RESEARCH PROPOSAL: CHANCE-IT MULTI-TOUCH TABLE

"Chance is always powerful. Let your hook be always cast; in the pool where you least expect it, there will be a fish."

Ovid

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ABSTRACT
We propose to study synthetic thinking in the creative process by developing a multi-touch table application. Combining chance operations, multi-touch, and support for distributed collaboration and synthetic thinking in the creative process, our project endeavors to support artists and designers in Design Lab 1. Our work serves the broader research agenda of creativity support research.

PROBLEM
Digital technology is a powerful tool for artistic creation that is increasingly accessible to many artists. Today's drive toward interdisciplinarity in academia and the plethora of less programming-intensive digital technologies for designing visual artifacts has allowed the creation of digitally-driven artworks by formally non-technical individuals. In addition, groups of individuals are coming together more frequently to create artworks, shifting the paradigm for digital art to one marked by collaboration [Edmonds]. Researchers in creativity support strive to develop software and interfaces that can empower users to be productive and more innovative [Shneiderman]. Recognizing that the advantages of collaborative, computer-supported art making extend beyond the acquisition of technical skills, educators also work to encourage these projects. At the University of Michigan, Design Lab 1's mission supports these agenda.

Our idea begins from several specific observations in this shifting creative atmosphere. The first is that while many digital creativity-support tools are available, from proprietary groups [Adobe Illustrator, Photoshop] as well as open-source models [Gimp, Inkscape, Blender], these tools tend to support predefined operations and present a steep learning curve. This results in **a high barrier of entry for creating art with digital tools.**

Research suggests that creativity constitutes a two-fold cyclic dynamic with an initial generative phase and a second exploratory phase [Finke]. Most digital tools support the second phase, but few address the first. Instead, tools assume that **the creator must approach the tool with a moderately developed idea. Without such an idea, the novice or even the highly-skilled creator may emerge from an interaction frustrated and lacking confidence in their own skills**.

A third observation proceeds from our awareness that as "the expressive sum of our intentions and experiences," creating art is rarely separate from life [Dewey]. Creativity is a mentally, socially, and physically engaging process for generating new ideas that are valuable to the creator. We see this in the way professional artists and designers inspire their works using personal, and the many "p-creative" acts that find their value in the creator's personal context [Boden]. The problem is a lack of support for creating art that bridges "the art life gap." The common hierarchical organization of our personal digital

artifacts makes for easier retrieval of known content, but works against browsing in a way that generates inspiration. Consider the way that the photos uploaded to a computer often end up grouped amid other very similar photos taken at the same general time and place. **Despite the digital surplus, we lack non-linear and generative ways to navigate digital material.**

THE PROJECT OBJECTIVE

How can the powers of digital technology be harnessed in new ways, to recognize the lack of clear separation between art and life and to meet the artist where they are, outside of preconceptions about what technologies they know and how fleshed out their idea is?

Our idea applies **chance operations** to this challenge. Chance operations are a generative application of systems theory in art, allowing the creator to move beyond preconceived notions of what elements should or should not be included in a piece.[1]

How do chance operations in digital technology solve the above problems in creativity support? Creativity has been associated with the synthesis of new structures, and the ability to consider parallel lines of thought instead of gravitating quickly toward a single, familiar solution [Edmonds]. Successful tools support these exploratory aspects and allow for numerous potential paths in an interaction [Shneiderman]. We propose to design a multi-touch tabletop application that encourages its user to build associations among a changing array of "found" elements, introducing new elements in the tabletop's center at a constant rate using chance operations. These elements, which might be snippets of text files, photos, or portions of music files, are copied onto a usb key attached to the table prior to use.

The most engaging experiences with technology immerse the user in a stimulating, embodied interaction. We implement our project using **multi-touch capabilities** and adding visual cues that resemble tactile properties, inviting users to touch. Fragments of documents and photos "float" to the surface in bubbles. The user has a moment to touch bubbles reaching the surface, making the content fully visible before it 'pops,' replaced by newer bubbles. Through a second gestural cue, a user can suspend a fragment on the surface and drag it into one of four virtual "buckets" around the tabletop's edges. If sufficiently stimulating, these tactile properties will prolong use, enhancing the learning experiencing to its full potential.[2]

Our application of chance operations to the creative process is **collaborative**, adapting Beat writers William Burroughs and Bryon Gysin cut-up method for asynchronous, distributed collaboration. The authors describe how a third mind that is more than the sum of its parts arises when fragments originating from multiple different authors works meet in a composition. Experiencing the effects of this third mind is a powerful motivator for student artists to collaborate beyond the use of the table. We realize this aspect by

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[1] A chance-based *system orientation* motivated the works of artists like Hans Haacke, Merce Cunningham, John Cage, and Alan Kaprow in the 1960's [Alt].

