3.4 DOCUMENTS ON CONTRIBUTIONS TO RESEARCH

3.4.1 RESEARCH PROGRAMME

RESEARCH THROUGH INNOVATION PATTERNS

“Give a man a fish and you feed him a day; teach a man to fish and you feed him for a lifetime.”

Throughout my exploration of the field of human-computer interaction, I have sought to look beyond the specificity of individual projects to discover the more fundamental research problems shared across different projects. After being involved in more than forty projects in the past decade, I have identified three such fundamental research problems:

1. As all technical solutions involve a collaborative effort between humans and computers, each of which have very different characteristics and advantages, one common problem of existing solutions is that many are not able to assign subtasks to the proper agent (human or computer) that best take advantage of their unique characteristics and abilities.
2. Interface designers often fail to identify a concise surface representation of the object of interest that matches users' mental model, requiring users to exert more cognitive and physical effort to interact with the interface.
3. There is often negligence of the change involved in the status of the user and the contexts in which a technical solution is used, which results in solutions that do not support smooth transitions between the different states and usage contexts.

To facilitate the discovery of innovative solutions when facing these fundamental research problems, I have developed three generalizable strategies I call innovation patterns: balance humans and computers, enhance directness, and facilitate transition.

Balance humans and computers pattern enhances the compatibility between subtasks and agents by assigning the proper subtasks to the proper agent (human or computer) to best take advantage of their unique characteristics and abilities. Enhance directness improves the affinity between the mental model and surface representation of object of interest. Facilitate transition improves the generalizability of technical solutions to deal with changing states of the user and the context of usage. These patterns provide a framework to tackle the fundamental research problems noted above and have guided me in creating novel solutions to these problems across numerous domains.

Using these innovation patterns, I have been able to generate solutions more effectively. This is evidenced by the wide range of projects I have been involved with, the recognition received for the solutions created, and the positive embracement of my designs by both private companies and the public, as noted by the following:

Breadth of research program

- My projects span across a wide range of problem domains including: accessibility, tools/systems for arts and creativity, human-robot interaction, information
visualization, interaction techniques, mobile and wearable computing, social computing, etc.

- My projects serve a variety of different users including: artists or people interested in art, housewives, elderly, disabled, students and teachers, researchers, volunteers, or just average users.
- My projects cover a wide range of devices, technologies and contexts, including: desktop computing, mobile computing, wearable computing, human-robot interaction, and web and social media.

**Recognition**

- Mentioned by ACM Interaction Magazine as the most prolific author in Asia at the ACM SIGCHI conference for the last six years (2009-2014).
- Served as senior area chair (SC) for the CAPS & MOD subcommittee, CHI’15 & ‘16
- Best Video award, CHI’14 – Draco
- Best Video award, CHI’11 – SandCanvas
- People’s Choice of Best Presentation award, CHI’14 – Draco
- Honorable Mention Best Paper award, CHI’14 - Draco
- Honorable Mention Best Note award, CHI’12 - BeyondStereo
- Honorable Mention Best Paper award, CHI’11 - SandCanvas
- Honorable Mention Best Paper award, CHI’11 – MOGCLASS
- NUS Young Investigator award ’09

**Media coverage and public engagement**

- *Draco Brings Illustrations to Life with Kinetic Textures.* Animation World Network (AWN), June 2014.
- *Autodesk’s Draco Lets You Animate An Illustration In Seconds.* Fast Company, May 2014.
- *Draco: Bringing Illustration to Life with Kinetic Textures.* HOW Design, April 2014.
- *Magic Cards.* TV Tokyo Digital 7 (a Japanese nation-wide TV channel), May 2009
- 30 projects were demonstrated at the Art Science Revealed events at ArtScience Museum (Singapore) for three consecutive years (2013, 2014, 2015)
- 3 projects, BeyondStereo, AutoGami, and DIY HMD, were selected to be displayed to hundreds of thousands of visitors at *Tertiary Display & Innovation Today Demonstration for Da Vinci: Shaping the Future,* ArtScience Museum (Singapore, Oct. 2014–Apr. 2015)
- Draco is selected to represent SoC in the Science & Technology 110 Exhibition

**Impact**

- *Draco* is currently developed as a product by Autodesk

- **InkSeine** is released as a prototype ink application

  User comments: “Windows 8 + Inkseine = Superb Windows 8.” “The inking app that had the greatest potential of any.” “I LOVE the ScrollControl widget that comes w/ InkSeine.”

- **SandCanvas** is released as an iPad application

  User comments on the Youtube video: “Oh My God. This is super amazing.” “Beautiful. Wonderful job guys!”

- **NEXP** is released as a free experimental design toolkit

  User comments: “Extremely easy to use.” “Neat UI.” “Make experiment order very clear.”

- **AutoComPaste** is released as an open source software

Below are examples of how these patterns have been used in my own research to drive innovation, solving challenging problems across different domains.

