing towards multiple potential reasons for not achieving them. One participant mentioned that "*it's [...] very difficult to learn a new skill in two days*" (P7) while another participant stated that "*there's always room to learn more*" (P4). Next to these general remarks P2 also stated that it was not possible for her/him to improve her/his presentation skills because someone else in her/his team was in charge of pitching. In addition, s/he stated that s/he would have expected to be taught more about e.g. how to write a business plan to create a start-up (P2). It would have certainly been possible for the organizers to support these participants to achieve their goals by planning the hackathon in a different way. There was thus no direct misalignment between participant and organizer goals but rather a lack of awareness about specific participant goals on the part of the organizers which might have resulted in some participants not being able to achieve their learning goals.

Another issue we found was that one participant was not able to work on her/his idea because s/he did not find a team and *"s/he didn't feel so great about any of the other ideas so [...] s/he just decided to leave"* (P6). This could have also been something that could have been spotted by the hackathon organizers especially since one of their goals was to support participants to turn their idea into a prototype.

For other goals of the organizers such as teams actually creating a start-up it is not possible to assess them at the end of the hackathon since they need to be assessed long term.

Goal alignment and achievement between the organizer and participants of hackathon 3 (H3)

For the organizer of H3 the main goal was to create an environment for people where they could network (A3) and collaborate on their project ideas (A1). The participants mentioned that their goals included networking (A3), learning (A4), meeting new people (B1), having a personal challenge (B2), experiencing something new (B3), and having fun (B4). Both organizers and participants thus mentioned networking as one of their primary goals. However, compared to both previous hackathons, there was not disparity in the respective details of this goal. Both participants and organizers aimed to foster professional networking with the aim to support the professional ambitions of the participants.

The organizer mentioned that her/his goal related to networking (A3) might only have partially been achieved. This perception was based on her/him expecting students to get together in their free time (*"if you think that only the students between each other will do projects, activities together, then that would be nice"*, O1). Participants however were excited about meeting new peers and potentially starting long term relationships, for example, P4 wanted to "*see more people in my field, make connections*" (P4), and P2 commented that "*maybe some other time I need advice*" and s/he could get it from the people s/he met at the hackathon (P2).

Apart from meeting new people, participants were also eager about learning, having a new experience and a personal challenge. P1 and P2 reported they were able to achieve these goals, meanwhile, P3 and P4 reported to have achieved all of them, except for learning (A4). P3 mentioned that s/he wanted to learn more about public speaking but also noted that her/his anxiety *"won't go away in one second"* (P3) but rather would *"get better, like, day by day,"* (P3). Finally, P4 wanted to learn about the hiring processes in companies but eventually did not ask the mentors – who were recruited by the organizers from local companies – about it. This is certainly something that the hackathon organizers could foster if they would be aware of it.

Discussion

The previously described analysis reveals a number of interesting aspects related to the question how the goals of hackathon organizers and participants align (RQ1). Our findings first indicate that the goals of participants and organizers mainly align with respect to networking and learning. Other goals such as fostering the creation of start-up companies (A2) were more important for organizers while finding investments (A7) and having fun (B4) were more important for participants.

However, when looking closer we found that participants and organizers were often interested in different aspects of networking and learning despite them both frequently mentioning these two goals. Organizers mainly focused on professional networking (A3) while participants were mainly interested in getting to know people on a personal level (B1). Similarly, when it comes to learning, participants on one hand were interested in learning about a large variety of different aspects such as creating a start-up, pitching, learning about new ideas and learning about how to collaborate with a group of people. Organizers on the other hand mainly focused on pitching, and although they were present throughout the entire duration of the hackathons, they mainly focused on facilitating operations and making sure "*that everything went smoothly*" (O2, H2). They only interacted with participants when triggered by them. The goals of organizers and participants thus appear to be well aligned at first sight but were not particularly well aligned when breaking them down into different aspects of e.g. learning.

Despite this apparent lack of alignment between the goals of organizers and participants we did however find that most participants reported to have achieved their goals (RQ2). The goals that they achieved were mainly related to aspects such as having fun (B4), learning about something new or improving existing skills both professionally (A4) and personally (B5). The specific aspects of learning that they reported to have achieved however differed not only between different participants but also between participants and organizers.

