Trip Report to Seoul Korea for ICED and to Visit Seoul National University, Yonsei University and Creative Design Institute (August 18-25)

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About ICED2013
International Conference of Engineering Design (ICED) is a biennial conference, with a growing academic and industrial audience. The conference has its roots in design engineering, but broadens scope to a general understanding of designing as an activity, its human factors and knowledge aspects, its complex and multidisciplinary nature, and its societal role and importance.

Figure 1. Logo of ICED13

ICED is one of the most important and core conference in design engineering field. The 19th ICED was held from Aug 19 to 22 in Seoul, Korea, hosted by the Design Society and chaired by Dr. Yong se Kim, Sungkyunkwan University. The main theme of the conference was “design for harmonies”, which covers four sub-themes: harmony of products and services, harmony of old and new, harmony of culture and technology and harmony of East and West. The conference sessions included plenary sessions, discussion sessions, podium sessions and workshop sessions with rich feedback from both academia and industry during and before the conference. The conference covered various research themes, including 1) design processes (such as topics of products development models and strategies), 2) design theory and research methodology (such as topics of design theories and approaches), 3) design organization and management (such as topics of organizational understanding of product development), 4) product, service and system design (such as topics of product and system modeling), 5) design for X (such as topics of design for sustainability), 6) design information and knowledge (such as topics of knowledge intensive design), 7) human behavior in design (such as topics of teamwork in design), 8) design education (such as topics of training in design) and 9) design methods and tools (such as topics of design tactics and methods).

Our Participation in ICED
The whole ADAPS group attended ICED2013, including Dr. Kremer, leader of ADAPS group & professor of Engineering Design and Industrial Engineering, Junfeng Ma, Ph.D. candidate in IE, Kijung Park, Ph.D candidate in IE and Kelly Sprehn, Ph.D candidate in IE. We got four papers accepted in total and all of us presented in ICED. These four papers include: “Critical factor identification in medical device development through supervised learning” presented by Dr. Kremer; “An analysis of decomposition approach applications in design engineering & suggestions for improvement” presented by Junfeng Ma; “Mediating engineering design team performance through conscientiousness and cognitive style” presented by Kelly Sprehn; and “The impact of complexity on manufacturing performance: a case study of the screwdriver product family” presented by Kijung Park. The first two papers were presented in discussion sessions and the latter two were presented in podium sessions. Beyond presenting in a discussion session, Dr. Kremer served as the chair of a session focused on the management of innovation and complexity.

In addition to attending our presentation sessions, we also attended many related sessions in order to get research ideas and extend our research scope. We also participated in all four keynotes talks, which were offered by famous experts in design field. We also joined many social events, such as the opening ceremony, welcome reception, young members’ event and the conference banquet, where we met many colleagues in similar research areas.

Our Gains from ICED
The main gain from our trip to ICED 2013 is discussing our research topics with colleagues in the same research area around the world. We presented our work first and in the Q&A step, we communicated and discussed with experts. Their comments and questions were really focused and extremely helpful for our future progress.
The first presentation in our group was “Mediating engineering design team performance through conscientiousness and cognitive style”, which was presented by Kelly Sprehn in podium session in Aug 20. The work investigated the impact of cognitive style on conscientiousness and team performance with the motivation that design teams are often chosen ad hoc, with membership often based more on niche expertise than with regards to interpersonal interaction. The work examined a link between conscientiousness as an aspect of human psychology and engineering design team performance with several cognitive style variables as potential mediating variables. The regression model results showed a negative relationship between the object cognitive style deviation and team performance.

The second presentation in our group was “The impact of complexity on manufacturing performance: a case study of the screwdriver product family”, which was presented by Kijung Park in a podium session in Aug 21. The work addressed research on the impact of complexity on the manufacturing performance from the perspectives of both product design and manufacturing process. Screwdriver product family case study was used to analyze and derive the conclusion. Single and multiple regression models were used to identify the impact of design and manufacturing complexity on lead time and total production cost under make-to-order and make-to-stock strategies and different demand levels. The statistics results showed that structural complexity negatively affected manufacturing performance only in the make-to-order system and the negative impact increased according to demand levels. Many famous and top experts were seated in this session, such as Dr. Steven Eppinger from MIT. After his talk Kijung has received many questions and comments that were helpful to this research.

