

Real “Dream Teams” Matter: Opportunities and Limitations of Design Collaboration

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Abstract: Design professionals, such as industrial designers and researchers, have been working in collaborative environments for many years. This paper illustrates three collaborative design research projects through the author’s observations and experiences. These three projects have different characteristics, circumstances and goals and as a result, they show different aspects of collaboration. A comparison and contrast chart has created in order to better understand opportunities and limitations of collaboration for each project. Based on these practical observations, the potential success factors in collaborative environments have proposed. The paper focuses on these critical factors and considerations to create the best possible design research collaborations. The success factors and considerations include designing optimum team dynamics, knowing the truth of individual team member’s goals and providing an external trusted mentor for each team member.

Key words: *optimal team dynamics, different collaboration models, mentorship, multi-disciplinary, cultural differences, academia and industry*

1. Introduction

Interdisciplinary and cross-cultural collaboration projects are commonly undertaken by today’s professionals, including design researchers. Social intelligence and teamwork matters immensely for success, especially in the research and development environments (Goleman, 1998). Design can act as a multidisciplinary *process* (Gu & Renaud, 1996). Design researchers regularly work with people from different backgrounds, fields of expertise and experience levels. Attributes of successful team members, and their high emotional intelligence, are well illustrated in Daniel Goleman’s book, *Working with Emotional Intelligence*. John Seely Brown, chief scientist at Xerox Corporation, added to Goleman’s book by stating, “Everything is done collaboratively, like every-where in today’s high-tech world. There are no lone geniuses anywhere” (*Working with Emotional Intelligence*, 1998, p.161). Other disciplines aside from design and technology, such as social workers, also realized the importance of multi-disciplinary collaboration. In one of Social Work Journal articles, Laura Bronstein (Bronstein, 2003) illustrated that it was impossible to serve clients *effectively* without collaborating with professionals from various disciplines.

This paper focuses on observations and experiences during three different collaborations. In each project I was able to play a different role: a design student, a principle researcher and a project leader. It provided an

opportunity to learn different characteristics and lessons from each situation. These experiences are summarized in a chart that compares and contrasts opportunities and limitations of these three collaborations. The findings led to practical considerations, which support potential success factors for future collaborative projects.

2. The Three Collaborations

2.1 Patient Room Prototype: Many Students to Many Advisors (Model A)

In 2005, three Canadian students from the School of Industrial Design at Carleton University were selected to be part of “Spartanburg Regional Patient Room Prototype Project” in South Carolina, USA (Allison, Buie, Linen & Ruthven, 2006). This project was a collaborative design project funded by the Spartanburg Healthcare system. Eight architecture and health graduate students from Clemson University kicked off this project by conducting an initial field research at one of the hospitals in South Carolina. As one of industrial design students, I was able to experience and participate in this process of collaboration (see Figure 1). It was the first *real* collaborative-interdisciplinary-design research project in which student team members were able to observe efforts from professional design faculty, healthcare workers, professional architects and product manufactures (Allison, Buie, Linen & Ruthven, 2006). The goal of this project was to build a user-centered patient room prototype in order to optimize comfort and control for three groups of users; patients, family members and healthcare professionals. Our initial mock-up room then would be presented to clients and other professionals for feedback during the final review in April 2006.

