Emotional and cognitive information processing in web-based medical education

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Abstract

The patient–physician relationship can be conceived as a process of structuring an ill-structured emotional-cognitive problem. So, new methods should be developed in order to capture the relations among emotions and cognitions, and physicians should be educated to recognize the influence of emotions on medical decision-making. The paper describes GRASP, an e-learning application based upon the assumption that cognitions and emotions are dual concepts. The results of a blended e-learning experiment are shown. The students were confronted with a role-playing based illness narrative. Their observations were segmented into information units, and uploaded on the e-learning system DVLN. The set of information units was then transformed into a bipartite graph, and analysed by means of STRUCTURE, an application aimed at grasping the structure of the relations among a set of “objects”. The results were compared with Correspondence Analysis. The implications for medical education, medical reasoning, and medical record design are discussed.

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1. Introduction

Dealing with emotions is probably the central focus of health care not only because of their psychological relevance, but also because they have a crucial role in clinical decision-making. From a general point of view, some authors claim that a satisfactory decisional process is impossible without emotions [1]. In fact, emotional and cognitive systems, even if distinct, are strictly interwoven and interdependent, and these interconnections drive an active and appropriate adaptation to the environment.

Emotions are also giving-sense judgment processes. So, they convey an intrinsic cognitive value, and are important in appraising the main problems of the patient and his (her) relatives.

Despite the relevance of emotions, physicians are not educated to recognise the patients’ and their own emotions and feelings, and medical diagnosis and treatment choices are implicitly considered as the result of a pure rational decision-making process. Also, medical records (electronic or not) are implicitly conceived as neutral accounts of “objective”, “facts”, and do not allow capturing and analysing the emotional aspects of medical decision-making. But, due to the importance of emotions in medical decision-making, medical records should include specific sections for emotions organized in a simple and efficient format.

However, one should realize that the registration of medical data is embedded into an emotionally charged interaction among the actors of the care/cure process (ACP). From this point of view, the doctor-patient relation can be conceived as the encounter of two agents who try to structure and solve simultaneously an emotional and a cognitive problem. An example of cognitive-emotional problem is the recognition of the deep meanings that a given patient attaches to the different aspects of his suffering, i.e. his illness narrative.

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The concept of personal illness narrative [2–4] denotes the construction of affective-cognitive meanings of the different aspects of the illness process in which the ACPs are engaged. But, in order to do so, physicians should be educated to be aware of their emotions.

From this point of view, the care-cure process can be conceived as the dynamics of the interactions among different narratives, where each actor tries to structure an ill-structured situation by extracting meanings (interpretations) from a complex dynamical situation. Different actors (e.g. patients and doctors) do extract different aspects from the same complex stimulus–situation leading to different plots of the same scenario [5]. So, different parallel decision-making processes are activated with different goals and priorities which probably are the results of different kinds of information processing due to different cognitive-emotional meanings attached to different aspects of the illness.

The assumption underlying the present paper is that the distinction between emotions and cognitions is somewhat blurred because they are the two sides of the same coin. So, they have an intrinsic dual nature; the emotions felt by a given individual in a given context depend on the way in which (s)he interprets the situation, and in turn the interpretation of the situation depends on the way in which (s)he emotionally reacts to it. So, cognitive problem solving is at the same time also emotional problem solving.

From this point of view, the appraisal of a given piece of information can be conceived as the act of creating a relation between emotions and one or more aspects of a given situation. In other words, [6] emotions themselves are in fact relations over eliciting conditions. So, the selection of one or more features (i.e. observations or interpretations) from a narrative can be conceived as the result of an emotional-cognitive problem structuring and solving. For example, Patel et al. [5] showed that during the physician patient interaction, doctors represent medical problems in terms of biomedical concepts related to the underlying disease, whereas patients represent them as a narrative. Disease is the technical description of body dysfunctions, whereas Illness is the set of meanings attached to the disruption of the patient’s normal life. Also, the laypersons’ understanding of disease and risk factors is often at odds with the experts’ ones [7].

So, the main problem is to develop a model aimed at grasping the emotional-cognitive meanings that different people extract from complex stimulus–situations, such as illness narratives.

