Proceedings of CHI UX Indonesia 2015 (CHIuXiD 2015) – The International HCI and UX Conference in Indonesia

Edited by Adi Tedjasaputra, Harry B. Santoso, Eunice Sari, Johanna Hariandja, Emil R. Kaburuan, Paulus Insap Santoso

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Welcome from Conference Chairs

It is with great pleasure we welcome you to CHI UX Indonesia (CHIuXiD) 2015. CHI UX Indonesia 2015 is an international ACM In-Coop Conference that provides a platform for Human-Computer Interaction (HCI) and User Experience (UX) academics and professionals from across Indonesia to share and learn about the development of HCI and UX in the region. This year CHI UX Indonesia 2015 is organized for the first time by CHI UX Indonesia (Indonesia ACM SIGCHI Chapter) in collaboration with Industrial Engineering Department of Parahyangan Catholic University (UNPAR).

The theme “Connect ~ Connecting academics and professionals in the UX world” was chosen to reflect our passion to gather and engage HCI practitioners from academia and industries to exchange knowledge and share their portfolio relevant to HCI and UX, as well as to build a common ground to advance HCI and UX collaboration in the region. HCI is not a completely new discipline in Indonesia, yet HCI practice has recently become a new “trend” in the industry. More universities have started to offer HCI courses as a part of their programs, while industries start to practice HCI and UX to improve their product and service delivery.

UX Indonesia – Malaysia 2014 Conference conducted in April 2014 was the first HCI and UX event ever conducted in Indonesia. This event laid a cornerstone for building a strong HCI and UX community of practice in Indonesia and gave birth to Indonesia ACM SIGCHI Chapter (CHI UX Indonesia). As people started to get together and engage in this new community, we realised a big gap of knowledge and interpretation among the community members.

CHIuXiD 2015 aims to engage academics and professional in a number of interactive activities, i.e. keynote sessions, participative sessions, position paper and poster presentations, workshops, design challenge activities, and industry tracks. This event provides a venue for its participants to learn the state-of-the-art of HCI and UX in Indonesia, discuss and exchange knowledge, address the challenges and exhibit the works being done related to HCI.

We currently receive the works of more than 70 contributors from Indonesia, Malaysia, Singapore, Australia, United States, Netherland, Belgium, Japan, Taiwan and United States through forty-two submissions. Out of twenty-four technical papers submitted, we selected twelve papers (four short papers and eight full papers) through a rigorous double-blind-review process done by a board of
international reviewers. These papers features a number of great and insightful articles related to usability testing and evaluation, HCI and Online Learning, HCI Education, Healthcare Experience Design and Applied User Experience.

Proceedings of CHIuXiD 2015 consist of the above technical papers and other submissions that were submitted under the following categories: workshop proposals, position papers and design challenge proposals, which were reviewed by their respective track chairs. Eight teams were selected to participate in the Round 2 of the Competition (24-hour design challenge) to present their proposals. Eight position papers were selected for poster and position paper presentation. Four hands-on workshops will be conducted as part of the conference programme.

Organizing the first International ACM In-Coop Conference on Human-Computer Interaction and User Experience is a great challenge. We knew that the field is currently growing in Indonesia. We extend our gratitude to our strong and dedicated program committee members, international board of reviewers, and also the co-organizer, Industrial Engineering Department UNPAR.

Last but not least, we do hope that you enjoy the conference and your stay in Bandung. We also wish our international participants a memorable experience during your stay in Indonesia.

Eunice Sari and Johanna Hariandja (Conference Chairs)

On behalf of CHI UX Indonesia 2015 Organizing Committee
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Supporting Social and Adaptive Interaction in Collaborative Rehabilitation Training

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ABSTRACT
Collaborative training can be considered as a way to support social interaction and enhance training motivation of patients during their rehabilitation. When performing collaborative training exercises as part of the rehabilitation program, a patient collaborates with his/her training partner with the hope that social interaction develops between them. However, different physical abilities which bring a performance gap between a patient and the training partner may impair the course of collaborative rehabilitation training. This issue can be solved by providing adaptivity.