[2] Tactile feedback from an interface is more salient, generating faster response times [Wickens].

requiring users to "donate" the files they input to the table to be included in the collages of future users. As a result, the works produced become increasingly pluralistic in authorship over the table's lifespan, aculturating return users to a collaborative view of art making.

"Experimental and for everyone," the cut-up method lowers the barrier to creation. In its original form, it allows a finished work able to reproduce itself across time and space via multiple authors. While our idea supports collaboration in the latter sense, the multi-touch aspect and possibility of adjusting the rate of items' appearance introduces the potential to include multiple as a user gathers others to help her in the design act.

The final theme in our application is **challenge**. Constraints are a natural preoccupation for artists who strive to manipulate their medium to its full potential effect. Limitations and rules can be extremely useful in creative contexts [Stebbings]. Csikszentmihalyi's well-known work on creativity describes how the element of challenge in the creative process contributes to the concept of *flow,* a state of mind in which the individual performing skilled work loses awareness of time, becoming deeply engaged in their activity. We impose a limit on the number of items a user can retain at a time in each bucket, encouraging the user to exercise their artistic intuition. In addition, the application's rate of introducing new elements challenges the user to operate at a critical mass of processing. In addition, a shadow of each user's resulting collage will remain on the surface after use, lending an element of competition to stimulate engagement.

Through the save operation and bucket categorizations, our application provides the opportunity for **data analysis and visualization of users' operations.** Data on user sessions is gathered, forming a network representation of the user's categorization of items into buckets. This data can be used for further network analysis to examine common themes across sessions. After interaction, the items the user saved migrate from the corners to spread out across the top of the table using a network layout algorithm. The user can save to a file or print the output. The diagram serves as an unanticipated reward[3] for interaction, potentially encouraging future use.

LITERATURE REVIEW

Our work is potentially relevant to research in Computer Supported Cooperative Work (CSCW), Computer Supported Cooperative Learning (CSCL), creativity support and cognition, and Information Visualization (InfoVis). In CSCW and CSCL, research studies the properties of tangible interaction systems, such as tangible manipulation, spatial interaction, embodied facilitation, and expressive representation [Hornecker]. Quantitative study of user interactions with our application might lead to insights on how factors like use of personal content and chance affect collaboration, as well as the role of more general properties of the multi-touch interface.

Collaboration is also a topic of interest in creativity support research, with the appreciation of supporting creativity of small teams as scholars seek to balance the many descriptions of creativity which focus on the user [Bennis and Biederman 1997 as cited in Schneiderman]. Creativity support research endeavors to develop improved

[3] Reward has been cites as a component of systems that support creative innovation [Shneiderman].

software and user interfaces that enable more effective searching of intellectual resources, improved collaboration among teams, and more rapid discovery processes. These advanced interfaces should also provide potent support in hypothesis formation, speedier evaluation of alternatives, improved understanding through visualization, and better dissemination of results. For creative endeavors that require composition of novel artifacts (e.g., computer programs, scientific papers, engineering diagrams, symphonies, artwork), enhanced interfaces could facilitate exploration of alternatives, prevent unproductive choices, and enable easy backtracking.

Creative Cognition literature studies aspects of creative thinking including synthesis and intuition [Resnick et al., Finke]. Our work allows for the study of how categories are constructed in creative thinking, and how elements like collaboration, chance operations, and multi-touch affect the creative process. The data gathered for each user session can be used to provide insight into how items are grouped in creative synthetic thinking, in isolation and collectively.

The network graph component makes our work relevant to InfoVis literature. By generating as output a network representation of the user's session that cannot be easily influenced or predicted by users,[4] our work is potentially of interest to work in studies of how visualization interfaces can operate in non-transparent ways [Boehner et al]. In addition, our work is potentially relevant to InfoVis research that studies how digitally-based works can impel users to consider more deeply the temporal patterns and aesthetic beauty present in mundane or everyday data [Viégas].