**Balance Computers and Humans**

To improve the balance between humans and computers in the art and creativity domain (where balancing tasks between humans and computers is arguably more challenging), we developed the SandCanvas project (CHI ’11)\(^1\). Together with my PhD student Rubaiat and colleagues in NUS and SMU, we transformed sand animation (an emerging art form) from a pure human activity into a new computer-supported activity. SandCanvas’ interface is designed on a modified multi-touch surface to maximally preserve the advantages of traditional human practice of Sand Animation (e.g., fast and fluid sand manipulation via versatile hand gestures) while incorporating the advantages offered with digital capabilities (e.g., record, undo, color, texture, recorded gestures, video mixing). The result is a compelling digital artistic medium that harnesses abilities from both humans and computers in a balanced way. SandCanvas won two awards at CHI 2011.

![Figure 1: SandCanvas (left), Vignette (middle), Draco (right)](https://example.com)

Following SandCanvas, we extended the *balance computers and humans* pattern to the artistic practice of pen and ink illustration (Vignette, CHI ’12)\(^2\). Vignette improves the

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\(^1\) SandCanvas video: https://www.youtube.com/watch?v=NQ9FERXWWsQ

\(^2\) Vignette video: https://www.youtube.com/watch?v=R4NnYNsOcio
balance between humans and computers in existing digital pen and ink illustration tools by reassigning certain subtasks to the appropriate agent (human or computer). Vignette preserves traditional workflow and allows artists to create an outline and sample textures of their drawings from scratch using a pen-based drawing interface, maximally preserving an artist’s signature style. Leveraging digital capability, Vignette accelerates the creation of textures from user-defined example strokes. The resulting application enables natural, smooth, and efficient creation of pen and ink illustrations.

Beyond Vignette, together with colleagues from Autodesk Research, we extended our innovation further into a more challenging problem domain of creating animation effects. While previous systems have introduced sketch-based animations for individual objects, our tool, Draco (CHI’14)³, leverages on Vignette's interface design and workflow but expands it to support texture motion by allowing users to efficiently specify animations for collections of objects, subsequently adjusting the properties of the global animation as well as finely tuning the granular motions of the individual objects. The result is an innovative and refreshing way to create many animation effects. Draco won three awards at CHI 2014 and is currently productized by Autodesk.

Enhance Directness
With the popularity of Massive Online Open Courses (MOOC), the importance of using video as an educational medium has significantly increased in recent years; however, enhancing the directness of video (3D) through 2D input devices remains a challenging problem. Together with my former PhD student TJ Monserrat and colleagues at NUS, we created the NoteVideo (CHI’12) interface that allows for direct manipulation of the conceptual object of interest in blackboard-style lecture videos through a summarized image of the video. Our in-scene navigation interface allows users to directly jump to the video frame where that object of interest first appears instead of navigating linearly through time. Our innovative solution significantly improves the ability to perform different navigation tasks as compared to the conventional scrubbing and transcript interfaces, saving valuable time.

In addition to NoteVideo, we sought to enhance the directness of Massive Online Open Course (MOOC) interfaces with the L.IVE project (CHI ’14). Instead of relying on video as the only source of information, L.IVE expands the sources of learning to the multiple channels currently available from MOOC websites, including lecture videos, forum discussions, and assessments. In current systems, these multiple sources are presented separately, which does not match the conceptual representation of the objects of interest, as information belonging to the same knowledge concept should be presented as an integrated whole. To enhance directness, the L.IVE interface links the different pieces of information that belong to the same knowledge concept together, allowing them to be displayed within the same platform. The result is a novel platform that significantly improves the efficiency of learning.

Facilitate Transition
In mobile and wearable computing, users often need to use the same interaction techniques across different contexts in space and time. Each context can impose a different set of

³ Draco video: https://www.youtube.com/watch?v=l84YK1_ytks
constraints and design requirements, making facilitating smooth transition across usage scenarios an important and challenging research problem. In earPod project (CHI '07, IwC '14), two types of transitions are carefully facilitated: the usage across different scenarios and the skill improvement from novice to expert users. For the first case, we proposed shared input multimodality interfaces, as we found that different modalities have advantages in different scenarios. Since shared input multimodal interfaces share the same input mechanism, they require less additional effort to learn. Furthermore, since the input mechanism is shared between two interfaces, the motor skill required to operate both interfaces is the same, and using either interface also trains the use of the other interface, which could potentially reduce the learning time for users to achieve expert performance.

In addition to facilitating the transition between scenarios, earPod is also designed to seamlessly facilitate the transition from novice to expert usage. The support of smooth and quick transition to expert behavior has allowed earPod, an eyes-free auditory menu, to achieve similar performance to the visual linear menu implemented on iPod and is the first solution to prove that via smart design, the performance of an auditory-based menu can compete with popular visual menus. Not only has earPod been well cited in academia but it has caught significant attention from the industry: more than 5 patents have cited this work.

The OmniVib project (CHI'15) is another example of facilitating transition across multiple scenarios. Together with our summer intern, Jessalyn, and post-doc fellow, Simon, we investigated the problem of how to allow users to consistently perceive spatiotemporal vibrotactile notifications when their phones are attached at different body parts, such as the hand, trouser pocket, belt, and arm. Our initial experimental results indicated that precise recognition of either position or orientation of simple spatiotemporal vibrotactile patterns was difficult across multiple body parts. Nonetheless, users were able to distinguish whether two vibration pulses were from the same location when played in quick succession. Based on these findings, we designed eight spatiotemporal vibrotactile patterns that can be reliably recognized (>80%) across the four tested body parts.