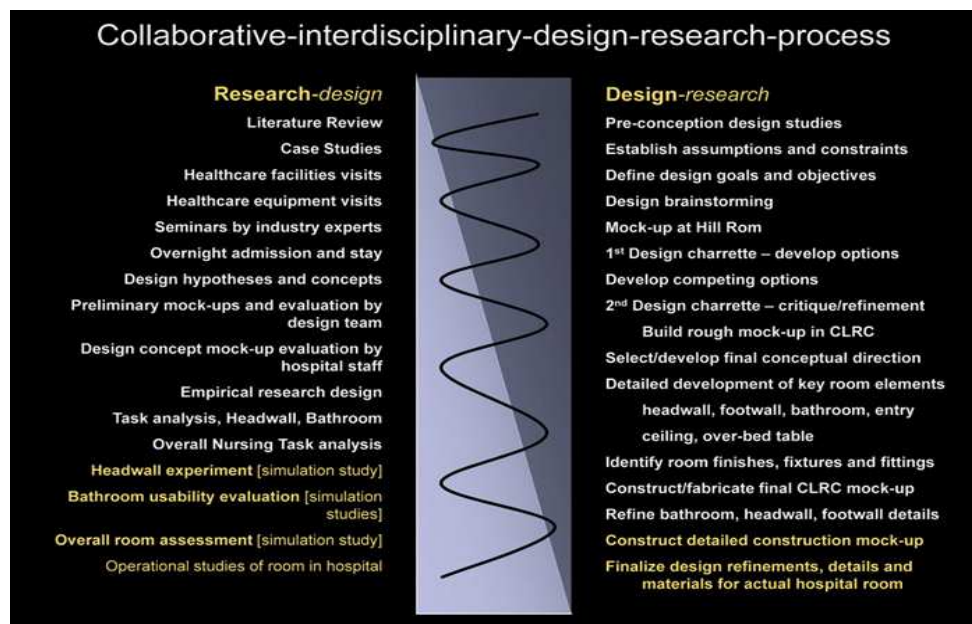


Figure 1: Design-Research Process (Battisto & Allison, 2008)

My role as an industrial designer was to explore different product solutions for the nurses’ working zone. At first, this nurse’s workstation seemed very challenging because there were many factors to consider. I had to research many aspects of the nurses’ responsibilities and interact with nurses and healthcare professionals from Spartanburg Regional Hospital. A patient’s point of view and his/her experiences toward the nurse station were also considered since it was very close to a patient bed (see Figure 2, page 3). I especially worked closely with Clemson architecture students, who were working on the staff zone area, in order to create a product that was

well integrated into their overall space.



Figure 2: Staff Work Zone in a Patient Room (Allison, Buie, Linen & Ruthven, 2006. p. 17).

I started to build my knowledge in healthcare design including materials, hospital guidelines and federal requirements. However I was able to learn more practical knowledge from other team members and external advisors. It was valuable to freely interact with external advisors since they were honest and inspirational. From research activities and interactions, I was exposed to different product ideas and potential solutions. Later in this project I was able to generate design concepts and mock-ups for this nurse's staff zone. My observations and experiences, as an industrial design student, are summarized in a table below.

Table 1: Opportunities and Limitations of Collaboration - Model A

Author's Role/ Team Structure	Goal	Opportunities of Collaboration	Limitations of Collaboration
Senior Industrial Design (ID) Student <hr/> 4 Professors, 11 External Advisors, 13 Students (8 Graduate architecture, 2 Fine Arts, 3 Industrial Design) Total Team size= 28 people	Provide design concepts and product concepts for Nurses' tool box in staff zone/ sink area.	A lot of freedom, design concepts (can be very creative) Many chances to interact with professionals, professors and graduate architecture and fine arts students Trusted external advisors are available "Team Member to Advisor Role Ratio"= 1: 1.2 (almost 1:1) Gross guidance was available from my professor but was not micro-managed (I had more trust and freedom with my design direction) High energy level from participant students Multi-cultural team with 5 nationalities (USA, Canada, Korea, Japan and India)	Little impact (less influence) on the final decision High risk (have to rely on student's ability/ talents) Having multiple various creative directions and solutions can be difficult to make decisions efficiently Industrial design students tend to rely on architecture students' direction (the graduate architecture student group has the largest number and may have a bigger impact)

2.2 MotoCare: One Researcher to One Project Leader (Model B)

Motorola's Enterprise Mobility division has been very interested in providing potential mobility solutions in healthcare. Some hospitals in the United States have already been using Motorola/Symbol Technologies products such as Mobile Computer (MC) 50 and MC 70 for many years. The main application of these products, mainly used by nurses, is called "medication administration. Its purpose is to match a patient's bar-coded wrist band to his/her prescribed medicines; in order to eliminate medication errors. In February 2007, I was assigned to be part of this healthcare project and my role was to lead all the research activities. The goal of this project was to present business opportunities in this healthcare market and make recommendations for product solutions. My role was to present research findings to support the business case and the proposed solutions. The project milestones and related business activities were directed by the project owner/ leader, Mr. Thomas Roslak. He was the director from the office of the Chief Technology Office (CTO) and had over 20 years of experiences in our business. I was a new design researcher and my role and responsibilities for this project included understanding our business in this market, key applications, technologies, and the workflow of users. Our "MotoCare" team was very small and the project leader was leading most of the project activities. Although I was a principle researcher, it was hard for me to create a research plan due to my lack of knowledge in this field. I then started to hold internal stakeholder interviews to understand their needs and worked directly with the project leader. Our team was able to collaborate more effectively and the decisions were made efficiently because of the small team size and its high visibility among team members. The project leader greatly supported research activities and provided me with external resources as well as some research funding. As a result, I was able to hire a design agency which was based in New York. I worked directly with design researchers and designers from this agency and we were able to engage with in-depth user research activities in different hospital sites. Working directly with an experienced director from the CTO's office helped me to see different aspects of our business that I could not exposed as a design researcher from the Innovation and Design group. I gained valuable perspectives from his 20 years of experiences and practical knowledge in this business. Later in this project, I was able to understand healthcare business models and created this visual diagram (see Figure 3) to show the importance of partner relationships. This diagram was used in many presentations and was well perceived by internal teams in Motorola.

