A Conceptual Analysis of Difficult Situations – developing systems for teenagers with ASD

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Abstract. The project, HANDS (Helping Autism-diagnosed teenagers Navigate and Develop Socially), studies how teenagers with ASD and with IQ within the normal range (IQ > 70) can handle what they see as difficult situations using mobile technology. HANDS is a project sponsored by the European Commission as part of the 7th Framework Programme. It is the basic hypothesis in HANDS that it is possible to improve quality of life for teenagers with ASD by providing a mobile ICT toolset supporting them in many daily situations. In this paper, it is argued that a careful conceptual analysis of the idea of "handling difficult situations" can be very useful as a basis for understanding the potential in a system supporting teenagers with ASD. It is also argued that such a conceptual analysis can be based on a combinations of i) psychological insights regarding teenagers with ASD, ii) so-called "usage narratives" describing difficult situations for teenagers with ASD, and iii) central ideas from temporal logic describing formally what it could mean to handle a difficult situation. Furthermore, it is argued that the conceptual analysis can be combined with ideas from so-called persuasive design (PD) in a very straightforward manner. It is finally shown that this conceptual analysis gives rise to a rather strong argument for certain specific system requirements regarding the future HANDS toolset.

Keywords: conceptual analysis, ASD, branching time, usage narratives, HANDS.

1 Introduction

Autism spectrum disorders (ASD) are lifelong neurodevelopment disorders. There is extensive evidence that autism leads to social marginalization and isolation. Even people in the high-functioning segment of ASD will often have difficulties with daily life management and self-care, and they will have problems being a natural part of everyday communicative transaction [9].

The project, HANDS (Helping Autism-diagnosed teenagers Navigate and Develop Socially), studies how teenagers with ASD and with an IQ within the normal range (IQ > 70) can handle what they see as difficult situations using mobile technology. It

is the basic hypothesis in the project that it is possible to improve the quality of life for teenagers with ASD by providing a mobile ICT toolset supporting them in many daily situations. The assumption is that it is possible to develop a toolset, which can help improving their social skills and self-management skills, thereby ensuring social integration and independence.

HANDS is a project sponsored by the European Commission as part of the 7th Framework Programme, Theme 7.2, Accessible and Inclusive ICT. There are 10 partners in the project (3 universities, 4 schools for teenagers with a diagnosis of autism spectrum disorder, and 3 software companies). The project is highly interdisciplinary (psychology, pedagogic, computers science, information science). For further information on the HANDS project see [4, 9, 10, 19, 25, 26].

The HANDS project strives to develop a set of software components based on Persuasive Technology [5], which will be an efficient tool for the teenager with ASD to improve social skills and self management skills, and to manage social activities. The idea is that the teachers at the schools for teenagers with ASD using the toolset should be able to design and customize individual tools for their students. These individual tools should be implemented on mobile units (e.g. smart phones) which the teenagers can consult whenever they find themselves in a difficult situation. The idea is that the system implemented on the mobile unit should be interactive, and that the application of it should promote user activity in certain situations. The tool will be an example of what Fogg has defined as Persuasive Technology, since the ambition clearly is an ”attempt to change attitudes or behavior or both (without using coercion or deception)” [5]:15

Recently, requirements have been formulated for prototype 1 of the HANDS toolset [4, 9, 25] based on conceptual considerations involving ideas from psychology, pedagogic and persuasive design. The input to the formulation of these requirements has been theoretical considerations in combination with a number of so-called “usage narratives” [4] which describe various examples of difficult situations, i.e. situations which are difficult to handle for the teenagers with ASD. In section 2, we discuss some psychological perspectives of why certain situations are difficult to handle for teenagers with ASD, and what sort of help the teenagers need in order to handle the situation satisfactorily. In section 3 of this paper we focus on the use of narratives as the empirical background for the conceptual work leading to formulation of the requirements. In section 4, we suggest a formal and conceptual framework for handling the difficult situations based on Ockhamistic temporal logic. Section 5 is a discussion of how techniques from Persuasive Design can be utilized in the HANDS project and what the HANDS toolset should include in order to be effective. Section 6 is a discussion of how a practical development of the Hands toolset fulfilling the requirements can be carried out.