From the educational point of view, the value of the so-called “story telling” for stimulating the acquisition of complex and meaningful knowledge, the crucial role of emotion in attention, planning, memorization, and as a powerful motivational learning tool [8] are widely recognized. The importance of the emotional dimension is also an emerging field in distance asynchronous learning [9], where the lack of visual interactions generates an artificial situation which is partially solved by means of the so called “emoticons”, e.g. stylized pictures of facial expressions [10,11]. Emotions are also important in the so called situated learning [12], e.g. in learning a foreign language [13] or in hospital training settings.

In this respect, illness narratives provide an ideal scenario in order to engage the students in emotional-cognitive problem structuring and solving, and in turn the analysis of the outcomes of their emotional-cognitive problem solving can help to understand the ways in which they appraise the events both from the emotional and cognitive point of view.

From the methodological point of view, illness narratives are usually expressed as texts, and content analysis is one of the main routes for grasping the manifest and latent meanings conveyed by written documents. Content analysis is centered on the concept of unit of analysis which refers to a great variety of objects such as interviews or diaries. In order to grasp the meaning units, the texts are usually de-structured into segments, and coded. In the field of education qualitative content analysis of narratives was applied to a variety of data [14,15].

From the teaching point of view, dealing with emotions implies three interrelated questions:

- What is the best educational scenario in order to engage the students in the construction of the interpretation of a complex stimulus–situation conveying simultaneously cognitive and emotional meanings?
- What is the best strategy for the integration of this scenario into a distance learning environment?
- What is the best formal method in order to represent and analyse the way in which the students interpret the situation on the basis of their emotions–cognitions?

In this context, role-playing seems to be a suitable candidate in order to solve the first problem because it is the simulation of a real-life-like situation in which the learner is involved either as a direct interpreter (actor) or as a spectator. Role-playing is particularly useful in teaching/learning relational abilities in medical settings [16,17].

So, an illness narrative role-playing based educational scenario can simulate a setting of situated learning involving at the same time emotional and cognitive issues.

However, despite its strong emotional-cognitive impact, role-playing seems to be unfitting for distance asynchronous learning settings which are instead appropriate for collaborative meta-reflection on the cognitive and emotional aspects triggered by role playing.

Moreover, the dynamics of the role-playing seem to be unsuitable for mathematical and/or statistical analyses, because it is typically used in small focus groups aimed at interactively evaluating aspects of the doctor–patient relationships that are almost impossible to face by means of classic lessons and seminars.
So, the educational problem is twofold:

(1) What is the best way for combining e-learning and role-playing in order to facilitate the acquisition of a better insight into the learners’ emotions in a classroom of hundreds of students?

(2) What is the best model for describing in a formal and rigorous mathematical way the relations between cognitions and emotions triggered by the role-playing?

In the present work a web based application (GRASP) was developed in order to analyse the way in which different people grasp pieces of information from the streaming of an illness narrative. The application is part of the e-learning asynchronous system DVLN (Dynamic Virtual Learning Networks).

The use of GRASP was embedded into a blended educational e-learning experiment based on role-playing and illness narratives.

The formal analysis of the relationships between emotions and cognitions was carried out by means of STRUCTURE, a Graph Based Structural Analysis application [18–20]. It was so possible to study the emotional-cognitive meanings that the students attached to different segments of the role-playing based illness narrative. This approach was compared with Correspondence Analysis [21], a classical statistical method for the analysis of the association patterns between two qualitative dimensions, and mostly used in text and data mining.

2. Materials and methods

The medical students of the course of Medical Statistics and Informatics of Faculty of Medicine of the University of the Naples “Federico II” were involved an illness narrative based role-playing. The course is delivered on first semester of the first year.

The experiment started after sixty hours dedicated to classical statistical issues (descriptive and inferential statistics, parametric and non parametric hypothesis testing, and so on), and e-learning activities. During the week before the role-playing session the students were given a set of seminars and lessons on the concept of illness narrative. The main principles and techniques of qualitative interviewing and content analysis were stressed. In particular, many examples of segmentations of illness narratives into meaning units were described. Also, the main techniques for taking field notes in complex dynamical settings were explained.

The experiment was carried out in different steps.