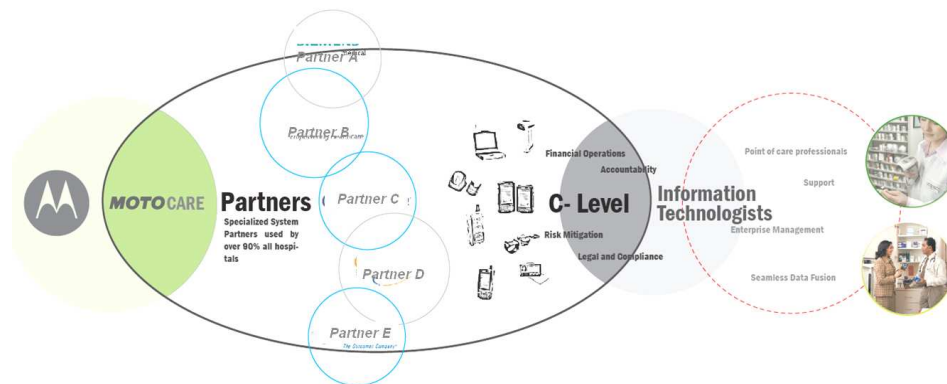


Figure 3: Motorola Healthcare Current Model; Channel Dominant Partners (Kim, 2007)

The project leader also acted as a mentor. He provided me with valuable guidance and inspired me with research ideas. I soon realized that I was relying heavily on mentor/ leader's recommendations. Due to my limited

knowledge and business relationships, my research activities were planned far better through Mr. Roslak's channels and network. As a result of our efforts, we were able to visit 5 major healthcare partners, 3 hospitals, and interviewed over 50 nurses. Observations and experiences, from my perspective as a principle researcher, are listed below (see Table 2). In November 2007, we presented our research, solutions and business opportunities to Motorola's senior executives. It was well received by the senior management team and moved to the next phase. My research and insights have been supporting future design directions and the project is now underway.

Table 2: Opportunities and Limitations of Collaboration - Model B

Author's Role/ Team Structure	Goal	Opportunities of Collaboration	Limitations of Collaboration
Principle Design Researcher 1 Project leader, 5 Professionals, 1 Principal Researcher, 2 Design Consultants (external design research support) Total Team size= 9 <i>people</i>	Provide research findings and insights to present the voice of our customers in the healthcare market.	Very efficient Well organized High visibility within the team Decisions are made fast and as often as needed (flexible) More advisors than team members (easy to get professional guidance) External support (from a hired design consultancy). This brings different perspectives and experiences	Laser-focused direction: Heavily rely on the project leader's vision (goals, perspectives and preferred methods) Mentor/ leader's ability (connections, experiences, expertise) determines the project directions. The mentor can be biased or politically influenced by other factors

2.3 Future MPOS: Many Students to Two Advisors plus Team Leaders (Model C)

Our Innovation and Design (ID) group has been interested in advanced technology use-case scenarios and mobility applications in Asia. I particularly was fascinated by Korean users' behaviors around new technologies and their fast-paced adoption rates. In January 2008, I proposed a "Motorola + Seoul National University (SNU)" project to our senior management in order to further investigate Koreans' use of current/ future mobility products. Our ID directors were very supportive and the project was able to start in March, 2008. We had never worked with non-North American universities before, resulting in a great deal of legal issues and other paper work. However, we decided to move forward with this project since it had great potential to learn about the use-case scenarios of Asian technologies from a local perspective. The goals of this Moto + SNU project were:

1. To research the current use of Mobile Point of Sale (MPOS) applications in Korea
2. To provide future MPOS scenarios and possible solution directions

