Learning from Collaborative Integration

The Hackathon as Design Charrette

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This paper examines the application of innovative and interdisciplinary collaboration methods that emerged from the rapidly developing field of information technology and its intersection within the realm of design and architecture. These events, also referred to as hackathons, have risen in popularity in recent years (Artiles & Wallace, 2013) and stem from a design response for the increasing demand for accelerated design decisions within the field of architecture. This paper examines the potential of hackathons as a platform for rapid development of design ideas into prototypes within a time constraint of 24 hours. The paper explores the hackathon as a robust foundational element for pedagogical approaches rooted in interdisciplinary collaboration. Using a case-study research methodology, this paper probes the framework of the event, the outcomes, and the lessons learned. As this paper demonstrates, the hackathon required participants to identify and explore shifting territories through interdisciplinary teamwork to arrive at innovative solutions. In this setting, the format of the hackathon serves as a vibrant territory that enables a concrete theoretical contribution to design pedagogy, CAAD education, and collaborative professional practice.

Keywords: *Design tools, Digital design, Collaborative design, Data manipulation*

INTRODUCTION

This paper examines the application of innovative and interdisciplinary collaboration method that emerged from the rapidly developing field of information technology and its intersection with the realm of design and architecture pedagogy. The paper presents an experimental application of a hackathon, that is tested within the realm of design discourse on both design and non-design students to foster new ways of thinking about design and communication through a time-critical activity. This paper presents the results as lessons for teaching when using this new application of an existing tool.

Application of Hackathon to design

The framework of hackathon event is typically set within tight time constraints and has largely been tested and used within the computer science realm. Recently, this format has been deployed in non-technological industries such as architecture and design (Safadi, 2014). With its emphasis on information technology, the hackathon format provides a platform for engaging with big data, which are increasingly relevant in the construction industry.

What is a Hackathon?

'Hackathon' has its roots in 'hacking' and 'marathon' in the computer science context where 'hacking' does not imply breaking into forbidden territory, but rather rapid prototyping for tangible solutions within a limited amount of time - typically 24 hours. The format of a hackathon has been appropriated for commercial, educational and civic purposes in recent years (Artiles & Wallace, 2013). For example, governments have utilized Civic Hackathons to actively link mobile application developers to citizens in an effort to increase transparency and citizen-government relationships (Nath, 2011). Hackathons, have risen in popularity in recent years (Artiles & Wallace, 2013) with experimental application stemming from a design response for the increasing demand for accelerated design decisions within the field of architecture. Events such as BIMStorms and Designathon are two examples of an intersection between hackathons and the field of design and architecture.

Designathon

The term Designathon has been coined by Jessica Artiles and David Wallace (2013) as they supplemented the 'traditional' hackathon with additional topics and expanded the audience to include designers as well as coders. The 39 hours Education Designathon included three categories Hands-On Learning, Digital Learning, and Systems Re-Thinking and yielded a mix of digital and analogue prototypes (Artiles & Wallace, 2013) and demonstrated the possibility of applying hackathon format to design problems.

BIMStorm

BIMStorm is a "massive Real-Time" live charrette of designers and consultants who collaborate remotely through "open standards based exchanges" on projects using large databases and model servers ("About BIMStorm," 2012). Kimon Onuma pioneered BIMStorms when collaborating on projects worldwide during the mid 90s (Onuma, 2008). Based on the idea that proprietary formats will become a hindrance to collaborative, interdisciplinary design in the architecture field, some scholars (Onuma, 2008; Kemp, 2011; Counsell, 2012) argue that focus on knowledge and process of data exchange will become central in the future of the industry. The argument provides a fertile ground for the explorations of intersection between computer science and design platforms such as BIMStorms, Designathons.

Design Charrette 'light'

The traditional Design Charrette stems from the last minute finishing of architecture drawings at the 19th century École des Beaux-Arts in Paris (Smith, 2012). The Charrette is typically used for engagement of key stakeholders and experts to produce a vision or an implementation plan for a large project with potential for contention and requiring community engagement (Smith, 2012). Time constraint serves both as a decision accelerator and a risk (associated with lengthy consultation period) reduction mechanism (Smith, 2012). The competition format of a Hackathon lifts the burden of accountability and consensus building and allows participants to explore novel ideas and innovate without the burden of delivery or failure within a short period of time.