The OmniVib project is the first to demonstrate that cross-body recognition of spatiotemporal vibrotactile signals is feasible, which could significantly impact the way we receive notification from mobile phones. As a result, this project has generated considerable attention from top mobile phone manufactures: Samsung research has specifically asked for the details of our technique to potentially incorporate it into the future of their mobile phone design.

Future
Innovation patterns have unbounded opportunities to fundamentally improve our ability to discover novel solutions in Human-Computer Interaction. I have highlighted three of them in this document, but there are many more in need of exploration. For example, one way to improve task performance is to exploit human ability to concurrently control more than one input/output channel. Effectively combining multiple input/output channels has resulted in several innovative solutions in HCI literature. This approach has great potential to be developed into an innovation pattern. In addition, identifying and combining complementary solutions into a hybrid solution that takes advantages of both approaches is
another potential innovation pattern that could be further explored. In the future, I plan to systematically investigate these innovation patterns and develop a framework that has the ability to significantly change the way we innovate as well as the approach we use to train our PhD students.
3.4.2 Evidence related to research outputs

3.4.2.1 My publication record

Over my six years at National University of Singapore, I have established from the ground up a new group in my school in the area of human computer interaction and solidified my group’s track record as a top research group both in Asia and in the world.

According to the article (“Asian Researchers in CHI conference”), published in the ACM Interaction Magazine, January 2015 issue, I was ranked as the No.1 author for ACM SIGCHI conference in the last six years (Fig. 2).

<table>
<thead>
<tr>
<th>NAME</th>
<th># OF PAPERS</th>
<th>COUNTRY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shengdong Zhao</td>
<td>14</td>
<td>Singapore</td>
</tr>
<tr>
<td>Takeo Igarashi</td>
<td>10</td>
<td>Japan</td>
</tr>
<tr>
<td>Darren Edge</td>
<td>10</td>
<td>China</td>
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<td>Masahiko Inami</td>
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<td>Japan</td>
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<td>Edward Cutrell</td>
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<td>India</td>
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<td>Naomi Yamashita</td>
<td>7</td>
<td>Japan</td>
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<td>Chi-Wing Fu</td>
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<td>Singapore</td>
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<td>Mike Y. Chen</td>
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<td>Daisuke Sakamoto</td>
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<td>Hideaki Kuzuoka</td>
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<td>Xiangshi Ren</td>
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<tr>
<td>Geehyuk Lee</td>
<td>6</td>
<td>South Korea</td>
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</tbody>
</table>

→ Table 4. Authors who published at least six papers in six years.

Figure 2: Screenshot of table 4 from the “Asian Researchers in CHI conference” article, ACM Interaction Magazine. January 2015 (Page 55). According to this table, I am the most productive author in Asia for the last six years (2009-2014).

This is challenging, as the foundation of HCI in Singapore has been weak. As of today, I have helped National University of Singapore to become one of the top institutions in the field of HCI. The university published a total of six papers and notes in 2014, which ranked No. 26 in the world (No. 1 in Asia) out of hundreds of institutions, and my group contributed five of the six papers.

On the ACM SIGCHI 2014 top author list, I was ranked 17th. CHI 2014 has a total of 1552 authors, making me within the top 1.1%.

Our group's publications are also widely recognized. Draco has won three awards including an honorable mentioned award for best paper (top 5%), the best video, and the best talk awards. In addition, we have won another best video award at the CHI conference (2011, SandCanvas) and three more honorable mention awards for CHI 2011, 2012.
Since 2009, Singapore has made great advancement in HCI research, growing from only one or two HCI related researchers to more than ten dedicated HCI researchers. While publications from Singapore were almost nonexistent in top HCI venues before 2009, the country has caught up quickly to become a significant force in producing high quality HCI innovations and studies. For the last five years, Singapore published a total of 35 long and short papers in ACM CHI (rank 1). My group contributed significantly to this collective effort: 16 of the 35 papers involve authors from my group. This represents 45.7% of all papers from Singapore.

I am also satisfied that the visibility of my group has increased, as recognized in the form of successful alumni (Autodesk research, UIUC), well-placed internships for students (Google, Microsoft Research Redmond, Microsoft Research Asia, Autodesk Research, Huawei's Noah Ark Research Lab Hong Kong, Tokyo University, University of Bristol, University of Chalmers), and conference-organizing program committee and technical program committee positions for myself (Senior Sub-committee Chair for ACM CHI 2015, ACM CHI 2015 working-in-progress co-chair, Associate chairs for ACM CHI 2013 and 2014, Technical program co-chair for Chinese CHI 2013 and 2014, Technical program co-chair for APCHI 2013, and one of the six steering committee members for Chinese CHI, Vice chairman for ICACHI).