Professor Eune was able to select 19 undergraduate and graduate students from the design and engineering school. We divided students into 3 sub groups and each group had a team leader who was either a Ph.D. student or a SNU lab researcher. The kick off session took place in one of the SNU's labs where local Motorola engineers were able to attend. The Motorola Korea engineer presented the overview of the current solutions and he showed Motorola's enterprise business products to students. I participated via a web-camera and supported as much as I could from New York. It was essential for the participating students to understand our enterprise

business, products and users. The students were not familiar with these enterprise products and applications. Consequently, this learning process was longer for SNU students and it took more effort to clearly define a goal for each student. We started primary research activities and also asked students to investigate the current Korean MPOS market, competitive landscape, trends and products (see Figure 4).



Figure 4: Current Korean MPOS Market (this diagram was created by SNU students)

I thought this market research was a better way to engage SNU students since they previously have seen these MPOS products in Korea. Local perspectives (student's view points) were valuable and critical for this project. As a client, I wanted to understand Korean views on these current MPOS products, trends and potential future scenarios. My initial plan, as the project leader, was to have many interactive sessions with SNU students in order to learn from each member's point of view. However, it was almost impossible due to unexpected obstacles including technology difficulties, different time zone and cultural gap. Overall, this project was more challenging for me since I was responsible for multiple roles including the advisor role since I was the most knowledgeable person about the MPOS in this team. It was critical for team leaders to interact with students as often as they can because project leaders (Professor Eune and I) could not provide enough consulting time for students. This relationship between team leaders and students acted as an important bridge for better communications and increased visibility of each student. During this project, SNU students used various design research methods and presented their findings (see Figure 5). The Motorola ID team including myself had a difficult time to clearly understand research findings from this chart. This event happened due to a number of reasons including the ID team's lack of familiarity with some of research methods and cultural difference in Korean visual presentations. I was surprised to face cultural differences with the SNU team since I have a Korean background as well as industrial design school experiences.

Method	Goal	Result	Method	Goal	Result
As it is-To be	MPOS의 현재상황을 기준으로 하고, "MPOS는 이런 기능이 있으면 좋겠다"와 "MPOS는 이런 기능은 없었으면 좋겠다."는 항목에 해당하는 답변을 모아 아이디어로 활용		Function diagram	MPOS의 예상기능을 나열하여 아이디어로 활용	
Body mapping	인간의 신체부위와 MPOS를 연관시켜 MPOS의 새로운 기능과 포지션을 떠올리는 아이디어 발상		Context globe	예상되는 특정 task를 바탕으로 하여 유저의 사용 시나리오를 예상	
Value keyword	"[]한 MPOS는 []에게 []이다"는 포맷을 제시하고, 이 빈칸을 채워 넣은 단어들을 아이디어로 활용		Storytelling for everyday life	일상생활에서 사용되는 여러가지 사물들에서 연상되는 아이디어들을 활용하여 MPOS의 서비스, 기능, 디자인 등에 활용	
PIER Matrix	Personal - Relation / Information - Entertaining의 두 축을 기준으로 MPOS의 예상 기능, 서비스, 디자인 등을 떠올리는 발상		6H Hub	Who, When, Where, What, How, Why를 기준으로 떠오르는 아이디어	
U Matrix	Unique-Ubiquitous / Conscious-Unconscious의 두 축을 기준으로 MPOS의 예상 기능, 서비스, 디자인 등을 떠올리는 발상		Task Flow	MPOS를 사용 시작할 때부터 종료할 때까지의 모든 task들을 나열해 보고 그 후에 따른 여러 행동양식들을 아이디어로 활용	
			Cultural probe	예상 target audience에 해당 하는 라이프 스타일을 잡지, 신문 등을 통해 조사하여 image map 작성	

Figure 5: Research methods presented by SNU students

A few months after completing this project, Professor Eune and I held a review session on this collaboration. We realized that there were more view points and cultural gaps than we had originally expected. Observations and experiences from my perspective as a project leader, a client and an advisor are summarized in a chart (see Table 3). I later discovered that Academia-Industry projects in Korea are structured in a different way than the ones that I experienced in the United States and Canada. Korean Academia-Industry projects tend to have better funding from large corporations like Samsung and LG. As a result, the overall scale of projects can be larger in terms of team size, list of deliverables and expectations from the sponsoring corporation. Due to different “academia-industry” experiences, Professor Eune and I had different expectations for the final deliverable of this project. Motorola’s expectation was to receive Korean MPOS research findings and future user scenario; in other words, we treated this as a student research project. However, from our Motorola ID perspective, SNU team went outside of the initial project scope; each SNU teams delivered professionally prepared research books, design concepts and 3D rendered prototype images. The ID team was impressed by this high quality of final deliverables, large volume of students’ work and their professionalism throughout this collaboration.