Our analysis also revealed that participants in the same team did not necessarily share the same goals. Moreover, each team created their own communication and coordination strategy including the decision which technologies they would use to communicate and exchange artifacts during the hackathon. These findings are similar to the ones reported by Trainer et al. (2016) and Lundbjerg et al. (2017). It should also be noted that teams rarely used technology to communicate. They did however use tools such as Google Drive and Slack to share artifacts. Ensuring awareness about tasks and goals was thus fostered by the co-located setting rather than additional technologies.

The fact that most participants reported to have achieved their respective goals despite an apparent lack of alignment points to the assumption that some goals are simply inherent to the nature of hackathons which means that it might not be required to specifically plan for them. Learning and networking are the two main

examples for this. Both can – according to our study – be achieved simply due to the nature of hackathons in that people that do not necessarily know each other before coming together during a hackathon to work on a project idea. Such ideas often involve working on something that is not necessarily familiar to all team members which in turn requires individuals to acquire new skills in order to complete their project and to pitch their project idea to an audience. This finding is in line with previous work by Warner and Guo (2017) who found that learning for participants can be incidental (as a consequence of doing), opportunistic (by taking advantage of the tools and facilities), or from talking to peers and that learning can thus be an inherent hackathon characteristic. Similar findings were reported by Drouhard et al. (2016).

That being said we also identified situations in which participants did not achieve goals such as attracting investment (A7) and creating a start-up (A2) directly. These specific goals however are very unlikely to be achieved during a hackathon and should thus be assessed in the months after the event has ended. In such cases organizers could point out that such goals are unrealistic and that a hackathon can be a starting point on a longer journey but that reaching these goals requires longer term investment. This is in line with previous work by Komssi et al. (2015) who stated that *"hackathons by themselves don't initiate new business, they require mechanisms in place in order to commercialize their results"*.

We also found situations in which participants did not achieve their specific learning goals despite them having the possibility to do so. One participant wanted to learn about pitching but someone else in the team pitched their idea instead, one participant wanted to learn more about start-up creation but there was no specific advice during the hackathon. Another participant wanted to learn about the hiring process in companies but did not get to talk to hackathon mentors about it. Those goals could probably have been achieved if the organizers would have been aware of them and adjusted the procedure during the hackathon. This points towards **goal awareness** on the part of the organizers being more important than actual goal alignment. To foster goal awareness organizers could in the future e.g. approach participants and ask them about what they would like to achieve during the hackathon. This would also organizers to support participants reaching their goals. The hackathon format itself however provides an opportunity for social interaction that inherently fosters goals such as networking and learning.

Contrary to Hou and Wang (2017) we did not find any tensions being created by misaligned goals. Our findings thus also stand in contrast to work in the context of project management where goal alignment is considered to be an important prerequisite for project success (Skulmoski and Hartman, 1999) and misalignment can lead to conflict (Kingston et al., 2000). This contrast however might stem from the fact that in our case participants in particular were mainly focused on learning and networking rather than completing a particular project. Both of these goals can

be achieved by individuals during a hackathon without any specific external support as discussed before.

Limitations

The aim of this study was to identify goals of hackathon organizers and participants, their alignment and the potential effects of goal alignment on their achievement. This particular phenomenon has received limited attention in research so far. It thus appeared reasonable to conduct an in-depth case study. We do however acknowledge that despite developing and applying a coding scheme that is grounded in relevant literature and carefully selecting study participants studying groups is different hackathons working on different problems with different goals might yield different results.

Future work

Based on the results of this study our aim is to develop a framework of goals which will serve as a basis for a survey instrument to study the interdependence of the different identified goals on a larger scale. Our sample for this study will include similar participants to those we studied thus covering individuals who are going to hackathons for the first time, individuals who have been to many hackathons, individuals who have ideas that they want to work on during a hackathon and individuals who do not. For the upcoming study we will also adjust our research focus by including the aspect of goal awareness as discussed in the previous section. We will also use the identified goals as a basis for a of keywords to conduct a quantitative case study on a larger hackathon database. These two studies combined will allow us to identify how different goals can influence hackathon outcomes as well as the perception of hackathon outcomes by participants.

Acknowledgments

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