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Toward a Virtual Tool to Train on Dissonance Control Supported by Learning and Cooperation

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Abstract: This paper proposes an original training virtual tool on the control of dissonances by applying learning and cooperation concepts. This virtual tool is a part of a SPOC (Small Private Online Courses) developed at the University of Valenciennes, and it is composed into three parts: the dissonance control theory presentation, the case study analysis part and the training supervision support. The dissonance control theory part contains several texts and a database of articles, texts or movies, and concerns the presentation of taxonomy, formalism and assessment of dissonances. The case study analysis part contains an illustrative database of images, animation movies, questionnaires or algorithms. By applying experience based learning and co-learning processes, students and tutors can jointly increase, refine or validate the content of the databases. The student training supervision support aims at detecting difficulties such as problems of understanding, surprises, or lacks of sensemaking for instance. It will consist in implementing the so-called reverse comic strip in order to define indicators about the quality of the course and its understanding.

Keywords: virtual tool, dissonance control, learning, cooperation, reverse comic strip, training supervision, SPOC

1. INTRODUCTION

A Small Private Online Course (SPOC) is an online remote course with a limited number of students who can receive a diploma after validating a minimum number of modules. The University of Valenciennes is building such a Master Science course with several modules oriented by the results on research projects and directed by tutors in order to support their student training supervision. Among the proposed modules, there is a virtual tool based course to train on dissonance control. The module on dissonance control makes students capable to model a system functioning by developing heuristics such as rules, and to identify, analyse and recover possible dissonances on heuristics in terms of riks.

A human-machine system is resilient as long as there is no accident despite the occurrence or consequences of any perturbations (e.g., well-known perturbations, unknown perturbations, exceptional perturbations, regular perturbations). Some perturbations can be linked with the autonomy of the system. Any instability of this autonomy is called dissonances. Resilience relates then to the success of the control of dissonance, i.e. of the instability of autonomy. A dissonance is a conflict of autonomy and is the subject of recent research articles that present dissonance engineering as a new way for analysis risks involving human and machine (Vanderhaegen, 2014a, 2014b). This concept gathers the cognitive dissonance principles (Festinger, 1957) and the organisational dissonance principle (Kerven, 1995). People are usually not trained when they face a dissonance. Situation awareness or sensemaking is then difficult to apply because of the surprise effect or a lack of perception or interpretation. Training programs implementing learning or cooperation support principles are then required and have to be defined.

This paper proposes a virtual tool to train on the dissonance control supported by learning and cooperation. The section 2 presents the architecture of this virtual tool. The section 3 summarizes the principles of the dissonance control theory. The section 4 proposes some examples of case studies. The section 5 presents the training supervision tool.

2. THE VIRTUAL TOOL ARCHITECTURE

The virtual tool architecture is given on Figure 1.

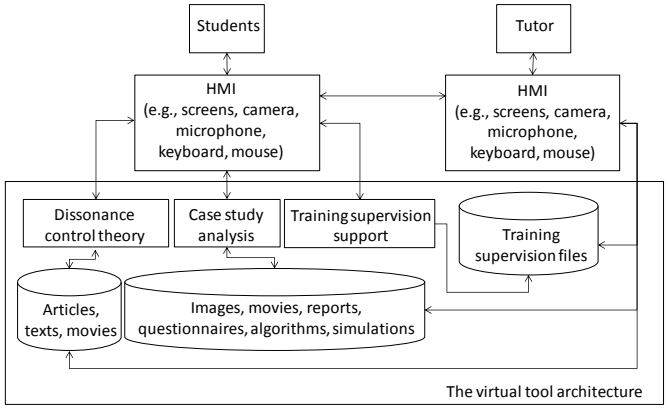

Fig. 1. The virtual tool architecture for training achievement and supervision.