2.1. Vis-à-vis phase

An actress interpreted the role of Mary, a young woman suffering since her childhood from type I diabetes with a recent onset of celiac disease. The simulation was aimed to stress several issues typical of medical stories, e.g. the quality of the patient–doctor relationships, the side-effects of illnesses on social life, and so on.

The actress, a 25 year old girl, was introduced to the students as a “true” patient.

A student was randomly chosen from the classroom and was invited to apply the rules of qualitative interviews in order to grasp the patient’s illness narrative. The other students were invited to take their field notes related to the scene they were going to see.

At the end of the role playing session a plenary discussion was activated. The entire session was filmed with the consent of the students.

2.2. Asynchronous uploading

As homework the students were then invited on a voluntary basis to revise their written notes and to register their up-most meaning units by using the asynchronous e-learning system DVLN [22]. DVLN includes the application GRASP which allows splitting a complex observation into meaning units.

In GRASP the interface of each meaning unit is composed of four panels:

1. What did you observe?
2. How do you explain the observation?
3. What did you feel?
4. How do you explain these feelings?

In each panel the student can write a short statement (2 or 3 lines). So, an online archive of meaning units was obtained. In the present paper only the observations (point 1) and the associated emotions (point 3) are analysed.

Also, an online discussion forum was activated.

2.3. Codification

The observations and the emotions, originally collected as short sentences by means of the GRASP interface, were first codified online by means of a set of labels negotiated at distance by two members of the research staff. The codes were then iteratively revised by the members of the research staff until a shared codification of each observational and emotional statement was obtained.

<table>
<thead>
<tr>
<th>Table 1</th>
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<tbody>
<tr>
<td>Codes of the observations</td>
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<tr>
<td>Patient illness perception</td>
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<tr>
<td>Not Compliance</td>
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<tr>
<td>Disease symptoms and signs</td>
</tr>
<tr>
<td>Negative interviewer/patient relation</td>
</tr>
<tr>
<td>Positive interviewer/patient relation</td>
</tr>
<tr>
<td>Transfer from paediatrics</td>
</tr>
<tr>
<td>Unfeeling doctors</td>
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<tr>
<td>Novel type of lesson</td>
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</tbody>
</table>
The following tables show the codes of the observations and emotions, respectively (Tables 1 and 2).

### 2.4. Graph based statistical analysis

Each meaning unit was thus described as a row in an \( N \times 2 \) matrix, where \( N \) represents the total number of collected pairs and the columns contain, respectively the emotion and observation codes.

From the original matrix an emotion-by-observation contingency table was set-up which contained in each cell the frequency of occurrence of the corresponding emotion–observation pair. The statistical analysis was carried out by dichotomizing the contingency table at increasing thresholds. So, at each threshold \( t \) an adjacency binary matrix \( A_t \) was obtained where each element \( a_{ij} \) was set equal to 1 if the corresponding pair \( \{\text{Emotion}_i, \text{Observation}_j\} \) was cited at least \( t \) times. Each binary matrix \( A_t \) represents a bipartite graph containing two sets of nodes, i.e. emotion_nodes and observation_nodes.

The graph was displayed by means of DKN where an arrow from an emotion_node to an observation_node indicates that the frequency of that particular observation–emotion pair was equal or greater than the threshold \( t \). The Correspondence Analysis was instead performed on the original contingency table by using the software SPAD (ver. 5.0).

### 2.5. Final plenary session

The results of the analyses were registered on DVLN and an online discussion forum was activated.

The experiment was concluded by a vis-à-vis interactive seminar on the role of emotions in medical decision-making, and on the quantitative and qualitative methods for analysing illness narratives.

### 3. Results

The illness narrative role playing based “lesson” begun with the assembly of the camera related equipments before the students. This triggered the students’ curiosity, because they were not able to frame such an atypical “lesson” within a course of Medical Statistics and Informatics.

The role-playing session was characterized by two unpredictable events.

In fact, the first interviewer had a panic reaction and was not able to formulate any reasonable question or to set up any meaningful interaction with the “patient”. Eventually he said: “Sorry professor, I’m an inadequate person because I’m too much timid”. The teacher then randomly selected another student who immediately accepted by saying “this interview will be a sort conversation with a friend because I suffer from the same illness”.