Hackathon as common platform for early design

The potential of hackathon format as a collaborative common platform for manipulation of relevant large databases in the early stage of design is the contribution of this research paper. The College of Architecture at Texas A&M University hosted a 24-hour hackathon where computer science, non-design and design students were exposed to the tra-

ditional architecture/design environment, mentorship and tools to address a contemporary issue. The following sections describe the planning, process, participation, outcomes and lessons learned from the event. The hackathon ultimately served as an integrative mechanism for enabling design discourse for multidisciplinary participants.

DIVERSITY OPEN DATA HACKATHON 2014

Architecture programs across the nation find themselves at a synergistic and inclusive intersection-a crossroads that links academic excellence to issues related to diversity and equity. The goal of this diversity-based, data-driven hackathon was to advance diversity awareness at Texas A&M University (College Station, TX) by identifying, collecting, and making visible a range of characteristics such as- ethnic backgrounds, religious beliefs, age, political beliefs, socioeconomic status, sexual orientations, physical ability and gender-in ways that embrace the richness of variety. Embedded is thus a shift beyond standard charts, graphs, and statistics to contextualize data through multimedia, three-dimensional objects and graphic representation. The format of Diversity Open Data (DOD) hackathon was used and based upon the ethos of transparency and collaboration. The hackathon centers on the creation of a flexible framework for active immersion of non-designers, computer scientists and designers in a multivalent design process dealing with evaluation and assessment of large data sets, followed by application in graphic, data driven or three-dimensional format. This approach generates meaningful, clear, and tangible data visualization tools that prepare students for envisioning new linkages in subsequent curricular activities. This study demonstrated the potential the hackathon format has as a translatable framework for reframing data into actionable ideas that align with architectural pedagogy.

Problem definition

The concept of diversity is rooted in the contemporary cultural imperative of inclusivity. One challenge posed by demonstrating inclusivity, however, is that including a wide range of aspects, facets, and characteristics of a population, also increases the difficulty of recognizing uniqueness, difference, or an individual's contribution to a specific area of study. This issue becomes even more amplified once the boundaries of a given system extend beyond the local context and taps into an even more diverse global context.

Planning and Partnerships

The College of Architecture Diversity Council at Texas A&M University partnered with the Center for the Study of Digital Libraries to deliver the Diversity Open Data Hackathon. The interdisciplinary steering committee worked to customise Hackathon format to a wider, multi-disciplinary audience including students of computer science, engineering, liberal arts and design disciplines. The wide ranging audience required an establishment of a network of committed mentors, who were willing to advise participants on various methods of visualization, handling of data and the topic of diversity. The event leveraged personnel resources from all departments of the college of architecture, geography, computer science, college of liberal arts and local business incubator.

Hybridizing data

The expansion of the hackathon platform to other design and non-design disciplines required the provision of source data in formats that would allow for rapid analysis and manipulation with and without coding capabilities. Hence publicly accessible data related to diversity collected by Texas A&M University were made available to participants in two versions: reference data: 'human readable' graphs and tables raw data for coding: 'comma-separated-values CSV files All data were stored in an on-line git-hub repository. Sample data were made available within a call for participants one month prior to the event. The data used for Diversity Open Data Hackathon were all publicly available data as part of open data ("What is Open?, " 2014) movement. Table 1 below shows data sources for all data made available to the participants.

	Texas A&M internal publicly available data			Other publicly available data	
Institution	TAMU DARS	TAMU Accountability	Cushing Library	Texas Tribune	
url	http://dars.tamu.edu/Data-and-Reports/Student	https://accountability.tamu.edu/content/university-metrics		http://www.texastribune.org/library/data/government-employee-salaries/texas-am-university/	
Description	Spreadsheets on faculty, students, staff	Human readable graphs on faculty, students, staff	Historic data, newspaper excerpts	Texas government employees salaries	
Requirement	Required to use by participants			Suggested to use by participants	

Table 1
Data and sources made available to participants.