The third presentation in our group was “Critical Factor Identification in Medical Device Development through Supervised learning”, which was presented by Dr. Kremer in discussion session in Aug 22. The work investigated the impact of different variables in Medical Device Development (MDD), where FDA (Food and Drug Administration) approval time was considered as a performance variable. The purpose of this study was to identify which product, company and regulation factors contribute most to the variations in FDA decision time. Minimal Description Length (MDL) algorithm was used to analyze variable significance. The case study data was from FDA database directly.
The last presentation in our group was “An analysis of decomposition approach applications in design engineering & suggestions for improvement”, which was presented by Junfeng Ma in a discussion session on Aug. 22. The work investigated the limitations of a famous modular product design algorithm Classic Decomposition Approach (CDA) and provided the preliminary revised algorithm. Refrigerator case study was used to identify the limitations of CDA, and elucidate the revised algorithm. Several useful questions and comments were offered from the audience. Such as how to prove and evaluate the revised algorithm, which was asked by Dr. Hong from Seoul National University, the application of revised algorithm in big number components product, which was asked by Dr. De Weck from MIT.

In summary, we have gained lots from our trip to ICED 2013. We expanded our research connections aboard, received new research ideas and connected to top experts around the world. ICED2013 provided not only a serious academic conference venue, but also a wonderful socialization with colleagues in design area. We really enjoyed it.

**Penn State University - Yonsei University Joint Research Workshop**

The Penn State University – Yonsei University Joint Research Workshop was held on August 22 at the Yonsei University campus. This joint workshop was accomplished by a proposal of the ADAPS (Applied Decision Analysis for Improved Products & Systems) Group to exchange current research with the Department of Information & Industrial Engineering (IIE) of Yonsei University. Yonsei University is the top private university in Korea and is ranked the 185th among the top 200 world best universities as ranked by Times Higher Education in 2012. The motto of Yonsei University is “Yonsei, where we make history” and indeed Yonsei shows significant research performance as a research frontier by publishing 4,506 SCI journal papers and 12 papers in Nature in 2012. As the main contributor of this research achievement, the College of Engineering in Yonsei University consists of 8 Schools and 10 Departments. Their mission statement is summarized with: “Creative Engineers with Global Leadership and Social Responsibility.” The College of Engineering at Yonsei realizes its mission through the Yonsei Engineering Research Park and the ABEEK (the Accreditation Board for Engineering Education of Korea) accredited programs to educate students with a high quality learning system.

Prior to the workshop, our group had a brief meeting with Dr. Jeonghoon Mo, who was the host of the workshop. We discussed the current research trends and expectations at Penn State and Yonsei in the field of Industrial Engineering. Although the IIE Department has a short history (established in 1994), it has over 80 graduate and 200 undergraduate alumni and keeps active relationships with Korean Science Foundation and industrial companies such as Samsung, LG, and Hyundai Motors to perform national projects as well as industrial projects. The workshop had two secessions with 7 speakers, 4 speakers from Penn State and 3 speakers from Yonsei, and over 30 Yonsei graduate students attended the workshop. The detailed workshop contents are shown below.

**Session 1 (4:00-5:00PM)**

Session Chair: Jeonghoon Mo

- Perceived Feature Utility-Based Product Family Design & Variant Optimization
  Gül E. Kremer (Professor, Department of IME, Pennsylvania State University)

- Sustainability, Complexity, and Product Family Evolution
  Kijung Park, (PhD Candidate, Department of IME, Pennsylvania State University)

- Study on The Model of The Sensor Network Performance Optimization
  Yewon Jeong (MS student, Department of IE, Yonsei University)

**Session 2 (5:15-6:15PM)**

- Brief overview on Big data analysis and its application in Information and Industrial Engineering
  Won Sang Lee (PhD student, Department of IIE, Yonsei University)

- Measuring the complexity of in-vehicle information system
  Sun Jung Lee (MS student, Department of IIE, Yonsei University)

- Modular Product Design with Uncertain End-of-Life Options Concern and Sustainability Optimization
All graduate students from Yonsei presented well. The research works presented span the topics of network sensor optimization, complexity in user-interface, and Big Data analytics applications. From the presentations it seemed that Yonsei faculty members and graduate students have a strong collaboration with industry. With active discussions regarding the presentations, the workshop was successfully finished and the future research collaborations by all parties involved, including the department head Dr. Wooju Kim, was seen as promising from many angles.