2 Why are certain situations difficult to handle for teenagers with ASD? What sort help do they need?

Autism, and more broadly, autism spectrum disorders, are highly complex neurocognitive developmental disorders, underlain by atypical development of the brain at least from early infancy – in most cases from intra-uterine life. Atypical brain development co-emerges with atypical psychological development, and these manifest themselves in characteristic patterns of behavior, which form the basis of diagnosis in current standards of psychiatric-psychological practice.

The behavioral manifestations of autism show striking variety in their surface form, in their severity, in their developmental patterns, in the specific situations they appear. Nevertheless, all individuals with ASD show symptoms, qualitative impairments, in three areas of complex human behavior: social reciprocity, communicative reciprocity, and flexible organization of behavior and interest [21].

As no known neurological, neuro-surgical or neuro-chemical treatments are efficient in autism, evidence-based, up-to-date treatment is based on complex psychological-pedagogical interventions [13]. As autism, with marginal exceptions, is a life-long condition, the aim of these psychological-pedagogical intervention regimes is not curing autism, but to increase the level of social adaptedness, communicative skills, daily living skills, self-help skills, the person's overall autonomy and competence, and reduce maladaptive behaviors. HANDS project is based on the principles of these pedagogical-psychological intervention regimes, and the HANDS toolset can be seen as a set of new means to be applied in the context of these regimes.

A key focus of the HANDS project is to help teenagers with ASD manage 'difficult situations', situations which are hard to handle for them. As autism shows impressive heterogeneity, it, of course, varies to a large extent from individual to individual which specific situations fall into this category. And, moreover, there is within-individual variability, too, concerning the situations which cause difficulties. A given kind of situation (e.g.: to spend the break between classes in school with adequate activities) may not cause difficulties in some circumstances (if, for example, the teacher or a peer mentor pays attention to offer him/her some activity), while the same kind of situation can lead to serious difficulties, and, consequently, to enormous stress and challenging behaviors under other circumstances (if, for example, there is no activity offered and a lot of children form a 'chaotic' social environment).

Nevertheless, on the one hand, we can make generalizations, as there are *kinds* of situations which recurrently lead to difficulties. On the other hand, the set of situations relevant for us here is delimited by the fact that HANDS project is aimed at helping *high functioning teenagers* with ASD.

In our current understanding of autism, it is determined by its key psychological/cognitive features, what kind of everyday situations individuals with this disorder will find difficult to manage. People with ASD are characterized by a set of psychological/cognitive anomalies, from among which we refer only to those which seem especially relevant for us here.

It is well-documented that individuals with autism have an impaired ability to understand others' mental states (intentions, thoughts, complex emotions, etc.). This

ability, called *naïve Theory of Mind* ability, works in an automatic, intuitive fashion in neurotypical persons, while in autism it may be missing or working in a significantly less efficient and automatic way [8]. *This leads to difficulties in situations where understanding others' actual thoughts and intentions is indispensable to manage the situation.*

Another cognitive ability deeply impaired in autism is the set of *executive functions*. This heterogeneous set of more specific cognitive abilities is crucial in planning one's own actions, maintaining these plans and adapting them flexibly to changes in the circumstances while executing them. In autism, evidence show difficulties in action generation, in planning, in flexibility, in generalization, and occasionally in inhibition of irrelevant responses – just to mention a few key aspects of executive functioning. This set of impairments often *leads to difficulties when novel, non-routine, and complex situations are to be handled, or mobilization of routines is not sufficient in itself* [12].