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The tool is composed by the three main parts: the presentation of the dissonance control theory, the analysis of case studies and the training supervision support. Students and tutors can interact with each other and with the virtual tool by using human-machine interfaces such as the keyboard, the mouse, the camera, the microphone, etc. The course takes two months and begins at the same time for a given group of students. Different appointments with videoconference or exchanges by emails are made between the students and the tutor until the end of the module. The use of the virtual tool for validating the module is about 50 hours of work with a final remote examination to validate it. The dissonance control theory part presents the concept of the dissonance and its control. The case study analysis part concerns the identification and the assessment of dissonances relates to the content of official accident reports or to practical exercises on real field situations. Both parts are interactive, i.e., the dissonance control theory can be called during the use of the case study analysis part, and inversely. Therefore, students can use these theoretical and practical parts as they want. For instance, they can try to discover by themselves the concept of dissonance by using the practical part, and require complementary information by connecting to the theoretical part. When these parts of the course are used, the training supervision tool registers the face and sound around the student environment in order to identify possible difficulties of understanding or possible errors on the course content. This recording process is done via a webcam and a microphone. The obtained file is then transmitted to the training tutor who has to verify these possible problems. Based on the students' experience, the content of the databases can be enriched by integrating other articles, images, movies, reports, questionnaires or algorithms. The tutor has then to validate them before integrating them into the database definitively. The experience based learning and the co-learning principles are then used in order to increase, refine or validate the content of the course. The cooperation principles are used for exchanging between a group of students and their tutor in order to support the training supervision and the course content quality. In the field of cognitive psychology, Millot & Hoc (1997) proposed that "two agents are cooperating if 1) each one strives towards goals and can interfere with the other, and 2) each agent tries to detect and process such interference to make the other's activities easier". However, cooperation between agents implies a bi-directional interaction when each agent aims at facilitating its own activities (Vanderhaegen, 1997, 2012). As a matter of fact, the agents of a given human-machine system cooperate together in order to facilitate the activities of other human-machine systems or/and the activity of their own group. The human-machine cooperation can then be applied for both individual and collective interests. This concept of cooperation is then applied to this course when students and tutors interact jointly to recover any problems. This can improve the understanding of the students of the content of the course.

3. THE DISSONANCE CONTROL THEORY

This part presents the theory of dissonance control. Students have the possibility to discover this theory by reading different articles available on the database. They can require a synthesis of the content of these articles. Texts and movies of the database are then used.

The original theoretical aspect of the dissonance control relates to the identification of a dissonance regarding a single autonomy reference (Figure 2-a), without any autonomy reference or with an unclear reference (Figure 2-b), or several autonomy references (Figure 2-c). Comparison between the autonomy reference level and the current autonomy level may lead to the occurrence of dissonances.

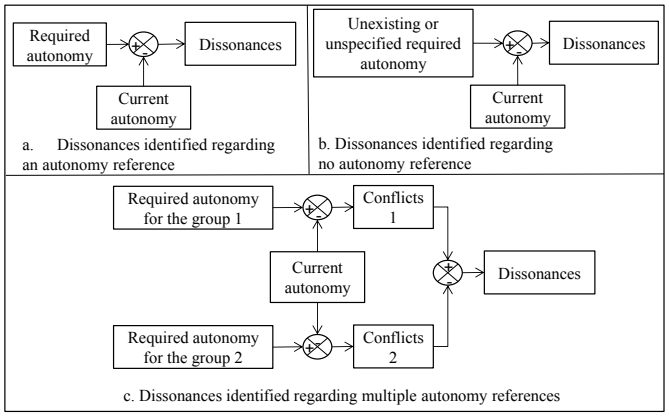

Fig 2. Dissonances and autonomy references.

Conflicts can occur on different system autonomy characteristics. The autonomy of a system can be modelled with a triplet (K, A, P) composed by (Vanderhaegen, 2012, 2015):

- K: The knowledge of the system. It concerns the competencies or the abilities of the system to achieve goals. It is composed by heuristics or rules for instance.
- A: The availability of the system. It concerns the occupation level of a human or of a machine. For instance, it can relate to physical, cognitive or physiological availability of a human operator.
- P: The prescription of the system. It relates to the allocation of goals between decision-makers. A decision-maker can then be competent and available but may be not authorize to act on the process.

Dissonances can then concern the knowledge, the availability or the prescription of a given system or between systems. Several kinds of dissonances can be identified and an example of taxonomy is given on Table 1. The references are available on the corresponding database. Dissonances can be formalized by using heuristics or rules (Vanderhaegen, 2014a) or by implementing Petri nets for identifying new affordances or inconsistencies between rules (Vanderhaegen, 2016). New affordances are the discovering of new relationships between actions and interactions to achieve these actions. Inconsistencies are either contradictions when a decision-maker is concerned or interferences when several decision-makers are involved. The learning process for taking into account a dissonance is inversely proportional to the dissonance acceptance (Festinger, 1957). This implies strategies for controlling a dissonance. They are strategies