The final plenary debate and the discussion forum were focused on the disappointing patient’s relationships with the “unfeeling” doctors, which were also confirmed by several students suffering from the same type of illness. Another important topic was the social impact of the limitations induced by the diet-therapy and in particular its consequences upon simple and natural social activities, such as “eating a pizza” or “eating an ice cream”. Moreover, it was pointed out that often the patient’s desire to be a “normal person” generates bursts of non compliance with the diet prescriptions. The non compliance was criticized by some “healthy” students. The “patient” also emphasized that her rebel behaviour started when she moved from a paediatric environment to a specialist clinic where she felt to be treated anonymously as if she was just a number.

### 3.1. Structural analysis

One hundred and three students out of 220 registered their up-most meaning units. On average 1.21 units per student have been collected.

Fig. 1 shows the graph of the structural relations between observations and emotions at the threshold \( t \geq 2 \). In this case, an arrow between observation-node \( i \) and emotional-node \( j \) indicates that the corresponding observation–emotion pair was quoted two or more times.

As one can see, there are two types of nodes: emotion_nodes and observation_nodes, and there are no links between two observation_nodes or between two emotion_nodes. It is also important to point out that the distance between two nodes has no meaning: the graph must be read only by looking at the structure of the links. The whole graph looks like a set of constellations of emotion_nodes linked to observation_nodes.

Each “observation-cognition” is linked with one or more emotions and vice versa. In this way, the structure of the relations represents the intrinsic conceptual duality of cognition and emotion: two observations can share one or more emotions, and two emotions can be linked to the same observation. As one can see, some nodes are
“stars” because many links converge upon them. So, for example, Fig. 1 shows that the observation-stars are “Unfeeling doctors”, “Consequences on social relations”, and “Patient’s illness perception”.

Two observations are emotionally similar if they share the same emotions; two emotions are observationally similar if they share the same set of observations. For instance, Fig. 1 shows that “Unfeeling doctors” shares five emotions with “Patient’s illness perception” (i.e. Regret, Identification, Helplessness, Disappointment, and Sadness), but also triggered specific emotions such as Worry, also, “Unfeeling Doctors” shares Regret, Sadness and Disappointment with “Consequences on social relations”, which is specifically related to feelings of Esteem and Tenderness; the “Novel type of lesson” elicited Surprise and Impulse to be active; the bursts of “Non-compliance” elicited Leniency and Understanding, on one side, and Dissent, on the other; the positive relationship between the second student and the “patient” during the interview triggered just one type of emotion, i.e. Appreciation, whilst the negative performance of the first student elicited Bewilderment and Understanding.

At a higher threshold the structure simplifies. Fig. 2 shows the graph at the threshold level \( t \geq 2 \).

The main constellation is again centered on “Unfeeling doctors” upon which converge two emotion pairs, i.e. \{Sadness, Panic\} and \{Regret, Disappointment\}. The last pair of emotions is shared with “Patient’s illness perception” which in turn shares “Helplessness” with “Disease symptoms” that is linked to “Understanding” related to bursts of “Not Compliance”. One can also notice two dyads: “Appreciation”-“Positive Interviewer/Patient Relation”, and “Surprise”- “Novel type of lesson”.

At a higher threshold level (Fig. 3) one can see three constellations: the dyad “Appreciation”—{Positive interviewer/patient relation}; the \{\[forkangle\] “Helplessness”—{Patient’s illness perception, Disease symptoms} and the \{\[wedge\]} {Sadness, Disappointment}—“Unfeeling doctors”.

3.2. Correspondence analysis

The same data were processed by means of a standard multidimensional data analysis technique, i.e. Correspondence Analysis. In order to simplify the comparison between the two models, only the emotions and the observations that turned out to be connected at a threshold \( t \geq 2 \) were considered.

The first factorial plane is reported in Fig. 4.

The interpretation of a factorial plane involves evaluating not only the proximity (and thus the distance) of each modality of a variable (for example, the type of observation) to each modality of the other variable (for example, the type of emotions), but also the distances between the modalities of the same variable (for example, among types of emotions or among types of observations).

The points are arranged on a Cartesian plane where the two axes condense the information contained in the original data set. The dimension of each point is proportional to the contribute that the specific modality has on the synthetic variable described by each axis. These contributes should be taken into account in order to attach a suitable meaning to each factor (axis).