Problems with actively finding and processing relevant input information in various situations, unfortunately, contribute significantly to the above-outlined difficulties. Autism (ASD) is widely characterized by *weak central coherence,* or detail-focused information processing style. This means that their tendency to integrate automatically the parts of incoming information into meaningful patterns in a context sensitive way is weaker than in the general population. Moreover, *attentional processes* show subtle but important deviations from those in neurotypical individuals, and these also lead to atypical patterns and ways of picking up information from various situations [11, 15].

And, finally, one must keep in mind that autism is a developmental disorder – so not only these fundamental abilities are impaired, but several other more specific skills that should have been built onto these, or should have been acquired by the aid of these. So arise *impaired insights about social norms, expectations, and routines; a limited conceptual and procedural knowledge about social relationships, institutions, and other concepts; as well as the impairment of behavioral routines and emotional responses associated with them.*

These rather deductive-theoretical inferences are in line with the more descriptive clinical and pedagogical literature which is abundant in examples of such difficult situations [17].

In sum, the following key (cognitive) sources of the rise of 'difficult situations' can be identified:

On the input side:

- difficulties in grasping the relevant features of situations (especially, but not only, social features),
- difficulties in tracking flexibly the changes in the situations.

Representational-conceptual aspects:

- difficulties in representing intentions of other actors in the situation,
- difficulties in representing what is socially acceptable, as a goal and/or as an action,
- not having acquired a normal set of social routines,

- difficulties in generalizing from one situation to another.

On the side of active agency:

- difficulties in generating goals and plans,
- difficulties in maintaining goals and plans,
- difficulties in generating actions,
- difficulties in executing plans, especially flexibly.

This list also implies that a lot of fundamental cognitive-psychological mechanisms and abilities are not necessarily impaired in autism – such as conceptual thinking *in general*, understanding causality *in general*, (formal aspects of) language, and so on.

Now, how and why it is relevant in the characterisation of difficult situations that high functioning teenagers with autism are in the focus of the HANDS project? At least the following points are relevant:
– difficult situations are most often not as elementary for them as for young children with autism (there are no deep problems with elementary self-help skills, for example);
– they have good language skills (apart from social aspects and pragmatics);
– they have considerable general world-knowledge;
– they are most often aware, to some extent, of their own difficulties;
– many of them are motivated to be socially effective and adapted – even if they miss the cognitive tools for that;
– they are all motivated to be effectively acting agents.

(Also, it may be worth emphasizing that adolescence is a psychologically difficult and 'stormy' transitive period of life for most typically developing people, too. Most of these 'normal' difficulties also arise for teenagers with autism, too.)

It is important to emphasise that high functioning teenagers with ASD have a strong motivation to avoid the rise of 'difficult situations' and, if these arose, to handle them. This is so partly, because (1) they are motivated, as neurotypical people are, to experience themselves as effective agents, (2) partly, because they are motivated to overcome their own difficulties, (3) partly, because they are, to some extent, sensitive to the social feedback on their inadequate behaviours, and finally, (4) since the frustration from the inability to solve certain situations is a negative emotion they are motivated to avoid.

All this implies, and this is a crucial basis for the HANDS project, too, that teenagers with autism have a strong motivation to be in control of their own actions and their own environment. This is a natural human motivation (see, e.g., [23]), characterizing all human beings from early infancy (see, e.g., [22]), often called *competence motivation.* This is clearly present in autism, too – although, due to the cognitive characteristics of this syndrome, children and adults with autism often attempt to use non-conventional acts and means to control their environment and actions. What complicates the issue, and makes the need for helping them in managing difficult situations even more important, however, are two further factors. First, due to their cognitive limitations, they fail to achieve competence, the feeling of control, in significantly more situations than typically developing people do. Second,

these failures invoke significantly more stress and anxiety from high functioning individuals (teenagers) than from typically developing people: partly, because they have much more of these failures, and partly, because they have less insight on the specific causes of these failures.