PATENTS

Patents Granted – International
4. United States Patent – Self-revelation Aids for Interfaces. filed 01/2008 (Granted 06/2012)

Patents Filed – International
5. Japan Patent – Vignette: Interactive Texture Design and Manipulation for Pen and Ink Illustration, filed 2012 (Pending)
3.4.2.2 **Statement on Significance of Publications**

Below I highlight five publications that I have authored, which I feel highlight the three innovation patterns I have previously mentioned. The bibliographic details of each publication are presented for ease of reference followed by my assessment of its significance. Sample versions of these publications are included in my supplementary dossier under the research portfolio section.

**earPod**


Publication no. 0641586

Leveraging the *facilitate transition* innovation pattern, this paper is one of the first to demonstrate that through clever design it is possible to achieve similar interaction performance for an auditory menu as compared with a popular visual linear menu (such as the iPod linear menu). It demonstrated that eyes-free interaction is not only useful for blind users but also for normal vision users in a mobile environment. This paper has had a significant impact in academia; it has been cited 149 times according to Google Scholar. It also has had a strong industry influence, as evidenced by its citation in five patents from Microsoft Corporation, Intel Corporation, 3D Labs, etc., for designing controlling techniques for touch screen devices.

**SandCanvas**


Presented at the SIGCHI Conference on Human Factors in Computing Systems, 7 –12 May 2011, Convention Center, Vancouver, Canada. **Awards: Honorable Mention, Best Video.**

Publication no. 0494148
Together with my PhD student Rubaiat and colleagues at NUS and SMU, we transformed sand animation (an emerging art form) from a purely human activity into a new computer-supported activity. SandCanvas leverages the *balance humans and computers* innovation pattern. Its interface is designed on a modified multi-touch surface to maximally preserve the advantages of traditional practice of Sand Animation (e.g., fast and fluid sand manipulation via versatile hand gestures) while incorporating the advantages offered with digital capabilities (e.g., record, undo, color, texture, recorded gestures, video mixing). The result is a compelling digital artistic medium that harnesses abilities from both humans and computers in a balanced way. SandCanvas won two awards at CHI 2011.

**NoteVideo**


Publication no. 0571328

Together with my former PhD student TJ Monserrat and colleagues at NUS, we created the NoteVideo interface which allows for direct manipulation of the conceptual object of interest in blackboard-style lecture videos through a summarized image of the video. Our in-scene navigation interface allows users to directly jump to the video frame where that object of interest first appears instead of navigating linearly through time. Our innovative solution significantly improves the ability to perform different navigation tasks as compared to the conventional scrubbing and transcript interfaces, saving valuable time. NoteVideo is a representative example of applying the *enhance directness* innovation pattern.
Draco


Publication no. 0624177

Initiated by my PhD student Rubaiat and myself, and developed together with colleagues from Autodesk Research and University of Toronto in Canada, Draco is an illustration/animation system with a sketch-based interface that allows artists and casual users alike to add a rich set of animation effects to their drawings, seemingly bringing illustrations to life. It is an extension of one of our previous works named Vignette and leverages the balance humans and computers innovation pattern. The key idea of this work is to create animation using artists’ natural sketches on a 2D canvas instead of point and click via widgets and menus. It revolutionized the way in which certain animation effects are created. Draco won three awards at the ACM SIGCHI 2014 conference. Autodesk is currently working on making Draco into a commercial product.

OmniVib


Publication no. 0641573
Together with our summer intern, Jessalyn, and post-doc fellow, Simon, we investigated the problem of how to allow users to consistently perceive spatiotemporal vibrotactile notifications when their phones are attached at different body parts, such as the hand, trouser pocket, belt, and arm. This is another example of facilitating transition innovation pattern, aiding transition across multiple scenarios. The OmniVib project is the first to demonstrate that cross-body recognition of spatiotemporal vibrotactile signals is feasible, which could significantly impact the way we receive notifications from mobile phones. As a result, this project has generated considerable attention from top mobile phone manufacturers: Samsung research has specifically asked for the details of our technique to potentially incorporate it into the future of their mobile phone design.

3.4.2.3 Statement on Co-Authorship:
Though most of my publications are in conjunction with students (as is typical for my discipline), I also publish, research, and program with external collaborators. In most papers I co-author with my students, I take the leading role in defining the research problem, guiding the students through the research process as well as working on the paper writing together. For most papers with external collaborators, the collaborator usually plays the role of co-mentor to my students while the daily discussion and execution of research is carried out in my lab under my direct guidance.

3.4.2.4 Non-Publication Research Highlights
I would also like to highlight four contributions that demonstrate my research impact and initiative and differentiate my work from that of my colleagues.

