Observing Flow in Child/Music Machine Interaction

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Abstract

The aim of this extended abstract is to introduce a grid created with the software The Observer XT10.5 (Noldus Information Technology) to observe and analyze the state of Flow (Csikzsentmihalyi [6]) in 4 and 8 year old children when they interact with a musical machine for children music improvisation: the MIROR Impro. The MIROR Impro is one of the three components of the MIROR platform, which is an innovative adaptive system for music learning and teaching based on the "reflexive interaction" paradigm [1,3,4,10]. The theory of Flow has been used to explain the ability of the IRMS (Interactive Reflexive Music Systems) to imitate the music style of the user and their ability to enhance and maintain the attention of the user [11]. The results would support the hypothesis that the IRMS and the reflexive interaction may generate an experience of well-being and creativity. The Flow grid worked in an effective way and it was possible to indicate some aspects of the MIROR Impro to be improved. The research is carried out in the framework of the EU-ICT Project MIROR (Musical Interaction Relying On Reflexion).

Theoretical Background: the MIROR Impro and the theory of Flow

The MIROR Impro is an IRMS (Interactive Reflexive Music Systems), and it is characterized by the idea of letting the users manipulate virtual copies of themselves through designed machine-learning software. "The basic concept in the paradigm of reflexive interaction is to establish a dialogue between the user and the machine, in which the user tries to 'teach' the machine his/her musical language" p.19 [3]. According to Pachet [11,10] the reflexivity in interactive systems is characterized by: similarity or mirroring effect, agnosticism, scaffolding of complexity and seamlessness. The basic hypothesis of the MIROR project is that the "reflexive interaction" enhances musical learning and creative processes in children. This hypothesis is based on several interactional, perceptual and neurophysiology mechanisms generated in children during the interaction with an IRMS: as well as imitation, self-imitation, imitation recognition, turn-taking, repetition/variation processes and the experience of Flow is considered as one of the creative experience enhanced by the reflexive interaction [1]. Leman et Al. [9] indicate the theory of Flow as one of areas of expertise, along with the concept of "presence", which should be explored to study the human/machine interaction. The MIROR Impro, tested in the protocol n.1 inside the MIROR project, is an evolution of a previous IRMS: the Continuator. The studies on the Continuator/preschool children interaction underlined as the Continuator, and so the IRMS, could be defined as Flow machine [4]8]. According to Csikzsentmihalyi [6], the state of Flow is a condition of well-being, an optimal experience reached when a balance between the skills of the subject and the challenges is present. The Flow is characterized by the presence of high levels of a series of variables: focused attention, clear-cut feedback, clear goals, pleasure, control of situation, awareness merged, no worry of failure, self-consciousness disappeared, the change of the perception of time, pleasure. From the 80s some studies and researches applied the theory of Flow to different field as daily life, economy and sport, and in recent years to the music education, performance and composition [4,5,7,12].

Method

Participants: 48 children involved in the protocol, 24 children observed = 12 (4 year old), 12 (8 year old).

Setting: a room used as atelier in a kindergarten; the library of the primary school. The keyboard and the two loudspeakers were on a table. The child played the keyboard resting in front of it. The laptop was on a little table near the other one. The camera was resting on a tripod in front of the child and was visible by the child.

Equipment: MIROR-Impro prototype v. 2.5; a music synthesizer KORG X50; a notebook TOSHIBA - Techra (Windows 7, 64 bits); two amplifiers M-AUDIO AV30; a video camera SONY (recording in HD).

MIROR Impro: three different set-up of the MIROR Impro prototype were used: set up A "same", based on the imitation of the input phrase; set up B "very different", the answer of the system presents minor similarities with the user's input; set up "nothing", the system was inactivated and there was no answer to the user.

Procedure: every child realized three sessions in three consecutive days. In each session, the operator asked the child to play four different games (tasks), as follows: Task 1 = the child played alone with the keyboard; Task 2 = the child played alone with the keyboard and the MIROR Impro Prototype; Task 3 = the child played the keyboard with a friend; Task 4 = the child played the keyboard and MIROR Impro Prototype with a friend. The children were invited to tell when he/she was tired and want to stop the activity and/or to change the task. The tasks were given in random order.

Independent variables: the use of MIROR-Impro (with/without the system); the set-up ("same", and "very different"); the age of children (4 and 8 year old); the gender of children; the exposition to the system (3 sessions); presence/absence of the friend.

Experimental hypothesis: the basic hypothesis is that the reflexive interaction and the mechanism of repetition/variation implemented by the IRMS could enhance creativity and learning processes. Consequently the experimental hypothesis is that the Flow emotional state increases when children playing with the MIROR-Impro and with set-up "same".

Data collected: video recordings, photos, MIROR Impro recordings, drawings made by the children, children profile filled by the teachers, questionnaires filled by the parents (provided only by the preschool teachers).