In sum, the emergence of situations difficult to manage is multiply determined in teenagers with autism; although they are motivated to be effective agents efficiently controlling their own actions and their environment, their complex and specific cognitive limitations prevent them to do so to a normal extent. This leads to considerable stress and anxiety, often to conflicts with social norms and expectations and to challenging behaviors, and, not rarely, to victimization.

3 Difficult situations for teenagers with ASD presented by a set of narratives

In all phases of the project leading up to the semi-formal sets of requirements, scenarios and stories about how the software might be used, and what kinds of situations it is meant to alleviate, has played a very important role. The use of such scenarios has been an intricate part of software development for decades, and is consistent with the choice of development strategies in the HANDS project, namely Use Cases [3] and Scrum [18]. In this particular case, the use stories have proven important for at least two reasons. In the first place, the highly interdisciplinary nature of the project calls for a very high degree of sensitivity between experts from various fields. Bringing academic traditions together obviously takes place through scientific formats (books, research papers, and presentations) but small recurring narratives have been instrumental in structuring discussions and triangulating meaning between the different fields of expertise. In the second place, although the core ideas of the project are very easy to communicate, it may still be difficult to foresee the actual needs of teachers and students, and to envision how everyday tasks may be improved and altered through the use of software. In order to provide a useful empirical input to the formulation of the requirements a number of brief “narratives” have been formulated. These narratives typically represent teacher experiences regarding situations which are difficult to handle for the teenager with ASD studied in HANDS. In the following, a few examples will be quoted:

> [ex 1]: AA is allergic to particular kinds of food. He is already very careful about what he can and cannot eat, but so far his mum has decided what to buy and what to cook. AA would like to be able to go and buy his own food. However, he is anxious about what he can, cannot or should buy. He gets confused by the variety of products on the shelves in the supermarket, and he is afraid of making a mistake. AA is very good with portable game consoles such as Nintendo DS and Playstation. He is good with computers, Internet surfing, mobile phones and other electronic items like video players. He finds it hard to cope with too much information and prefers structured step-by-step options. [4] p9

> [ex 2]: Morning time is very hectic in AA's home. His mum has to get three children ready for school and it would be good if AA takes responsibility for preparing his school bag. Besides managing time effectively, AA also should remember what he should pack for the school day. Doing so will make both AA and his mum less anxious and angry in the morning. [4] p11
> [ex 3]: MW is very shy and can get very anxious when in crowded places or when having to interact with other people. He finds it difficult to read other people's faces, and he finds it hard to show his emotions. He does not know how to tell others what his feelings or moods are, and he has learned to smile even when he is very anxious or upset. [4] p17

These small stories are used to identify the core elements in the difficult situations the teenagers face, and they do in fact contain a wealth of information for both software and interaction designers. In particular, the stories point to the complicated environments the intended cognitive support systems have to function in. The stories provide insights regarding the agents involved in difficult situations, as well as the nature of actual situations. They also illustrate the core problems enumerated in section two. From this perspective it is quite clear that examples 1 and 2 highlights the lack of organization and planning often experienced by people with ASD. Examples 2 and 3 illustrate the need to work with communicative reciprocity, and example 3 also shows very clearly the experienced problem with social reciprocity.

Each in their own way, the three examples point to pertinent consequences of having impaired executive functions. In the first example we see the need of reducing and selecting information in potentially stressful situations. In order for the system to achieve this goal, teacher and student must work together and find anchor-points in the layout of the grocery stores in questions, handle the small print on foods in the stores and so on. The problem outlined in Example 2 is actually tied in with example 1. Besides dealing with ordinary routines such as matching a timetable with lists of books needed for the day, AA has to be mindful of the menu for the school lunch. If the school lunch on a given day contains items to which he is allergic, he must prepare a lunch bag as well. This property of the scenario turns out to be rather typical. In many cases, the user narratives indicate the need for adding extra information to the ICT solutions proposed in the HANDS toolset. A possible solution to the problem at hand would be to incorporate the school menus into the toolset for this student. Use stories regarding public transportation points to similar needs e.g. timetables for busses and other relevant contextual information.