Leadership roles in the international HCI community
I co-chaired the Capacity and Modality sub-committee for the CHI 2015 conference together with Sriram Subramanian from the UK, and will co-chair this sub-committee for the upcoming CHI 2016 conference together with Chris Harrison from CMU. The size of the HCI community is much larger than many of the other areas (the SIGCHI conference has about three thousand attendees each year, as compared to many other conferences with a few hundred attendees). For the ease of management, the technical program is divided into eight sub-committees; each is the size equivalent to a committee for many other areas, such as SIG IR (information retrieval) or ACM Multimedia. The duty of chairing a sub-committee is nearly equivalent to chairing an entire committee in many other fields. Additionally, I am the co-chair for the Work-in-Progress (WIP) venue of CHI 2015. I have also served on the Technical Program committee as an area chair for the last two years of CHI and this year for TableTop.
**Promoting HCI for Chinese researchers**

While HCI has become increasingly popular and important in North America and Europe, it is still relatively unknown in Asia, especially in the Chinese community. To promote HCI to Chinese researchers, we established the International Chinese Association of Computer Human Interaction (ICACHI) together with Prof. Ren Xiangshi from Japan in May, 2012 in Austin, Texas, US. Within two years, we have grown the organization to include hundreds of members including Chinese HCI researchers from all over the world. I now serve as the Executive Deputy President of ICACHI. During the first two years, I served as the Technical Program co-chair to establish an inaugural HCI conference for international Chinese HCI researchers (Chinese HCI). Successfully run for over three years now, Chinese HCI attracts close to 100 attendees each year from all over the world and is financially sustainable. Its proceedings are now included in the ACM digital library.

**Singapore HCI Society**

Outside of the School of Computing at NUS, I have initiated and co-organize a monthly meeting that gathers HCI researchers from all over Singapore (including NUS, NTU, SMU, SUTD, A*Star) and brings renown international HCI researchers (e.g., James Landay from Stanford University, Ravin Balakrishnan from University of Toronto) to give presentations. The Singapore HCI Society has grown to become internationally visible. To date, we have had over 30 meetings. The number of publications by our members in the most prestigious conference in HCI (ACM SIGCHI) has grown from almost zero to thirty-five.

**Reaching the public: research revealed at the ArtScience Museum**

Our group continuously aims to connect the public with our research. We have had more than five open house events in the lab, which entertained thousands of visitors from all over the world. In particular, I would like to highlight our exhibitions at the ArtScience Museum as part of the ArtScience Revealed event in 2013 and 2014. Our group was chosen as the first group to open this series of events beginning on February 3, 2013. Our demos were well-received by visitors, who scored our presentation at 4.0/5 points for how much they learned from it. Visitors called our contributions “innovative,” “awesome,” “a thrilling and innovative experience,” and “very impressive,” saying they “learned a lot.” Due to the positive response, we were invited back again on February 9, 2014, and it was again a great success. The rating for the second year was 4.2/5 for learning and 4.3/5 for enjoyment with over 87% of the visitors wanting to return to another similar event. The comments from the second year were again very encouraging: “cool, creative, innovative,” “good demo – look forward to next year,” and “very interesting and stimulates the mind.” The only complaint by some visitors was the lack of sufficient manpower at each station, a consequence of our lab being understaffed.
3.4.3 Evidence related to research impact

3.4.3.1 Citations (current as of August 2015)
I have 1019 citations as of August 2015 according to Google scholar. To demonstrate the extensiveness of my research, I offer a comparison between my own citation counts and those from our department’s historical statistics. Based on this review, I conclude that I have been relatively successful compared to my peers and more prolific. I believe this is due to my approach to research.

Please note that as a researcher in computer sciences, journal publications are not deemed as important, as such publications often take one to two years from submission to publication. Given how quickly my discipline changes, conference publications are the preferred vehicle for scholarly dissemination, and citations of these sources should be considered the most telling. Since my name is relatively rare (I know of no other person in computer science that has my name), the records from these searches are clean. Our department also keeps statistics for past tenure cases, so I’ve included these statistics (max/average/min) in the second line for your comparison.

Google Scholar:
- My citation count is 1019 (as of August 2015): citations for all papers (~80 documents indexed), 149 cites for top paper
- Computer Science Dept. (Max/Avg/Min): 753/341/108 for all papers, 533/120/29 for top paper

My citations are comparable with my colleagues in the department. A more detailed analysis of the results show a long-tail effect: many of my more recent works are still gathering citations. No single paper dominates my citation counts. Overall, over half of my publications have been cited in Google Scholar, again supporting my assertion that my contributions to research excellence are continuous and long-term.

A vast majority of my publications are published in the proceedings of the SIGCHI conference, which is regarded as the most prestigious publishing venue in the field of Human-Computer Interaction, even compared to other reputable venues in HCI (such as ToCHI, UIST, CSCW, etc.) In addition, many of my publications have won prestigious awards, including the Best Video (twice), People’s Choice of Best Presentation (once), and Honorable Mention Best Paper/Note (four times).

3.4.3.2 Consultancy
To assist Freehills (an Australian legal firm) as an independent consultant expert in the field of HCI, for a legal proceeding between Apple and Samsung (07/2012- 05/2013). Since only the leading expert researchers in the field of HCI will be invited to participate in helping the preparation of the legal proceedings between Apple and Samsung, my involvement of this case is an indication that the international community recognized me as a leading expert in HCI.
3.4.3.3 **TRANSLATIONAL RESEARCH**

We also like to share our research findings with the public. A number of software systems/techniques were released as applications or open source software to the public. This includes the multi-stroke marking menu, InkSeine, the SandCanvas iPad app released in the app store, a vibration notification app for the android platform, and the open source release of the AutoCompaste platform. We have just released a tool called NEXP to help researchers to design controlled experiment. In addition, Draco is currently under development in Autodesk, and there is a good chance it will be released as a product for public use.