Table 3: Opportunities and Limitations of Collaboration - Model C

Author’s Role/ Team Structure	Goal	Opportunities of Collaboration	Limitations of Collaboration
Leader, Expert, Client 1 Professor, 1 Project Leader/ advisor 19 Students 3 Team Leader Total Team size= 24 <i>people</i>	Understand current MPOS applications in Korea and provide insightful future scenarios	Students bring freshness/ newness to the problem (no previous experiences with enterprise mobility products) Local perspectives Close relationship between SNU and Motorola ID team Each group has a experienced and knowledgeable team leader A clear hierarchal system: professors, group leaders and team members. Roles are clearly assigned High energy and hard working team members Highly capable students (pre-selected by Professor Eune)	Almost no external mentors (outside professional guidance) for student participants Less visibility within teams (more team members can result in less individual influence and hard to recognize individual contributions) The project client is the only available expert in the team (A same person has responsibility for both roles). SNU design students dominate and they have a better chance to lead (only 2 non-design students in the team)

3. Practical Considerations

These three projects had different team dynamics, circumstances and challenges and they resulted in different types of collaboration (model A, B and C). I created a pie chart of each collaboration model (see Figure 6, page 8)

in order to better illustrate team dynamics (overall size, roles and number of disciplines). I was also able to calculate the ratio between team members and advisors for each team (see brown boxes in Figure 6). These values represented the availability of professional guidance for each team member during the collaboration. Model A had the ratio of 1:1.2 and it was the closest value toward the ideal ratio 1:1 (team members: advisors). Model C showed the ratio of 1: 0.91 because there were almost no external advisors available for SNU students during the “Future MPOS project”. Model B resulted in the ratio of 1:2 (3 team members with 6 available advisors) because the project (MotoCare) had twice more advisors than team members.