The focus of our work is the investigation of social interaction and integration of adaptivity in collaborative rehabilitation training. We have implemented the automatic adaptation of interaction difficulty in a collaborative training exercise developed to support upper arm rehabilitation for Multiple Sclerosis patients. A user study was carried out to investigate the social interaction and the adaptation outcome. With adaptation, we found that a better progress of performance was shown, a better quality of interaction was perceived and the training sessions were more enjoyable. The development of social interaction was also observed during the collaborative rehabilitation training.

Author Keywords
Social interaction; adaptive; collaborative, rehabilitation.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION
In the domain of healthcare, rehabilitation training activities hold a main purpose of restoring or bringing a patient’s physical, sensory or mental capabilities, that were lost due to an injury, illness, or disease, back to a certain level. Typically rehabilitation exercises involve a patient training on his/her own (under a therapist’s supervision) and performing repetitive movements for a certain time period predetermined by the therapist. The high repetitiveness of the exercises tends to make patients feel bored and less engaged in the training after a while. To maintain the training continuity, it is very crucial to keep the training motivating for patients.

One way to enhance patients’ motivation in training is through supporting social interaction in the rehabilitation program. During rehabilitation, patients can receive social support from different groups in their social network. Not only from their family members and friends, but also from other support groups such as their therapists, caregivers or fellow patients. These people can extend their form of social support to the patients by actively participating in the therapy sessions.

Social interaction can be incorporated in the rehabilitation training by providing a social play medium which requires a patient to collaborate with his/her supporting partner in performing the training exercises. Thus, the idea is that the patient will keep being engaged and stay motivated in training by collaborating with other people as a training partner.

Through collaborative rehabilitation training, we aim to support social interaction and enhance motivation of patients. However, collaborative rehabilitation training may also have its drawback. Collaborative rehabilitation training involves two persons playing and collaborating together while performing the exercises. The players, either two patients or a patient and a healthy person, are most likely to have different physical abilities. This difference can influence the quality of interaction of the players which may affect their collaboration during the training. For instance, a patient may have a weaker level of interaction (e.g. less speed when performing the movement) compared to a healthy person, which results in a gap of performance between the players. When this gap becomes larger, it might cause an unbalanced collaboration during the training and make the game less engaging for the players (i.e. less
engaging for the patient since it is too difficult and less engaging for the healthy person since it is too easy).

The differences in physical abilities between a patient and his/her collaborating training partner may cause a drawback in collaborative rehabilitation training. Adaptivity can be the key to solve this issue. Adaptivity in rehabilitation training can play a significant role in accommodating the patients’ diversity. It is considered important to integrate adaptivity in any kind of rehabilitation training due to the diversity of patients in terms of their rehabilitation needs, limited capabilities and training or disease progress. A personalized training should be tailored for every patient according to his/her individual characteristics and current condition to ensure the effectiveness of the rehabilitation.

Our work focuses on the investigation of social interaction and integration of adaptivity in collaborative rehabilitation training. This paper firstly describes a brief overview of our research effort for developing a social play medium in a haptic-based upper arm rehabilitation system for Multiple Sclerosis (MS) to support social interaction, followed by an elaboration of adaptive interaction provided in the collaborative rehabilitation training. Furthermore, we present a user study conducted to investigate the outcome of the integration of social and adaptive interaction in collaborative rehabilitation training.

**SOCIAL REHABILITATION TRAINING**

Social support can be beneficial for the engagement and motivation of patients to continue training. Patient’s motivation during rehabilitation can be maintained and further enhanced through the incorporation of social interaction into the training exercises. A study on rehabilitation needs of stroke patients was performed [9], which indicated that social support is critical for patient motivation in order to adhere to the necessary regime of rehabilitation exercises in the chronic phase of stroke. In our research, we would like to explore the role of social support in the rehabilitation exercises of MS patients.