One can notice the closeness between “Unfeeling doctors” and {Worry, Professional detachment, Panic and Identification} (down left quadrant); “Patients’ illness perception”...
perception” and {Sadness, Regret and Disappointment}; “Disease symptoms” with {Surprise and Helplessness}; “Consequences on social relations” and {Tenderness and Esteem}; and finally between “Not compliance” and {Understanding, and Leniency}.

Thus, the analysis of the proximities provides an interpretation schema roughly similar to that obtained by means of the Structural Analysis.

The arrangement of the points can also be used in order to assign a meaning to each factorial axis.

By observing the projection of the points on the horizontal axis, (beginning from positive coordinates and going leftward), one moves from positive marked emotions towards the “patient”, such as for example Leniency and Understanding, to “running away” feelings such as Panic and Worry. So, the horizontal axis could be interpreted
as a propensity-escaping dimension of the emotions generated by the situation.

The second axis, is more complicated to analyse, and shows Helplessness with respect to the “Disease symptoms” on the negative semi-axes, and Tenderness and Esteem elicited from the “Consequences on social relations”.

4. Discussion

The objective of present project was fourfold (1) to activate an educational setting of situated learning aimed to elicit the students’ emotional-cognitive reactions to illness narratives, (2) to integrate it within an asynchronous distance-learning environment, (3) to develop an algorithm for grasping the structure of the relations between emotions and cognitions elicited by an illness narrative within an e-learning context, (4) to suggest some guidelines for the design of a section of medical record specifically given up to the emotions.

A cognitive act is the appraisal of some aspect of the world that appears to the subject as a conscious observation or interpretation. We will use interchangeably the terms observation and cognition, even if, strictly speaking, cognition is the underlying deep mental “mechanism”, and the observation or interpretation is the manifest effect.

As one can see, this is a field where some amount of subjectivity is unavoidable, and also the terminology is characterized by some semantic ambiguity. For instance, terms as “feelings”, “affects”, “emotions” and so on are often used interchangeably. Accordingly, we will use indifferently these terms.

There is a widespread literature on the psycho-physiology of emotions [23–29].

A radical linguistic approach led Davitz [30] to build up a consensus dictionary of terms denoting emotions, i.e. a dictionary of shared emotional meanings. The basic idea is that the emotional experience of a given person cannot be directly observed, and should be studied as it is, i.e. embedded in a linguistic system. In fact, people can communicate only those aspects of their experience for which they have an available language, and such a language is also the limit for the expression of the emotions.

Our approach is somewhat similar to this method. In fact, the students were asked to describe by means of a short statement what they felt while attending a lesson based upon the role-playing of an illness narrative. Hence, the results of our educational experiment were influenced by students’ linguistic abilities, which unfortunately are increasingly worsening over time.
Our objective was to capture the relations between emotions and cognitions in a situated blended e-learning setting in medical education.

Several authors emphasized the deep relations between emotions and cognitions [31–41].

However, the cause-effect relation between emotion and cognition (interpretation) is an egg-hen type of problem. Lazarus’s claimed [42] that the same event may be interpreted in different ways according to the observer’s appraisal of the situation, and therefore different interpretations of the same situation produce different emotional reactions: e.g. the supporters of two opposite football teams do interpret in opposite ways the “fact” that one of the teams won, and this interpretation leads to different emotions. From this point of view, interpretations come first.

The assumption of the present work is that emotions and cognitions are dual concepts: given a context, an emotion is the collection of its associated interpretations and cognitions are dual concepts: given a context, an emotion is the collection of its associated interpretations and cognitions. From this point of view, interpretations come first.

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Moreover, we believe that emotional-cognitive problem-solving can be represented as a sort of anti-puzzle. In fact, in a classic puzzle one has to re-construct the whole picture by arranging the pieces according to a unique predetermined pattern, whilst in the patient–physician relationship the physician must extract from a complex stimulus configuration (the illness narrative) the significant elements in order to construct coherent and meaningful sub-sets of pieces. So, we assume that people construct the distinctions within a complex and rapidly changing scenario in a personal way. This implies that different people appraise different aspects of the same complex-stimulus depending on their emotions. This selective perception is an emotional-cognitive phenomenon and can lead to different interpretations by different observers, or by a given observer in different contexts and/or at different times.