Example 1 also provides very important information about the level of skills the designers can anticipate in this case. This kind of information is vital for understanding the Information Ecology: the often very complicated contexts that information systems have to work in [14]. In one school, several of the students are not actually using mobile phones, but there is an existing practice for using MP3 players and digital cameras.

When teachers and other caretakers work with designing cognitive support systems for people with ASD, the solutions must necessarily be very individualized. This means that scripts for structuring recurring tasks such as morning routines, or 'social stories' used to describe social interactions must be highly customizable in order to

work. The stories mentioned here, nicely illustrate this point. At the same time, most teachers do in fact report that they often deal with the same kinds of situations, e.g., dealing with breaks between classes, using public transportation, preparing for trips etc., which obviously is consistent with the insight that the three problematic areas mentioned in section 2 stand out. This leads us to believe that the situations described through user stories do in fact have a logical core that can be represented formally. But we are also led to believe that the narrative form actually is a very important instrument in extracting this information from experience. What remains from this extraction process is the task of ensuring that other needs that have not necessarily been told in the same fashion are also covered by the requirements that inductively emerge from the narratives.

4 Handling the Difficult Situations: A tempo-modal model

It is evident from the sections above that it is very important for teenagers with ASD to be able to handle difficult situations. It is of great significance to them to have the feeling of staying in control even in difficult situations. The purpose of HANDS is to assist them in this respect.

In order to handle a difficult situation the person in question must first of all understand that a difficult situation is coming. Next he or she will have to generate an appropriate goal, i.e. an outcome of the situation which is acceptable as a solution to the problem. Finally, the person must be able of stepwise carrying out the plan leading to the goal. As it follows from the sections above, all this will in many cases be very difficult for the teenagers with ASD. However, the HANDS toolset should provide help in all these respects.

First of all the HANDS toolset should be designed to predict that a difficult situation may be coming up. This means that it should at 'the right time' make the user aware of the problem. In fact, we may here refer to Kairos concept [27] which is a nice classical way of expressing what is needed when warning the user.

The idea of Kairos has a very long history. It can be traced back to pre-Socratic, Greek thought. The idea was incorporated in New Testament texts, and it later became an important element of Christian theology. Kairos also became essential within the theories of rhetoric [20]. The concept is difficult to translate since it combines notions of 'the right time' and 'the appropriate measure' with considerations regarding ethics (doing the right thing) and Pythagorean notions of justice and harmony. In a Greek fable from the 6th century B.C., Kairos was portrayed as a god — in fact, a young athlete running towards us. He is bald, but he has a lock of hair on his forehead, which we may grasp in order to stop him if we are prepared to do so. If not, it becomes too late. There is no way to grasp his bald head when he has passed us. According to the fable not even Zeus can pull him back [2].

The point when dealing with the classical notion of Kairos seems to be that it is closely linked to the idea of being prepared. We have to grasp the moment before it is too late. On the other hand, there is no point in reacting before Kairos is present. This

means being aware of what might be about to come. The practical and technological problem is, of course, how we should identify Kairos? When is ‘the right time’ for intervention and persuasion? And how should the information about its coming be communicated?

In [27] it is argued that taking this classical notion of Kairos into account and transforming it into a modern context, the practical identification ‘the right time’ will depend on the calculated probabilities of various possible future developments. This calculation will have to be situation-sensitive. In fact, the identification of Kairos may in the context of HANDS be based on information included in an online diary prepared for the individual teenager with ASD (see [4, 10, 25]).