As mentioned earlier in the previous section, there are several sources of social support for patients such as family members or therapists. This support can be manifested in two different forms: *sympathy* and *empathy* [4,5]. Both depend on the types of relationships built based on shared emotions and sense of understanding between the persons. Two possible social scenarios can exist in this context:

(1) **Sympathetic:** this social situation occurs when a person shows the ability to understand and to support the condition or experience of the patient with compassion and sensitivity. For example, healthy family members and close friends may be able to show sympathy towards MS patients.

One can imagine a situation, where a patient is visited by a family member (e.g. a daughter). This family member could show her sympathetic support through her help in the rehabilitation program by performing the collaborative training exercise together with the patient.

(2) **Empathetic:** this social situation happens when a person shows the ability to coexperience and relate to the thoughts, emotions, or experience of the patient without them being directly communicated. Other fellow patients can easily have empathy towards MS patients due to the resemblance of their condition.

One can imagine a situation, where two patients are supporting each other by training together at the same time through the collaborative exercise, which makes the training more pleasant and fun.

The possibility of social rehabilitation training has been explored by designing a simple collaborative game-like training exercise [10]. A collaborative balance pump game was created, where two people ‘play’ together during the therapy session. Both players have to collaboratively control and balance the height of both sides of the beam by pumping each side of it in turns. This game illustrates the setup of the social rehabilitation training session in a sympathetic scenario, where a patient plays the collaborative balance pump game with a family member. An informal user study has revealed that some patients and therapists liked and enjoyed training with this collaborative balance pump game.

Inspired by this, we developed another collaborative training exercise, *Social Maze*, which has more game elements and variations [3]. Figure 1 depicts our social maze exercise with all game elements. The goal of this game is to collect all symbols, which represent points, by picking up each symbol and bringing it to the collecting bin. The elements of the game were purposively designed so that two players (i.e. a patient and his/her training partner) have to collaborate as such to achieve the goal. Without collaboration, it is impossible to finish the game.

![Figure 1. The Social Maze exercise.](image)

The social maze exercise is designed to enable the collaborative training in both social scenarios, sympathetic and empathetic. In both scenarios, the patient will use the HapticMaster as the input device to manipulate the avatar. With haptics, the patient’s movement will also be kept
within certain limits, for example it is not possible to go through the walls of maze. In the case of the empathetic scenario, a fellow patient will also use the HapticMaster as the input device. In the sympathetic scenario, the healthy player (e.g. family members or therapists) can have different possibilities of input devices. They can either use the Novint Falcon, which is a consumer haptic input device, or the Microsoft Kinect, a motion sensing input device which enables operations using body gestures.

**ADAPTIVE INTERACTION**

The social maze exercise presented is designed as a collaborative game/training exercise to stimulate social interaction between patients and other people. As the nature of the game is collaborative, the game will be played by two different players who are most likely to have different characteristics as well. For example, a patient and a healthy person will have a significant difference in their physical abilities, which might affect their collaboration during the gameplay. The variation of physical abilities between patients may also be present due to the fact that the patients might be in different stages of their disease. Therefore, integrating adaptation in collaborative training exercises may be necessary to enhance the collaborative experience between the patient and his/her training partner.

To enhance the patient interaction in collaborative rehabilitation training, we have investigated the integration of a type of adaptation, *adaptive difficulty level*, in which the system automatically and dynamically adjusts the difficulty of the exercise according to the patient’s performance and progress in the exercise [7,8]. A user study has shown that providing adaptive difficulty in the training exercises has delivered an adaptive personalized training to each MS patient according to his/her own individual training progress. Patients and the therapist have appreciated the automatic adjustment of difficulty levels and considered it to provide more variety in the training and also give the patients more freedom to train on their own without any interference from the therapist to manually adjust the exercise parameters.

The aforementioned adaptation of difficulty level adjustment is integrated as a type of adaptation which occurs between the training sessions (i.e. one game play in one day). We propose another type of adaptation, *adaptive interaction difficulty*, that happens within/inside one training session.

As discussed earlier, the players of the social maze exercise (two patients or a patient and a healthy person) most likely have different physical abilities which can affect the interaction quality of the players and cause a performance gap during game play. This may result in an unbalanced collaboration during the training and make the game less engaging for the players.