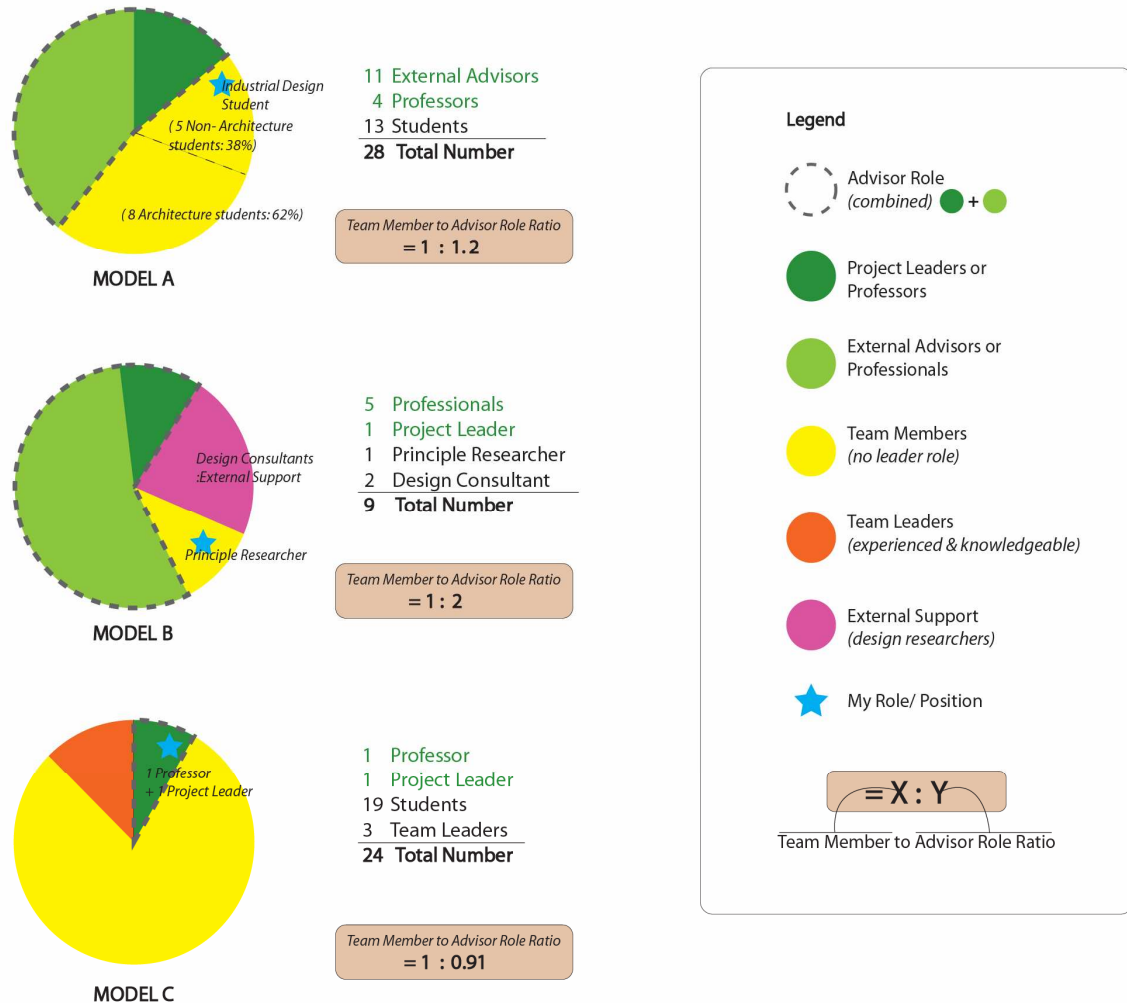


Figure 6: Team dynamics for collaboration model A, B and C

Based on my observations and experiences, the biggest opportunity to succeed in collaborative environments is providing an external mentor for each participant (see figure 7, page 9). An ideal mentor should have the following attributes:

1. Unbiased, outside of the project, a person who is not involved politically
2. Experienced, very knowledgeable, extensive professional experiences
3. Genuinely interested in helping his/her mentee’s professional growth

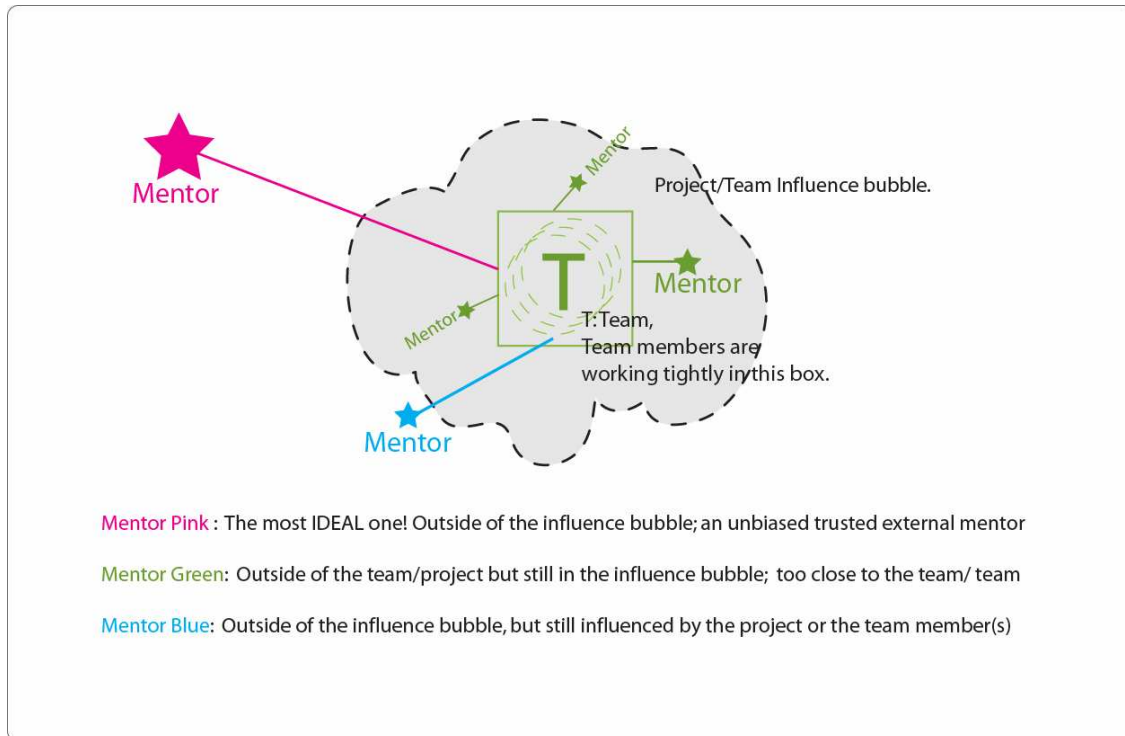


Figure 7: Potential Mentors and Ideal Mentor Position (the pink star)