When the system has identified a Kairos at which the user should be warned and encouraged to take action, it should also suggest the best possible outcome in the situation and generate a stepwise plan which if followed will lead the teenager with ASD out of the difficult situation and to the goal. This means that the user will be asked to accept a certain goal, and having accepted this, a certain realistic action representing a first step towards the goal will be suggested to the teenager. When this step has been carried out further steps will be suggested. When a suggestion has been made to the teenager, he or she can in principle accept or decline to follow the suggestion. From an ethical point of view, it is essential that the wish of the teenager to stay in control is respected. If the teenager at some stage chooses not to follow the suggestion given by the system, an alternative plan should be generated based on this choice. This alternative plan should lead to the best possible outcome given the choice of the teenager.

The idea of handling difficult situations may be conceptually presented using a model of branching time. In fact, since we want the model to include the notion of plans (including alternative plans) it will be obvious to make use of so-called Ockhamistic branching time models, which were first presented by A.N. Prior based on inspiration from the medieval logician William of Ockham (c. 1285-1349) [16]. In an Ockhamistic branching time there will at any point (moment) be a selected or preferred future branch among the various possible future branches. In a non-Ockhamistic branching time model this will not be the case.

A model based on Ockhamistic temporal logic which may be interpreted as including a dynamic plan, i.e., a plan including alternative plans corresponding to any possible choice made by the person(s) in question. This means that the model should include a suggested choice (i.e., an advice) whenever there are alternative futures. This plan is supposed to lead the user to the best possible outcome given the choices of the user.

It is possible to formulate a detailed temporal logic corresponding to Prior’s understanding of the Ockhamistic idea. See [24]. Diagrammatically, we may present the idea of an Ockhamistic branching time model as shown below:

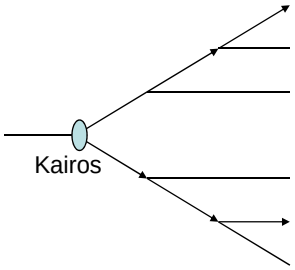

Fig. 1: An Ockhamistic branching time model

The idea presented in the above diagram is the identification of a difficult situation at "the right time" (Kairos) and should give rise to a plan leading to the best possible outcome. The main plan and the alternative plans are all indicated in the model by the use of arrows.

If the teenager with ASD chooses not to follow the advices given by the system, an alternative plan should be generated leading to the best possible outcome given the choice of the teenager.

It is a crucial property of the branching time model that every point (moment) of the model can be conceived as a very expressive proposition including all information about all other parts of the system as seen from this particular point (moment). The moment may be understood as a conjunction of everything which is true at this particular moment, including statements about the possible future, the past and the past possible futures. In this way every part of the branching time system may be said to include information about the complete system. Conceived in this manner, it is obvious that the representation of the handling of a difficult situation in terms of branching time model is very rich, conceptually speaking. It seems obvious that the dynamic planning needed to handle such situations may be represented in terms of Ockhamistic branching time models.

In addition, this kind of diagrams may also be useful as a background for discussing and designing the various features of the HANDS toolset.

5 How can PD technology support teenagers in handling difficult situations

Designing for such varied outcomes, in such difficult circumstances, and for such a specific target group obviously poses a challenge. Since the purpose of the project is to investigate how attitude and behavior may be changed through the use of technology, it seems natural to draw on the tradition of Persuasive Technology and Persuasive Design in the process.

In the groundbreaking work of B.J. Fogg [5, 6], interactive computing technology can take on three basic forms of persuasive roles. ICT may embody *Tools* of persuasion, such as guiding the user through preferred paths of an information space; ICT may function as a *Social Actor*, in the sense that it invokes social response; and finally, ICT may be used to persuade people through *Simulations*. Each of these three

roles, known as the functional triad, is then described through a series of principles, investigating the persuasive potential of the roles. In the HANDS toolset, we propose to utilize all three roles for a variety of purposes.