3.4.3.4 **PATENTS**

See 3.4.2.1
3.4.4 Evidence related to international reputation and visibility

3.4.4.1 Program Committee

Steering Committee Member
  • Chinese CHI 2015-18

Conferences Program Committee Member

Technical program co-chair
  • Asia Pacific CHI 2013 (with Ed Cutrell, Microsoft Research)
  • Chinese CHI 2013 (with Zhang Xiaolong, Pennsylvania State University)
  • Chinese CHI 2014 (with Wang Haochuan, National Tsinghua University)

Subcommittee co-chair for interaction using specific capabilities or modalities
  • ACM SIGCHI 2015 (with Sriram Subramanian, Bristol University)
  • ACM SIGCHI 2016 (with Chris Harrison, CMU)

Works-in-progress (posters) co-chair
  • ACM SIGCHI 2015 (with Shamsi Iqbal, Microsoft Research and Shaun Lawson, University of Lincoln)

Program Committee Member
  • ACM Conference on Human Factors in Computing Systems (CHI) 2013-16
  • International Conference on Human-Computer Interaction with Mobile Devices and Services (MobileHCI) 2015
  • IEEE Tabletops and Interactive Surfaces (TABLETOP) 2014
  • International Symposium of Chinese CHI (Chinese CHI) 2015
  • ACM Conference on Intelligent User Interfaces (IUI) 2010
  • International Workshop on Modeling Social Media: Mining Big Data in Social Media and the Web (MSM) 2013, 2014, 2015
  • International Symposium of Visual Information Communication (VINCI) 2011
  • International Workshop on Sensor-based Activity Recognition and Interaction (iWOAR) 2015

Conferences – International
  • SIGCHI 2016 (rank 1), subcommittee co-chair
  • SIGCHI 2015 (rank 1), subcommittee co-chair
  • SIGCHI 2015 (rank 1), working-in-progress co-chair
  • SIGCHI 2014 (rank 1), area chair
  • Chinese CHI 2014, technical program co-chair
  • SIGCHI 2013 (rank 1), area chair.
  • APCHI 2013, technical program co-chair
  • Chinese CHI 2013, technical program co-chair

3.4.4.2 Service as a Reviewer

Journal Reviewing
• ACM Transactions on Computer-Human Interaction (ToCHI) 2011, 2014
• ACM Transaction on the Web 2014
• IEEE Computer Graphics and Applications 2013
• Applied Ergonomics 2012
• Multimedia Systems Journal 2010)
• ACM Transactions on Multimedia Computing, Communications, and Applications (TOMCCAP) 2010
• International Journal of Human-Computer Studies (IJHCS) 2007-08
• International Journal of Human-Computer Interaction (IwC) 2005-06

Conference Paper Reviewing
• ACM Conference on Human Factors in Computing Systems (CHI) 2004-12
• ACM Symposium on User Interface and Software Technologies (UIST) 2008-14
• International Conference and Exhibition on Computer Graphics and Interactive Techniques (SIGGRAPH) 2013, 2014
• ACM Conference on Computer Supported Collaborative Work (CSCW) 2009, 2011, 2012
• ACM International Conference on Multimedia (MM) 2009
• IEEE Information Visualization Conference (InfoVis) 2009
• IEEE Tabletops and Interactive Surfaces (TABLETOP) 2008
• Conference on Visualization and Data Analysis (VDA) 2006
• International Conference and Exhibition on Computer Graphics and Interactive Techniques (SIGGRAPH Sketches) 2006
• Graphics Interface (GI) 2005
• International Conference on Human-Computer Interaction with Mobile Devices and Services (MobileHCI) 2012, 2013, 2014
• International Workshop on Modeling Social Media: Mining Big Data in Social Media and the Web (MSM) 2013, 2014, 2015
• International Symposium of Visual Information Communication (VINCI) 2011
• International Conference on Information Systems Security (ICISS) 2010
• The AAAI Conference on Artificial Intelligence (AAAI) 2012
• International ACM Workshop on Crowdsourcing for Multimedia (CrowdMM) 2012