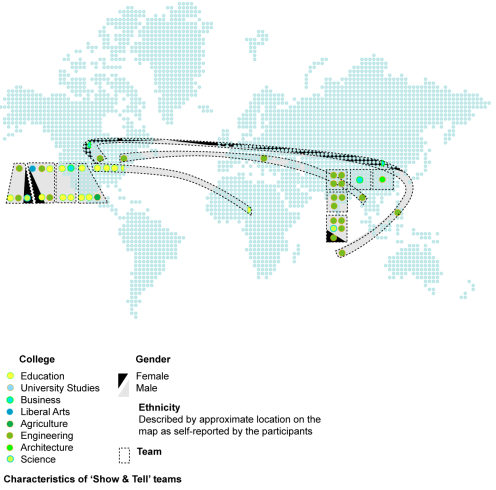
The hackathon mechanism, transforming pools of data through coding and/or hacking, proved to be a useful platform to encourage participation at a variety of scales. It also provided the creative environment of celebrating the design-oriented "culture of making" that when properly calibrated, gave the participants invaluable insights on managing a range of complex data sets and enabling tangible products.

Figure 1
Space claimed by a Hackathon team was turned into a private multifunctional lab. Image credit [By Author].

Description of the event

The Diversity Open Data (DOD) hackathon took place over an intensive 24-hour period in April 2014. The central challenge delivered to participants was that while diversity is meant to include a variety of aspects, facets and characteristics of the population, its actual "measurement" is commonly simplified via two variables: race/ethnicity and gender/sex. Participants were first tasked with imagining reliable alternative metrics to measure diversity in a more complex and sophisticated manner. The second charge was how to visually represent such metrics; indeed, the expectation was for participants to transcend conventions of graphic representation and to propose innovative ideas. The DOD was loosely divided into three phases: team-building activities; brainstorming and production (see Figure 1); and exhibition/showcase of alternatives/outcomes. The competition venue included classrooms, studios, fabrication facilities, computer laboratories, galleries and common areas in a university building housing the College of Architecture. Team-building activities were facilitated to increase team multidisciplinarity. To better support and encourage active engagement, a team of mentors was created with defined skills. To further stimulate discussion and to provide a first-hand experience in crossing disciplinary boundaries, teams were required to demonstrate some type of diversity within their ranks; teams were incentivized to assemble groups with the highest degrees of diversity (Figure 2 shows selected team characteristics) as defined by each team in its own terms. In summary, the key learning objectives of the DOD hackathon event included: engaging students, faculty, staff and the wider community in a discussion about diversity; visualizing publicly available data of the Texas A&M University as related to diversity; providing a platform for free expression through design language, and to provide experience working in diverse collaborative teams.

Figure 2
Characteristics of teams who participated in the final 'Show and Tell'



Event statistics

Fifty-six undergraduate and graduate students participated in the Hackathon. Majority of students were from colleges of Engineering and Education, the rest of students were from Liberal Arts, Business and Architecture colleges. Though widely advertised within and hosted by the College of Architecture, only two students from the college participated in the hackathon. Factors that may have contributed to this low participation include the prohibitive time-intensiveness of architecture design studio projects, design studio instructor restrictions on participation and/or a misinterpretation of the term "hackathon" vis-à-vis coding/programming. This gave the planning team an opportunity to assess the hackathon format as a tool for teaching beginning design, since a substantial majority of the participants had never enrolled in a design studio. The composition of twelve teams participating in the competition ranged from homogeneous to semi-diverse by the metrics mentioned in the previous section.