The Flow Grid

The grid has been created with The Observer XT 10.5 software (Noldus Information Technology, Wageningen, The Netherlands). The research by Csikzsentmihalyi measures the Flow using interviews and diaries in which subjects, in first person, describing situations in which there is the Flow (self-reported data). Instead, in the grid of Flow here described, the Flow is measured by the observation of the children's behaviour. For this reason, only the variables that could be described through an operational behaviour have been considered, as follows: focused attention, clear feedback, clear goals, control of the situation, pleasure. In some cases, to define better the operational behaviours of the variables the indicators of Custodero [7] were used. The basic idea of this grid was that the observer did not observe/register directly the Flow state, but rather the "variables" and the intensity of each variable. The Flow grid allows recording the presence/absence and the duration of each behaviour. Furthermore, the grid allows recording the level of intensity of each behaviour, by using the "Modifier" tool: 1 = low level of intensity; 2 = medium level of intensity; 3 = high level of intensity. The Observer XT calculates, through a specific data profile, the combinations of the different levels of the different behaviours: when the levels of all behaviours are recorded with high levels, the presence of the state of Flow is indicated as present. The data profile was based essentially on a series of consecutive "nests" over the behaviours. The Nesting function allows selecting among the data registered by the observers the combined presence of pre-defined level of the behaviours. Before starting the observation, each independent observer received a document named "Instructions for the observers", within the definitions of the behaviours, the modifier and several "practical actions" to register the behaviour by the software. Reliability tests within the five independent observers have been realized before to start the registration and during the registration of the observation. The cases of disagreement were solved by collective discussions and observations. After the observation, the data collected have been analysed with The Observer XT and in particular by the behavioural analysis. The software calculates: total duration (total duration of the video observed), analyzed duration (the duration of the video observed with "dead moments") duration of each behaviour, percentage (analyzed duration) of each behaviour. The results obtained with The Observer XT have been exported to statistical software (SPSS) to make MANOVA and t-student analysis.

Results

The percentage of state of Flow is higher, for all subjects, when the child/children played with the MIROR Impro (T2=Task 2; T4 = Task 4); supporting of this outcome, the lowest percentage of Flow has been recorded when the child played alone without partner and without the system (T1 = Task 1), see Figure 1.

Thus, we can affirm the MIROR Impro enhances the state of Flow in children. The presence of the Flow is always (considering the four tasks) higher in the sessions of 8 years rather the 4 years old. About this finding, we could assume the MIROR Impro is more suitable for older children rather the younger. In the sessions with the set up A "same" the percentage of Flow is always higher than the set up B "very different", see Figure 2 and in all 4 tasks. The difference between set-up "same" and set-up "very different" is significant (p=.004). This result support the experimental hypothesis that the Flow state increases when the system's reply is more similar to the input played by the children, that is when the system's reply is more "reflexive". In this case, it is therefore possible to say that the result support also the hypothesis that the reflexive interaction could enhance the flow state. Considering all the sessions, the trend of the Flow remains constant between the first and the second session, while it rises between the second and third session. The understanding of the rules of the system, the presence of high level of control of situation, the pleasure to play may make the children more self-confident and these may be important factors to enhance a state of well-being and the state of Flow.

Conclusion

The analyses carried out with The Observer XT confirm the experimental hypothesis: the results show that the Flow increases not only when children play with MIROR-Impro, but also when they play with the set-up "same", that is the more "reflexive" set-up used in the experiment. Furthermore, the Flow state is more evident when children play alone with the system. The creation of the coding scheme and of the data profile, the observation with The Observer XT has been a very demanding task. Nevertheless, it has been also very helpful because it allowed to reflect on and define better the behaviours (finding operational definitions), to observe and code many data that could be analysed in different ways (different data profiles), to control many variables, to make some basic statistical analysis. In the realization of the grid some difficulties raised especially in the definition of the data profile, during the observation (for example how to solve the problem of the presence of "dead moments" in the video), how to organize the results in the behavioural analysis and in the exportation of the data to other software for the statistical analysis.

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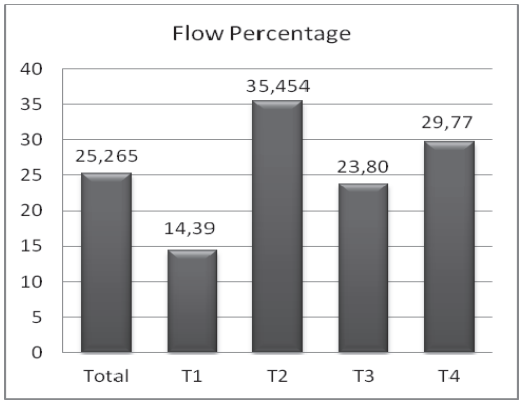

Figure 1. The percentage of the duration of the Flow, all subject in the four tasks.

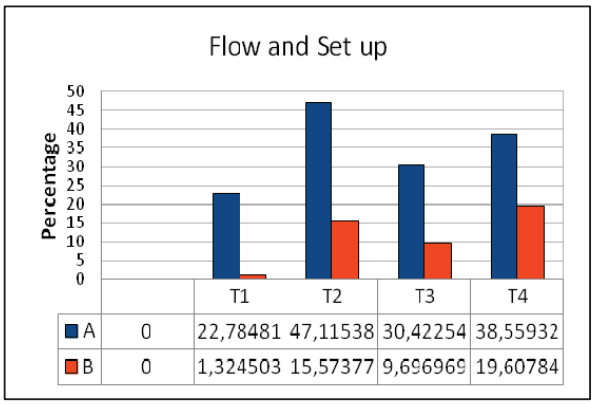

Figure 2. The percentage of the duration of Flow in all Subjects with the set up A (same) and B (very different).

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