Inspired by the Flow Theory of Csikszentmihalyi [1], we aim to achieve the optimal flow of training experience. It is important to keep the balance between interaction difficulty and the patient’s physical ability (i.e. reflected in his/her current level of interaction) as illustrated in Figure 2. We want to avoid overtraining where the patient performs the exercises with a higher level of interaction difficulty when his/her physical ability is low, thus the training movement becomes too difficult for the patient. We also want to avoid undertraining, which happens when a lower level of interaction difficulty is given to a patient who has a high physical ability which makes the training movement easier and not that challenging anymore.

![Figure 2. Balancing the interaction difficulty and physical ability.](Image 355x450 to 520x599)

Therefore, we propose an automatic adjustment of interaction difficulty to balance the collaboration. This is done through altering the viscosity of movement parameter according to the current interaction level of the player. The level of interaction is determined based on the player’s speed in completing one task (i.e. select and transport a symbol). We compare the player’s current speed to a predetermined reference which reflects the normal level of interaction. When a player (e.g. the patient) is moving too slow (i.e. below the reference speed), we decrease the viscosity to make the player’s movement smoother so his/her interaction will be easier. Vice versa, when a player (e.g. the healthy person) is moving too fast (i.e. above the reference speed), we increase the viscosity to restrict the player’s movement so his/her interaction will be more difficult. By doing this, we expect the collaboration to be more balanced and the game to be more engaging for every player.

**USER STUDY**

We have integrated the adaptation of interaction difficulty in the social maze exercise, where the viscosity of movement parameter is altered according to the current interaction level of the player. We decrease the viscosity when a player is moving too slow and we increase the viscosity when a player is moving too fast. To investigate how patients perceive the result of the implemented adaptation, we conducted a user study with a group of participants. Furthermore, we would like to investigate the
social interaction between the players in the social maze exercise.

Participants
We recruited 7 patients of the Rehabilitation and MS Centre in Overpelt (Belgium) who all suffer from upper limb dysfunction due to MS. They were 5 males and 2 females with an average age of 60 years, ranging from 47 to 72 years old. The duration of the MS diagnosis varies between 3 and 34 years, with an average of 18.8 years. Five of them used the left hand to operate the HapticMaster in training, while the other two used their right hand. Table 1 shows the personal information of each MS patient participating in this research. To have an overview of the severity of their upper limb dysfunction, we obtained their clinical measures as shown in Table 2: upper limb strength (Motricity Index [11]), upper limb functional capacity (Action Research Arm Test [2]) and arm motor function scores (Brunnstrom Fugl-Meyer proximal and distal [6]). Only one therapist participated in this user study and the Novint Falcon was again used as the therapist’s input device. All patients used the HapticMaster as the input device.

Procedure
The user study consisted of three sessions: one non-adaptive session and two adaptive sessions. We asked the pairs of participants to perform the social maze exercise as depicted in Figure 1.

In the non-adaptive session, there was no adaptation of interaction difficulty integrated. In the adaptive sessions, we integrated the adaptation of interaction difficulty within the training session. During the training session, we observed the player’s speed in completing each task (i.e. select and transport a symbol). When the speed goes below a certain threshold considered to be too slow, the viscosity of the movement is automatically decreased. When the speed goes above the threshold considered to be too fast, the viscosity is automatically increased. In this user study, we only investigate the adaptation of interaction difficulty of the patient since we were mainly interested to find out how patients perceive the implemented adaptation.

After each session, patients were asked to rate their subjective perception on quality of interaction and enjoyment, on a 5-point scale rating (e.g. 1 not at all to 5 very much) based on their experience of performing the social maze exercise. Averagely, the user study lasted for about 15 minutes per participant. Figure 3 illustrates the setup of this user study.

Results
We have integrated the adaptation of interaction difficulty adjustment in the social maze exercise, which was triggered within a training session when the player’s speed falls outside the predefined normal speed range. During the two adaptive sessions in the user study, we observed that the interaction trajectory was different for every participant. Within a session, the participant can experience staying at the same interaction difficulty (i.e. same viscosity), going to a lower interaction difficulty (i.e. decrease of viscosity) or going to a higher interaction difficulty (i.e. increase of viscosity), depending on his/her current level of interaction.