Hackathon Outcomes

The formation and work of the twelve teams, along with the discussion with the mentors, resulted in a variety of outcomes (see Figures 3, 4, 5), which were presented to and judged by an ad-hoc panel of judges. Prizes were awarded based on overall rating, best understanding of diversity, team diversity, and most creative as voted by the event organizers and mentors. One exemplary observation expressed during one team's presentation is the fact that though individuals' differences are typically perceived to be significant, the human genetic composition differs only by a mere 0.1% among individuals. In tension with this reality of a miniscule difference is the perplexity of perceptions of the things that define our differences. For many of the teams, the process of redefining diversity was achieved through a two-step process: 1) quantification of particular cultural or social trends, and 2) an extrapolation of data through an additive or subtractive process. Cultural variables analyzed included things such as number of spoken languages, while social trends analyzed included things such as social media usage. The teams learned that simply stating a variable quantity could unintentionally induce a marginalization of the differences.

Figure 3
Still image from a Data Driven Document (D3) presentation by the Infolabelers team. Image credit [By Infolabelers team].

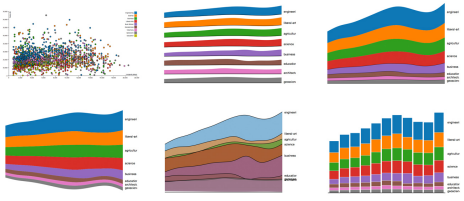


Figure 4
Still images and a photograph of data driven document (D3) visualization of the composition of Texas A&M University student population per colleges and departments. Image credit [By Santanu and Friends team].

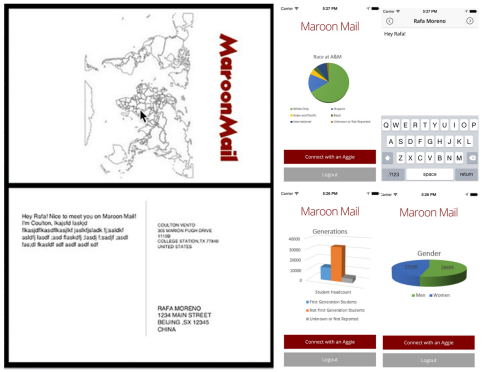


Figure 5
Image stills from a mobile application. The app matches people on campus who have the least in common and generates a postcard for them to post. Image credit [By Three Amigos and a Friend team].

Role of mentors

Mentors played a crucial role in overcoming the difficulty of team building across disciplines. Sixteen mentors took part in facilitating the event: faculty, graduate students and staff members from the College of Architecture, Multicultural studies; New Media, Religion and Digital Studies; Geography; the Center for the Study of Digital Libraries, and professional mentors from the technology incubator and local businesses. The intent of the mentor recruitment process was to maximize diversity among the mentors to reflect the diversity of disciplinary expertise and to share a broad array of ideas with the teams. Mentoring techniques varied from helping the team define realistic boundaries to developing a formative common vocabulary that could be deployed by the team to steward active engagement through a critical thought process. In this context the mentor served as a "collaborative critic" who bridged between concepts and the means to enable them. Consequently, the role of the mentor is defined by three modes of operation: as enabler-enabling the teams to help the team narrow down their ideas to a few key concepts; as strategist-developing a strategy or tactic for examining the data; and as stage-to pose questions and from which the team could self-configure a strategy for presenting their findings in a short amount of time. While characterizing their participation as intense and invigorating, most mentors wished that they could have spent more time at the hackathon event. In subsequent feedback questionnaire, mentors conveyed that the format was a creative mode of teaching that could be incorporated into classroom practice. The format of the hackathon allowed mentors to float between teams, participating in conversations through various modes of interaction. This floating enabled mentors to remain nimble, monitoring teams through a variety of stages of design processes. In reviewing the approach that led them to the winning design solution, members of the first-place team cited questions posed and suggestions made by one of the architectural design studio professor mentors and the architectural historian mentor as triggering the shift in perspective that pushed them past the limits of their collective disciplinary expertise.

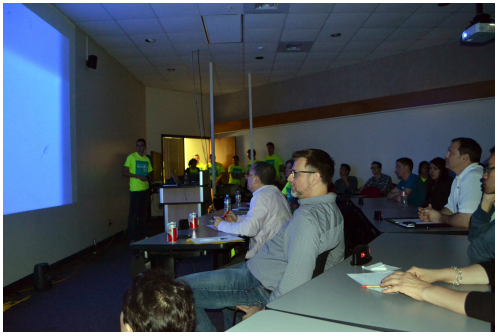


Figure 6
Photo of an audio presentation accompanied by changing gradients of color "What could you see if you didn't look for diversity?" by the Paco-Taco team. Image credit [By Author].