Visit to Seoul National University

On August 19, Dr. Gül Kremer, Kelly Sprehn, Kijung Park, and Junfeng Ma were welcomed by Dr. Myung Wan Yun to the Industrial Engineering Department at Seoul National University. Located in Gwanak-gu, Seoul, South Korea, the industrial engineering department is a popular discipline in the Engineering school.

Professor Yun introduced us to the program and provided a generous lunch. During the lunch, a number of professors, recent graduates, and researchers attended, making for a diverse conversation. During lunch, it was discovered that SNU offers a small monetary incentive for graduate students to publish in highly ranked journals, thus enticing more journal publications and reducing the emphasis on conference papers. Many of the professors were adamant about maintaining publications even in an industry setting. Dr. Yun explained that due to the Korean technology prowess, the number of companies partnering with universities is quite large. Many of the research projects of the graduate students come from government projects, Hyundai Corporation, Samsung Corporation, and others in the area. Although it might be difficult to attain funding from government programs for publishable research, industry partners, and hence, proprietary research is abundant. This presents the problem, then, of the publication emphasis.
After a wonderful lunch, Dr. Yun introduced us to a small seminar of students and professors during which we each presented a small facet of our current research. Dr. Kremer explained the research areas of the Applied Decision Analysis of Products and Systems (ADAPS) lab. Her current work with the National Science Foundation was explained using the fundamental aims of the NSF organization and our country’s efforts to maintain the highest level of quality in our scientific endeavors. Junfeng Ma presented his work concerning the enhancement of the Decomposition Algorithm. His modifications seek to make the original algorithm more usable and reliable when clustering product features for modularity. Kelly Sprehn presented the initial work of her dissertation including the state-of-the-art research on cognitive style as well as factor analysis and clustering of market segmentations. These characteristics together make for a more individualized experience. Kijung Park presented on his research in both sustainability metrics usability as well as product families. He explained how he intends to use network theory to model the evolution of products for better anticipation of innovation. The professors and students provided excellent questions and feedback from our presentations.

We enjoyed tea and conversation after the seminar. During this time, the funding situation was discussed again. In South Korea, the government funding agencies do not recognize Industrial Engineering as a specific discipline or branch for which to offer a share of the research budget allocation. The same is true for the United States. Funding options through both NSF and the Korean Science Foundation were mentioned as a way to encourage cross-country and cross-cultural research endeavors. Dr. Yun seemed very interested in pursuing a joint venture. Our discussions have allowed us to find common ground in the research areas of human factors and product design, particularly in modularity and statistical modeling. We hope to continue our relationship with Seoul National University and produce robust research collaborations.

**Interview with the Director of the Creative Design Institute**

We have conducted an interview with Dr. Yong Se Kim of Sungkyunkwan University. Our interview concentrated on how he founded the institute, their research foci, and how Dr. Kim saw the research trends in the design domain to develop.
We started our conversation learning about the current research portfolio of the Creative Design Institute. Dr. Kim explained the various research projects under their current portfolio along with the qualifications of the personnel he is leading. This introduction naturally allowed us to probe deeper into how the institute was founded. As part of this focus, Dr. Kim explained his efforts in securing major funding which allowed him to negotiate the foundation of the center. Currently, he is directing major projects, along with the institute staff, focusing on design.

Dr. Kim also explained about the trends in design research from his vantage point. A major topic in this conversation was service design. He described the evolution of service design as a research focus for engineering designers. He compared design for the tangibles and design for service underlying the need for further theory development in service design research.

We also note that Dr. Kim was one of the first graduates of Stanford University’s D-School. He also explained his time there, pointing to his career trajectory as a design researcher and educator.