Patient | Gender | Age (years) | Diagnosis duration (years) | Training hand |
--- | --- | --- | --- | --- |
1 | Male | 64 | 14 | Left |
2 | Female | 58 | 3 | Left |
3 | Male | 71 | 10 | Right |
4 | Female | 47 | 14 | Right |
5 | Male | 57 | 27 | Left |
6 | Male | 56 | 30 | Left |
7 | Male | 72 | 34 | Left |

Table 1. Personal information of MS patients in the user study

Patient | MI (max=100) | ARAT (max=57) | BFM-prox (max=66) | BFM-dist (max=66) |
--- | --- | --- | --- | --- |
1 | 76 | 41 | 25 | 40 |
2 | 83 | 56 | 36 | 29 |
3 | 84 | 46 | 32 | 28 |
4 | 76 | 56 | 36 | 30 |
5 | 55 | 41 | 23 | 21 |
6 | 60 | 30 | 27 | 24 |
7 | 50 | 1 | 12 | 7 |

Table 2. Clinical characteristics of MS patients in the user study

Figure 3. The setup of user study.
Figure 4 shows the adaptive interaction training trajectory for each pair of participants in the first and second adaptive session respectively, as a result of integrating adaptive interaction difficulty in the social maze exercise.

Further, we analyzed how these conditions of adaptation influenced the performance of patients and their subjective perception on quality of interaction and enjoyment across the sessions. Due to the small number of samples and observations in this user study, we used the nonparametric methods for the statistical analysis.
Patients’ Performance with respect to Adaptive Interaction Difficulty

Based on the comparison of the speeds between two symbols, we calculated Progress index, as an indicator of the patient’s progress. The calculated indexes were categorized as follows: the indexes when the viscosity was decreased, when the viscosity stayed the same and when the viscosity was increased.

Figure 5 shows the average of the progress indexes for the three conditions of adaptation: (1) decrease of viscosity, (2) same viscosity and (3) increase of viscosity. Kruskal-Wallis test showed that there is a significant difference of Progress index between the different conditions of adaptations (H(2) = 20.691, p<0.001) with a mean index of 3.93 for condition 1, 1.12 for condition 2 and 0.78 for condition 3. This finding showed that the training performance of patients differed by the condition of adaptation. Mann-Whitney pairwise comparisons tests confirmed the significant difference of performance progress across all conditions (p<0.05). This showed that the progress of patients was significantly higher when the viscosity was decreased compared to when the same viscosity was given. Their performance decreased when the viscosity was increased.

![Figure 5. Patient’s performance with respect to different interaction difficulty adjustments.](image)

Figure 6. The mean progress indexes in the non-adaptive and adaptive sessions.

Patients’ Subjective Response with respect to Adaptive Interaction Difficulty

Based on the patients’ subjective responses, we calculated the average ratings of perceived quality of interaction and perceived enjoyment, for the three different sessions as shown by Figure 7.

For the Perceived Quality of Interaction, Friedman test showed that a significant difference was found (H(2) = 6.615, p<0.05), with a mean rating of 3.43 for the non-adaptive session, 3.86 for the first adaptive session and 4.14 for the second adaptive session. Posthoc analysis with Wilcoxon Signed-Rank tests showed that there is a significant increase in ratings between the non-adaptive and the first adaptive session (Z = -1.732, p<0.05), and also between non-adaptive and the second adaptive session (Z = -1.890, p<0.05). It was also shown that there is no significant difference in ratings found between the adaptive sessions. These findings indicates that patients perceived their quality of interaction to be significantly better when the adaptive interaction difficulty adjustment was integrated in the social maze exercise.