LESSONS LEARNED & MOVING FORWARD

With a theoretical grounding in activity theory, the hackathon format enables a deep dive into a particular topic, inspires teamwork and collaboration, and triggers the imagination within a constrained time period. Aligning the topic of diversity to teaching, research, and service-intrinsic components of the academic setting-enhanced student learning and community engagement. Hackathon participants found that attempting to define the complexities of diversity through a parameter-based solution was initially

perceived as limited or limiting and that it was not an easy task. One team posed a question that perhaps was the most compelling answer to the challenge: "What do you see if you don't look for diversity?" (see Figure 6). Allowing differences to be defined by two variables was perceived to be archaic, simplistic and too limited; and accepting that difference exists is the first step in redefining the term. Ultimately, the team arrived at three key observations: first, one can utilize data from a variety of contexts and align seemingly parallel issues through creative visualization; second, by viewing topics such as diversity from multiple vantages, previously unknown patterns can emerge; third, platforms such as the hackathon enable both self and collective discovery at a variety of scales. As one of the mentors noted the most valuable aspect of the hackathon format was "triggering the shift in perspective that pushed each student team past the limits of their collective disciplinary expertise." As an educational tool, the DOD hackathon was shown to be a reliable and versatile outlet for design-driven creativity. The 24-hour time constraint allowed for an intense stimulation of innovative thinking, much like in an architectural design studio charrette. The subversive stimulation of the work environment was well received, including non-design students. In this sense, the hackathon is also an operative mechanism-an optimization toolkit-comparable to more complex algorithms that design students usually encounter later in the curriculum-such as uncertainty analysis and sensitivity analysis-that allow collaborative design teams to craft optimal solutions within a given boundary of constraints. The competitive environment frustrated, challenged, and ultimately, inspired teams to think beyond their perceived capabilities. Driven by a sense of ownership and pride in the output of their analyses, participants from non-design disciplines were able to experience one of the typical rewards of the design studio environment. One of the mentors noted her excitement of participating in the "Google-like atmosphere" when she "saw a lot of light bulbs go on in people's minds." Finally, the presentation of the outcomes enriched the individual and team experience, creating new levels of synergy among team members, regardless of homogeneity or heterogeneity in team composition. At the time of this submission, the research team is developing an interdisciplinary grant proposal and will be partnering with the Texas A&M University to bring several of the workshop platforms to fruition. By providing funding to jumpstart the research, the teams will be able to transform their hackathon research into apps and visualizations.

CONCLUSIONS

Framing the hackathon experience with issues of diversity challenged students in a variety of ways. First, confronting the definition of diversity challenged the assumptions of students who had not, in general, questioned this concept in a profound and complex way. Second, the restrictive time frame generated an artificial burden that resulted in a heightened sense of urgency. Third, the event location (unfamiliar to most participants) was, in the end, an equalizing element: the venue meant that most participants were equally out of their comfort zone. Mentors catalyzed anticipated successes in the formation of the teams and through encouraging complex discussions on data interpretation as well as search strategies that led to more complex data sources. In combination, these elements seem an innovative pedagogical tool with potential for design studio applications. By generating creative thinking and by forcing participants from comfort zones (spatially, temporally, socially and culturally) event organizers generated new realms of conceptual exploration. In conclusion, the Diversity Open Data hackathon promises to be an effective tool for stimulating critical thinking and self-efficacy in the beginning design process. Further, within a restrictive time frame, students left empowered by a high level of design freedom and first-hand knowledge of the intricacies of disciplinary acculturation. Incentivized by rewards for creativity rather than for course credit, students felt motivated to access untapped intellectual resources and unexplored areas of scholarly imagination. Students hesitant to

pursue open-ended problems were ultimately able to activate realms of learning beyond their comfort zones.

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