3.4.4.3 Invited Presentations at Scholarly Meetings/Workshops
International:
• Initial thoughts on innovation patterns in HCI
  Host: Ken Hinckley, (Microsoft Research, Redmond, WA, April, 2015)
• Connecting the dots: Balancing Human and Computers
  Host: Prof. Morten Fjeld, (Chalmers University of Technology, Gothenburg, Sweden, Jun, 2014)
• Connecting the dots: Balancing Human and Computers
  Host: Daniel Wigdor, DGP lab, Computer Science Department, the University of Toronto (Toronto, Canada, 12 Dec 2013)
• Connecting the dots: Balancing Human and Computers
Host: Prof. Mark Chignell, IML lab, Mechanical Engineering Department, the University of Toronto (Toronto, Canada, 13 Dec 2013)
• Connecting the dots: Balancing Human and Computers
Host: Tovi Grossman, Autodesk Research (Toronto, Canada, 18 Dec 2013)
• Connecting the dots: Balancing Human and Computers
Host: Daniel Vogel, the University of Waterloo (Kitchener, ON, Canada, 19 Dec 2013)
• Connecting the dots: Balancing Human and Computers
Host: Pierre Dragicevic, INRIA, Paris, France, (May 2013)
• Connecting the dots: Balancing Human and Computers
Host: Prof. Sriram Subramanian, (University of Bristol, Bristol, UK, May 2013)
• Connecting the dots: Balancing Human and Computers
Host: Sellen Abigail, (Microsoft Research Cambridge, Cambridge, UK, May 2013)
• Connecting the dots: Balancing Human and Computers“ Host: Prof. Steven Brewster, (University of Glasgow, Glasgow, UK, May 2013)
• Connecting the dots: Balancing Human and Computers“ Host: Prof. Michael Haller, (University of Applied Sciences Upper Austria, Hagenberg, Austria, May 2013)
• Designing an effective vibration-based notification interface for mobile phones CSCW 2013 Conference (San Antonio, TX, USA, Feb 2013)
• Farmer’s Tale: A Facebook Game to Promote Volunteerism, ACM CHI Conference (Vancouver, BC, Canada, May 2011)
• Effective and efficient techniques for hierarchy interactions.
Host: John. Starkey Research Center, Starkey Inc. (Berkeley, California, USA, March 2008)
• Eyes-free Menu Selection for Mobile Interfaces.
Host: Hiromi. Canadian Imperial Bank of Commerce (CIBC) User Experience Team (Toronto, Canada, August 2007)

Regional
• Research flash talk
• Keynote Speech: Connecting the Dots – Balancing Human and Computers
VisioGame 2014 conference, (Bandung, Indonesia, Nov 2014)
• Connecting the Dots – Balancing Human and Computers
Host: Prof. Hong Mei (Sichuan University, Chengdu, China, Jun, 2014)
• Keynote Speech: Connecting the Dots – Balancing Human and Computers
4th International Conference on Intelligent Human Computer Interaction (IIT Kharagpur, India, Dec 2012)
• Connecting the Dots – Balancing Human and Computers
SoC-Suzhou workshop (Suzhou, China, 4 – 5 Jan 2013)
• Keynote Speech: Connecting the dots – Seeking the Optimum Balance between Human and Computers
13th Philippine Computer Science Congress (PCSC 2013) (Ateneo de Manila University, Manila, Philippines, Mar 2013)

- **Keynote speech**: Connecting the dots – Seeking the Optimum Balance between Human and Computers
  International Conference on Intelligent Interactive Systems and Assistive Technologies (Coimbatore, India, Aug, 2013)
- Connecting the dots – Seeking the Optimum Balance between Human and Computers
  Technologies from the Edge Conference (Ateneo De Manila University, Manila, Philippines, Sept 2013)
- Connecting the dots: Balancing Human and Computers
  Host: Prof. Shi Yuanchun, (Tsinghua University, Beijing, China, Oct 2013)
- Connecting the dots: Balancing Human and Computers
  Host: Koji Yotani, (Microsoft Research Asia, Beijing, China, Oct 2013)
- Connecting the dots: Balancing Human and Computers
  Host: Mike Chen (National Taiwan University, Taipei, Taiwan, Nov 2012)
- Connecting the dots: Balancing Human and Computers
  Host: Gong Zhang (Huawei’s Noah Lab, Hong Kong, Dec 2012)
- Seeking Scientific Creativity: Research Projects@NUS-HCI Lab Host: CSE department, (BUET, Bangladesh, Oct 2011)
- Seeking Scientific Creativity Human Computer Interaction
  Projects in SoC
  Host: CS department (Isfahan University of Technology, Isfahan, Iran, April 2011)
- Seeking Practical Scientific Creativity: Research Projects@NUS-HCI
  Host: Alvin Chin (Nokia Research Center, Beijing, China, Jan 2011)
- Seeking Practical Scientific Creativity: Research Projects@NUS-HCI
  Host: Prof. Tian Feng, (China Academy of Science, Beijing, China, Jan 2011)
- Seeking Practical Scientific Creativity: Research Projects@NUS-HCI
  Host: Prof. Yuanchun Shi (Tsinghua University, Beijing, China, Jan 2011)
- Seeking Practical Scientific Creativity: Research Projects@NUS-HCI Host: Xiang Cao
  (Microsoft Research Asia, Beijing, Jan 2011)
- From Magic Cards to earPod: HCI beyond desktop
  Host: Prof. Jiang, (Fudan University, Shanghai, China, Jan 2010)
- From Magic Cards to earPod: HCI beyond desktop
  Host: Prof. Liu Zhengbao, (Xi’an Industrial University, Xi’an, China, Oct 2009)
- From Magic Cards to earPod: HCI beyond desktop
  Host: Hua Xiansheng (Microsoft Research Asia, Beijing, China, Oct 2009)
- A summary of my past research
  Host: Prof. Jiang, (Fudan University, Shanghai, China, Dec 2008)
- A summary of my past research
  Host: Prof. Yang, (Shanghai Jiaotong University, Shanghai, China, Dec 2008)
- A summary of my past research
  Host: Prof. Wan Huageng, (Zhejiang University, Hangzhou, China, Dec 2008)
• Magic Cards: Using paper tags to support task-centric human robot interaction.  
Host: Prof. Siio, (Ochanomichi University Tokyo, Japan, Sept 2008)
• Effective and efficient techniques for hierarchy interactions.  
Host: Prof. Ren Xiangshi, (Kochi University of Technology, Kochi, Japan, Apr 2008)
• In-a-nutshell presentation of my past research.  
Host: Prof. Takeo Igarashi, (Tokyo University, Tokyo, Japan, Apr 2008)
• earPod: mobile eyes-free menu selection.  
Host: Prof. Takeo Igarashi, (Igarashi Design Interface Project, ERATO, Tokyo, Japan, Apr 2008)
• earPod: Expanding the Role of Responsive Audio in Mobile Interfaces  
Host: Prof. Tian Feng (Chinese Academy of Sciences, Beijing, China, Sept 2007)