The most ideal scenario is when the project leader can provide an external mentor from the beginning of the project. However in reality, it is difficult to achieve this situation because of limited time and resources. It is then important to keep the ratio between “team members and advisors” as low as possible so that the mentor is not divided among too many people. Mentors must be genuine with their guidance and take personal interest in mentees’ career development (DeLong, Gabarro, & Lees, 2008). Based on three previous collaboration models, Model A (Patient Room Prototype project) has the most preferred ratio of 1:1.2 between mentors and team members respectively (see Figure 6, page 8). Clemson and Carleton students had 11 available external mentors and as a result, these interactions created positive synergies and professional guidance. Mentorship is particularly important for university students (Academia – Industry projects). In general, students have less experience and skill-sets, therefore this mentor-student interaction can create higher positive impact on a student team member. In addition, mentors can play a key role to maintain a high energy level for the teamwork resulting in members’ positive attitudes toward the common project goal.

Another factor to consider is optimal team size particularly regarding the number of team members and their backgrounds. The study by Gu & Renaud (1996) showed that diversity, size and maturity were not sufficient to ensure a successful research team. “The more, the better” did not hold for team members in another study (Barjak, 2006). Team leaders or program managers must examine the optimal structure of a team from the beginning of the project. A journal article entitled, “*Social Dilemmas, Subgroups and Motivation Loss: In Search of an “Optimal” Team Size in Division of Work*”, in *Social Psychology Quarterly* (1992), reported on a study of the effectiveness of dividing a collective into subgroups as a method for reducing members' motivation losses in group performance. Their study concluded that subjects' motivation on two cognitive tasks peaked at moderate-

sized subgroups (Davis, Kameda, Parks, Stasson & Zimmerman, 1992). During the “Future MPOS” project, the group was able to function better in a sub-team setting where each member had more opportunities to interact with their team leaders directly. My challenge, as a project leader and a client, was to keep team members’ energy and motivation levels as high as possible in this project.

Another study conducted at the University of Applied Sciences Northwestern also emphasized the importance of the right combination of knowledge and skills from different backgrounds and research cultures. The study concluded that the most successful teams had a moderate level of team diversity: 20-25% of the team members came from a different country or research discipline (Barjak, 2006).

4. Discussion and Conclusions

Design collaboration is framed by the social world. It is therefore essential to understand the social situation in which they were created first (Brown & Duguid, 2000). Design researchers in particular are placed in various situations where they must work with people from different backgrounds and expertise. I was able to observe different types of collaborative design research projects and summarized opportunities and limits of collaboration for each situation (see Table 1, 2 and 3). These findings and insights resulted in a list of considerations and the potential success factors (see the list below) that can help to better design and manage future collaborations.

1. Optimum team dynamics:
 - a. moderate and limited number of different backgrounds (cultural, expertise)
 - b. relatively small teams but well balanced (similar numbers in each discipline)
 - c. talented team members with high social/emotional intelligence

2. A crystal clear understanding of personal goals of the project:
 - a. positively controlled self-interests
 - b. true understanding of individual goals
 - c. define role for the common project goal

3. Mentorship:
 - a. an unbiased external member who is not part of the team
 - b. trusted and experienced
 - c. genuinely interested in his/her mentee’s development

Due to advancements in technology and today’s global society, there will be a higher demand number of cross-cultural multi-disciplinary teams, including international virtual teams. To produce the best possible outcome, everyone in a team must understand the potential successful factors of collaborations and the common goal of a project as well as individual goals. This will become clear when team members reconsider the truth about their role and they are able to negotiate positively with one another. In addition, the open process of collaboration, correct mix of team dynamics, and trusted mentorship are critical to successful “design research” collaborative projects.

*“Collaboration is the only answer for innovation”, Carly Fiorina
(former Chief Executive Officer, HP),*

*“Creative and integrative thinkers are people who are more interested in other people. And
are interested in how groups work together”, Roger Martin
(Dean of the Rotman School of Management, University of Toronto).*

These quotes are from the 2008 International Design Culture Conference proceedings (Lee, 2008. p 28).

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