It is also reasonable to assume that different interpretations (observations) lead to different decisions and behaviours. In fact, several studies showed that a satisfactory decisional process is impossible without emotions, and probably emotions are themselves basically decisional processes. This idea stems from the seminal work of Simon [43] on the concept of bounded rationality which includes cognitive factors into the evaluation of uncertainty and risks [44,45]. In Artificial intelligence [43,1] it is widely accepted that cognition (including intelligence) cannot be understood if the emotions are not taken into account, and there are deep interactions between the cognitive and affective behaviour. So, the decision-maker is always involved in a process of balancing rational and emotional reasoning.

Moreover, we assumed that there are close connections between emotions and learning.

Historically most of the experimental psychology and mathematical models of learning were based on the punishment-reward model, which is still used in animal training, and it is hidden under the logic of the school exams. More generally emotions are considered as a prerequisite of long-term memories [46].

The problem we faced was to set up a suitable scenario, i.e. a complex and emotion-laden stimulus–situation, in order to analyse the students’ emotion–cognition relationships within an e-learning environment.

Illness narratives were chosen because they convey both cognitive and emotional messages [47]. So, a role-playing setting centered on an illness narrative was activated.

A variety of role-playing experiences has been carried out in the field of medical education with different objectives and results [48–51].

In fact, role-playing is a flexible tool, and can be used with different purposes both in pre and post degree education. Nevertheless, even if its utility in order to implement a live real-like practical experience is not controversial, it is not clear how to use it within a distance-learning context aimed at stressing the student’s appraisal of the emotional side of health care.

In our model the asynchronous e-learning platform DVLN played a fundamental role from several points of view.

Firstly, in order to upload their observations, the students were forced to reflect on their personal emotional experience, also because they knew that their registrations would have been accessible to the entire virtual classroom.

Moreover, the DVLN web based application GRASP generated an online repository of the observational (cognitive) statements with their associated emotional statements. The analysis of this repository led to the negotiation of the coding schema among the member of the research staff. So, no attempt to compute inter-rater reliability was carried out, since the agreement was by definition equal to 100%. This is the usual strategy in qualitative research where the objective is to generate hypotheses rather than to test predefined hypotheses. In fact, the present work can be considered as a kind of content analysis, and has no inferential objectives. So, for example, the set of students cannot be considered as a sample in any statistical sense, and the focus is on the development of a reasonable methodology for grasping the relations between emotion and cognition in a virtual environment rather than to generalize to a hypothetical population of students or classrooms. From another point of view, the “sample” can be considered as a sort of case-study.

Inevitably these codes contain some arbitrariness. Nevertheless, they allowed transforming a complex scenario into a simple contingency table.

So, DVLN was the bridge between the vis-à-vis role-playing and the statistical analysis. This was carried out by means of STRUCTURE, an application which allows analysing the structure of the relations among different sets of objects. The structure is represented as a bipartite graph, and eventually displayed by means of DKN. It is worth noticing that at the moment both STRUCTURE and DKN are stand alone off-line applications, and can be
managed only by the tutors. However, the results of the analysis (i.e. the graphs) can be uploaded to DVLN so that the whole virtual classroom can access them.

From the methodological point of view, Structural Analysis enabled us to translate an apparently complex situation into a manageable graph that can be displayed on the screen. No particular skills are required to read the relationships between emotion_nodes and observation_nodes.

This approach is at odds with the classical approaches such as correspondence lexicographic analysis which has already been used in Textual Analysis. Even if the formal analysis of the relationships between the two methodologies is going on, the preliminary comparison with Correspondence Analysis (CA) showed that the results of the two types of analysis are only partially overlapping, but whereas structural analysis provides a simple and intuitive key for grasping the structure of the relations among the “objects”, Correspondence Analysis requires a greater creative capability, and some arbitrariness in the interpretation. Moreover, CA does not allow interpreting the emotional similarities between two observation_nodes and/or the cognitive similarities between two emotional_nodes.

The main result of the present work is that the same observation had different meanings for different students, since the vast majority of the students registered just one meaning unit (on average 1.21 per student).