For the Perceived Enjoyment, Friedman test showed that a significant difference was found (H(2) = 13.13, p<0.001), with a mean rating of 3.43 for the non-adaptive session, 4.57 for the first adaptive session and 4.86 for the second adaptive session. Posthoc analysis with Wilcoxon Signed-Rank tests showed that there is a significant increase in ratings between the non-adaptive and the first adaptive session (Z = -2.53, p<0.05), and also between non-adaptive and the second adaptive session (Z = -2.456, p<0.05). No
significant difference in ratings was found between the adaptive sessions. These findings indicates that patients enjoyed the training more when the adaptive interaction difficulty was integrated in the social maze exercise.

The most shown behavior during the social maze exercise was the act of discussing strategy. It was pretty obvious that the nature of the training exercise requires the two participants to closely collaborate and discuss their strategy and necessary actions. This behavior happened throughout the whole session, sometimes followed by the act of looking at each other. At the beginning and during the session, participants discussed what actions they should perform and the best way to perform them. At the end of the session, participants briefly reviewed their previous session and how they should perform better on the next session, as illustrated in Figure 9a. In some participants, we can also observe the behavior of unconsciously mimicking each other during the strategy discussion, as illustrated in Figure 9b. Several remarks from participants (both the patients and the therapist) were as follows.

Therapist: “What should we do now? Which symbol should we take first?”
Patient: “Maybe we should demolish the bomb first, then take the symbols. What do you think?”
Patient: “I wasn’t that good. What do you think I should do?”

Throughout the sessions, we can observe all participants smiling (Fig. 9c), laughing and chuckling (Fig. 9d). This mostly happened when one of them made an error such as encountering the devil or hitting the laser beam. A couple of participants tended to make jokes during the training session that resulted in both of them laughing at each other. Some examples of their jokes were as follows.

Patient: “No, you’re no good. I’m way much better than you, aren’t I?”
Patient: “If I help you, can I get some sweets later on?”

Every now and then, participants asked or offered each other’s help when they needed help or saw their partner in need of help, which were shown by some remarks as follows.

Therapist: “Can you help me to push the bomb please?”
Patient: “I can’t pass through, you must help me!”
Patient: “You can’t reach it. Do you need help?”

Some participants showed politeness towards their partner after getting or giving some help, as shown by some remarks as follows.

Patient: “Thanks! That’s very sweet of you!”
Therapist: “Here you go! You’re welcome!”

During the session, participants motivated each other especially when they saw their partner struggling or performing well, which were shown by some remarks as follows.

Patient: “Come on, you can do it! I’ll wait for you!”
Therapist: “Good job! Keep up the good moves!”
CONCLUSION AND FUTURE WORK

We have explored how social interaction and adaptivity can be integrated into collaborative rehabilitation training, where the training involve not only a MS patient but also a training partner. This training partner can be anyone from the patient’s social environment such as family members, friends, therapists, caregivers or even fellow patients. We have implemented the automatic adaptation of interaction difficulty in the social maze exercise. A user study has shown the outcome of this adaptation to be effective. We can conclude that when adaptation is integrated, patients showed a better progress of performance, perceived their quality of interaction to be better and enjoyed the training sessions.

However, we have not examined how the therapist as the training partner perceives the result of the adaptation of interaction difficulty. We also have not investigated if the integrated adaptation results in a more balanced collaboration between the patient and the therapist. Further investigation is needed to optimize the adaptation algorithm to achieve a balanced collaboration between the patient and the training partner.

With regard to social interaction, we believe that the social maze exercise has become a social play medium between patients and their therapist. We have observed some relevant behaviors and remarks which indicated the development of social interaction during the collaborative rehabilitation training. While performing the social maze exercise collaboratively, they have showed several particular behaviors such as smiling, laughing or chuckling, asking or offering help, looking at each other, motivating each other, joking, being polite and discussing strategy.

We have investigated the integrated adaptation within a sympathetic social scenario between a patient and his/her therapist. We realized that the adaptation has been implemented with a focus on the patient’s needs and characteristics despite the existence of a training partner. In the sympathetic social scenario, it may be interesting to investigate how or what kinds of adaptation can facilitate the family member or the therapist to achieve a more engaging and motivating collaboration with the patient. For the empathetic social scenario, we also need to investigate how the different types of adaptation can accommodate the needs and characteristics of another patient as a training partner.

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