We surveyed numerous mutli-touch applications for collaboration and learning in developing our idea, and identify a collective insufficiencyiy in generating creative learning experiences that leverages chance. Systems we surveyed can be categorized as collaborative and/or creative but lack the emphases on choice and/or challenge. The Reactable supports creativity through collaborative music-making [http://www.reactable.com/]. The Diamondtouch table supports collaboration and differentiates users, [http://www.merl.com/projects/DiamondTouch/], yet we prefer for multiple users of our application to remain equivalent from the system's perspective. Art+com has created numerous collaborative interfaces, including a floating numbers table for museum-goers from which we draw inspiration for the appearance of elements [http://www.artcom.de/index.php?lang=en&option=com_acprojects&id=14&Itemid=144&page=6]. The University of Michigan Museum of Art recently installed a multi-touch table for learning about the collection. In none of these examples is chance used to stimulate creative choice, or user content supported.

Our project also bears resemblance to several collage interfaces that support single users. These include a query visualization system for photos that generates confections, juxtapositions of images in a narrative context that allow for visual conversations with novel stories [Koh and Kerne]. Photo collage applications include Microsoft's Touch Pack [http://windowsteamblog.com/blogs/windows7/archive/2009/05/27/introducing-the-microsoft-touch-pack-for-windows-7.aspx] and the Photosketch system that generates

[4] Unless a user is familiar with network theory and highly perceptive of their actions during use, the transformation function from user actions to graph is not transparent.

collages to match user drawings [http://vimeo.com/6496886].These applications too concentrate on browsing and collaging in less surprising, and possibly challening, ways.

PROJECT ACTIVITY AND BENEFIT OF COLLABORATION

We plan to build the table and program the application during the first half of the semester. We will then begin gathering data, using students in Professor Mick McQuaid's classes in DL1, and present a work-in-progress version of analysis of how the table is used at the GROCS wrap-up ceremony.

Each team member brings a unique perspective. **Jessica Hullman** is a doctoral student studying Information Visualization, creativity and digital technology, and Human-Computer Interaction. Her background includes an M.F.A in experimental poetics and an M.S.I. in Information Analysis & Retrieval. She can lead the inquiry pertinent to the fields of InfoVis, CSCW, and creativity research. She has programmed in Flash and actionScript, and is familiar with network theory algorithms that might be used to create the collages. **Zhang Zhang** is a second year graduate student in Art and Design. Her major field includes graphic design, multi-media design and she is strongly interested in combing art with digital skills and seeking a way of inspiriting imagination and creation, both for other designers and herself. Her main skills are drawing and painting and she is familiar with using design software such as PS, AI, Aftereffects and Flash, which will be useful for the project's appearance. Her own experience of being a designer will also help for the foundation and development of the concept of this multi-touch table. **Yi-Wei Chia** is an M.S.I. student in Human-Computer Interaction. He has a former M.S. in Networking and Multimedia, and considerable experience building and programming for multi-touch tables like Diamondtouch and MicrosoftSurface-like Tabletop systems, as well as experience in actionScript and Flash. Based on this experience, he knows the pros and cons of each system and can provide suggestions and guide use of the techniques. **Tze-Hsiang (Stan) Lin** is also an M.S.I. student on in Human-Computer Interaction, who majored as an undergrad in Industrial Design and Computer Science. He excels at design and programming, and uses Adobe products, freehand sketching and mock-up skills in prototyping. Stan's interests include product design, prototyping and programming, all of which become relevant in this project.

Together, our collaborative perspective is rounded in systems, artistic, and analytic perspectives. Through the project, we each hope to build our skills sets in the areas that we are less familiar with. In this respect as well our project aligns with creativity research, which advocates that the process of disciplinary convergence must be accelerated for progress to be made in the development of theory and tools supporting creativity [Schneiderman et al].

OTHER COLLABORATIVE POTENTIAL

This project's potential for encouraging collaboration lies in the stimulating tactile feedback and the way it supports multiple users. In addition, there is the potential to stream the table's output to a public website so that it reaches others.

SPECIAL EQUIPTMENT REQUIREMENTS

A significant portion of our grant money will be used to purchase materials to build the table. We do not anticipate problems obtaining these materials as they are relatively

easy to find. We have spoken to Erik Hofer at SI, who has volunteered to answer questions regarding the materials and details of constructing the table.

We intend to make use of Community Core Vision (CCV), a highly usable and extensible open-source community for designers of multi-touch systems created by "nuiGroup", the creators of numerous tabletop related finger detecting programs. The CCV's usability includes the possibility of using various modifiable filters, such as threshold, high-pass, smooth, and its communication ability with Flash or other program receiving messages in TUIO protocol. CCV is highly extensible: because it is open source, any needed extensions of CCV can easily be programmed. We can add more filters, change the way it communicates with Flash, or collect more sensors feedback to detect various user's interaction.

ORIENTATION MEETING TIMES
Tuesday morning from 9:00 to 12:30 and Friday afternoon from 1:00 to 5:00.

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