National
• WADE: Simplified GUI Addon Development for Third Party Software  
GeekCampSG, Singapore, (Oct 2014)
• Connecting the Dots - Balancing Humans and Computers  
UXSG (Singapore, Jan, 2013)
• SandCanvas: A Multi-touch Art Medium Inspired by Sand Animation.  
Host: Carlos Miranda Levy, (TEDxKRP, NUS, Singapore, Mar 2011)
• Farmer’s Tale: A Facebook Game to Promote Volunteerism.  
Host: Prof. Wong Poh Kam, (Opening ceremony of Crament Creative Lab, NUS, Singapore, Feb 2011)
• From Magic Cards to earPod: HCI beyond desktop.  
Host: Jamie Ng, (I2R, Singapore, July 2009)
• A summary of my past research.  
Host: Prof. Goh Wooi Boon, (Nanyang Technical University, Singapore, Jan 2009)
• A summary of research projects  
Department of Computer Science, (National University of Singapore, Singapore, Jan 2009)
• Effective and efficient techniques for hierarchy interactions.  
Host: Prof. Chua Tat-Seng, (National University of Singapore, Singapore, Mar 2008)
• Effective and efficient techniques for hierarchy interactions.  
Host: Prof. Rajesh, (Singapore Management University, Singapore, Mar 2008)
3.4.5 Other evidence of research achievement

3.4.5.1 Research grants

I have been successful in securing monies internally within the University in past years and have large (100K+) long-term projects. I have also successfully engaged multiple industrial grants as well as international grants to support my research group.

Grants Approved

Young Investigator’s Award

"Multi-dimensional Adaptive Interface for the Aged", WBS R-252-000-414-101, NUS Young Investigator Award, S$366,000 (~US$270,275) (PI)

Industry

• "Virtual Fitting Room", WBS R-252-000-467-720, CK Tangs, S$ 5000 (PI)

International

• STINT collaboration grant with Sweden

External grant (governmental)

• "Research Collaboration between NUS and CSIDM Phase 2”, WBS R-252-100-372-490, S$157,000 (~US121,855) (PI) 06/2011- 05/2014
• "Deliberative governance: Developing a digital platform”, SoC IRC – R-252-000-547-113, TSF – R-252-001-547-113, S$527,095, (SoC, co-PI), 04/2014 – 03/2017

Internal

• “Alternative Interaction Techniques for Mobile and Ubiquitous Environment”, R-252-000-375-133, AcRF Tier 1, S$179,590 (~US$132,618) (PI, Startup Grant), 04/2009 – 03/2012

3.4.5.2 Research Awards and Prizes

• NUS Young Investigator Award - 2009/2010
• ACM SIGCHI Best Video – SandCanvas (2011)
• ACM SIGCHI Best Video – Draco (2014)
• ACM SIGCHI Best Talk – Draco (2014)
• ACM SIGCHI Honorable Mentioned Award – SandCanvas (2011)
• ACM SIGCHI Honorable Mentioned Award – MOGCLASS (2011)
• ACM SIGCHI Honorable Mentioned Award – BeyondStereo (2012)
• ACM SIGCHI Honorable Mentioned Award – Draco (2014)
3.4.6 Future Plans
In addition to further exploring and developing innovation patterns, another long-term goal of mine is to create a university-based innovation factory in which the processes of research and development as well as the commercialization of research results are streamlined. There are several challenges to realizing this vision.

First, only a very small fraction of research results have the potential to be commercialized; some purely contribute to knowledge. Similarly, not all commercialized products have research value. I will have to carefully identify which projects have both research value and commercial potential and then further investigate those projects.

Second, commercialization is very different from research; it requires a unique set of skills and demands the same amount of time and dedication to excel. To accomplish this alone would be a difficult task. Therefore, I hope to identify a partnership in which I will play the role of an R&D director, while my partner manages business development. With our skills combined, we can put more of our exciting research results into the hands of the public without sacrificing the quality of either the research or business side of the work.

Third, combining research and commercialization efforts in my lab will also place a more specific demand on the students I will work with. Consequently, I will need to spend more time finding and training students with both research and business skills, so that they can effectively achieve the commercialization of their products as well.

In summary, I hope my tenure will allow me to continue to work on impactful, innovative research that will not only help advance the field of HCI but also largely impact society as a whole.