For example, one can see that the consequences of the disease upon social relations elicited feelings of Tenderness, or Esteem, Disappointment or Regret; some students were impressed by the novelty of the “lesson” and felt a strong drive to participate to the discussion, whilst others did not take into account this observation; the unfeeling doctors elicited contrasting feelings: from Identification with the “patient” to Disagreement, from Helplessness to Professional detachment; from Sadness to Worry; from Disappointment to Panic; the bursts of patient non compliance indicated to consider emotions not only merely as psychological factors separated from the decision-making process, i.e. from diagnostic reasoning and treatment prescribing. In fact, emotions drive the way in which a given agent extracts meaning units form an (illness) narrative, and these differences probably account for the well known disagreement among doctors and/or between patients and doctors.

In this respect, we believe that physicians must be educated to consider emotions not only merely as psychological factors separated from the decision-making process, i.e. from diagnostic reasoning and treatment prescribing. In fact, this separation is the implicit assumption of clinical medicine, and perpetuates the so called Descartes error [64].

Moreover, we believe that the analysis of the relations among emotions and cognitions can be carried out within the framework of a mixed methodological approach (i.e. qualitative and quantitative), and that GRASP Structural Analysis is an innovative way for grasping these relations, even if we are conscious that this is a simplification of a complex process.

We believe that e-learning is a valuable tool for obtaining an electronic repository of meaning units, and for engaging medical students in a personal and public reflection on the role of emotions in health care. However, we do not believe that un-blended e-learning models do really work. In fact, in our model the online activities were triggered by *vis-à-vis* role-playing which is itself an emotionally charged situation. It is likely that without such an intense
stimulus the online interactions would be more academic, if any. It is also of paramount importance to upload the results of the structural analysis in order to initiate *vis-à-vis* and forum discussions. The final *vis-à-vis* interactive seminar allowed emphasizing also the methodological and statistical issues underlying GRASP Structural Analysis. This led to resolve the (productive) cognitive dissonance generated by an apparently atypical “lesson” that had been initially perceived as at odds with the students' prior expectations about medical statistics and informatics. We are also analysing the online discussion forum in order to understand the way in which the interactions among the students led to the construction of a sort of social appraisal of the illness narrative.

Finally, we believe that medical records should include specific sections for the emotional aspects of decision-making. In this respect, the GRASP fourfold structure could provide a simple and effective solution of this problem. To this end we are building up a dictionary of possible categories of observations and emotions that will be embedded into GRASP in order to facilitate the registration of cognitive-emotional statements to the over-busy actors of the care/cure process.

This objective could be accomplished, for example, by enlarging the scope of the Problem Oriented Medical Record (POMR). This is based upon the organization of a list of items according to the SOAP (Subjective, Objective, Assessment, and Plan) procedure. Usually subsets of the items are joined together, and for each sub-set a diagnostic assessment is formulated. Then, for each assessment a plan is defined along three paths: diagnostic, therapeutic, and follow-up.

Now, one could add to the list of the POMR traditional items (symptoms, signs, lab tests and so on) a GRASP-like interface in order to build-up a list of meaning units defined by the answers to four questions: (1) what did you observe? (2) how do you explain this observation? (3) What did you feel? (4) How do you explain these feelings? Separate fourfold panels could be provided for each meaning unit. A script aimed to code observations and emotions could be embedded into the electronic medical record. Finally, one could enlarge the scope of the plan by including also the interventions aimed to manage the meaning units or set of interrelated meaning units.

This modified POMR could be used either as an educational version of the electronic health record for training medical students to be aware of their emotions or in the real medical practice and as a tool for forcing the physician to record his (her) own emotional-cognitive reactions to the patient’s suffering. The statistical analysis of the meaning units could provide further insight into the medical decision-making process, and contribute to the humanization of the medical practice.

Of course, this is just a suggestion, and other solutions can be explored. However, we believe that the introduction of a specific section dedicated to meanings would generate a data base of complex medical records which could be analysed in order to grasp the relations between cognitive-emotional appraisals and medical decisions. Finally, this modification could contribute to the humanization of the medical practice by forcing physicians to think also in non technical terms. But, this implies that medical students should be educated to appreciate the relevance of the illness narratives in the care/cure process, and to this aim suitable e-learning environments can play a crucial role.

References

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