The functionality of the HANDS toolset consist of six parts:

1. The Handy Interactive Persuasive Diary (HIPD).
   An interactive calendar function with usual calendar facilities, but also with configurable/programmable abilities and "knowledge" about situations, where the user is more likely to be persuaded to adopt a new behavior or attitude. It is also capable of raising the awareness of problematic behavior. It is supposed to be interactive and able to initiate a user session autonomously.
2. The Simple-Safe-Success Instructor (SSSI).
   An instructor function that can be designed to give precise and practical advice on how to solve a given problem. This function is also highly configurable, and may incorporate various media formats. The SSSI is flexible, and its level of support to the user can be reduced once the user becomes better capable of managing the problem.
3. The Personal Trainer (PT)
   A training function which is basically a simulator of problematic situations with concrete and practical advice, given with the necessary credibility. It may function is the same way as the SSSI, but for rehearsal purposes.
4. The Individualizer (TIn)
   This facility makes it possible for the teacher and the teenager with ASD to customize the functionality of the toolset directly from the phone. In terms of aesthetics, this includes the choice of audio- and visual skins.
5. The SharingPoint (SPo)
   This facility makes it possible for the teenagers with ASD to share their knowledge, experience and interests with other users thus facilitating a protected creative environment for young people with ASD.
6. The Credibility-o-Meter (CoMe)
   This facility is an attempt to measure to what extent the HANDS toolset is experienced as being credible by the user. The measurement is mainly based on the electronic footprints left by the user on the mobile device during normal use.

The HIPD is clearly the most important component of the HANDS toolset. The other components can all be integrated in the HIPD, which provide a temporal framework for the practical use of the toolset. In fact, the interactivity of the HIPD is very much based on the fact that the other facilities are available in the same system. In this way the use of the system may promote certain kinds of user activities.
When the HIPD has been developed, it is expected that – when properly adjusted to the special needs of the teenager with ASD – it can support him socially. The idea is that the HIPD tool should warn him when a difficult situation is likely to come up, and that it should also offer to guide him through the difficulties.

In order to enhance motivation the HIPD requirements should include ways of letting the user be in control.

6 Towards an implementation of the Hands toolset

In the HANDS project the tools will be implemented at two different levels through two stages. We will first implement a toolbox to be used by the teachers at the partner schools. As such, the system should offer all the facilities that the teacher may want to employ in implementing the system with the participants. Given this toolbox the teacher should, in close cooperation with the HANDS researchers, implement a specific tool oriented towards each individual teenager. In this process it will also be essential to involve each teenager in order to optimize the knowledge-development, customization and adaptability of the tool.

The system development within HANDS will be carried out according to the principles of the so-called Value Sensitive Design (VSD). According to [7] VSD can be presented as "a theoretically grounded approach to the design of technology that accounts for human values in a principled and comprehensive manner throughout the design process.'' This idea will be integrated in the design process in HANDS, which will follow the so called SCRUM principles [18]. This means that the development of the toolset will be an iterative incremental process. It also means that there are some specific roles in the process:
1) The Product Owner (in this case representing the three universities and the four schools in HANDS);
2) The SCRUM team (in this case representing the three software companies in HANDS).

During the production period the Team will produce every 2-3 weeks a new partial release of the toolset. Each release will be discussed and evaluated by the Product Owner. This evaluation will clearly also have to involve considerations based on ICT ethics and system developers [1]. The general assumption within the HANDS consortium is that if the HIPD (and the HANDS toolset as a whole) is being developed in this way, it will be more likely that it can function effectively as a tool to help the teenagers with a diagnosis of autism navigate through the demands made upon them, and develop socially. One of the reasons making this likely is that this procedure will make it realistic to involve the users closely during the system development process.

CONCLUSION

We have argued that the toolset described in the requirements recently prepared may be seen as the obvious choice given a conceptual analysis of what it would mean for a teenager with ASD to handle difficult situations. The conceptual analysis is based on information embedded in "usage narratives" and on a notion of Ockhamistic branching time.

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