An Enneagram based Model for Personality Based Adaptive Systems

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Abstract

A model to seamlessly adapt to personalities of agents (human or artificial) in a multimodal environment is presented. The model is based on a generic personality typing technique called the Enneagram, to discover the traits stemming from egoistic stimulus. Specific traits are quietly discovered based on a *hidden* dialogue management system that employ a mixed initiative frame representations to guide the system towards inferring the personality type by identifying specific patterns of behavior.

***Keywords: ECA**, Personality Typing, Adaptive Multimodal User Interfaces, Dialog Management.*

1 Introduction

The spread of fast and intelligent machines in every aspect of our lives is slowly but surely making their acquirement and recognition of social and emotional phenomena imperative in order to interact with humans. Nevertheless, environments in which this interaction takes place are rather complex. The human and machine interpretation of intentions is important however can be rather difficult because of the incompatibility of the input and output means that humans and machines use. Furthermore, communication can be in different ways and forms, including non verbal movements and facial expressions, etc. It is specially proven to be a real challenge for machines to interpret the intentions of the humans unless *explicitly* exhibited. Some of the questions pertaining to this line of research are, from the broad to the specific: how can machines detect if they are being manipulated? Can machines have personalities? Why should machines have Ethics? How can machines show feelings of empathy and understanding towards humans when appropriate? Finally, can machines recognize and adapt to the personalities of humans and other machines during the interaction in a complex environment with different types of input and output modalities?

In this work we present an attempt to tackle some of the problems in the domain of social machines, starting with machine-*adaptation* to user needs using *personality* traits, in multimodal user interactions. We present a novel, and initially broad, architecture which enables automatic recognition of traits body language and speech, with a minimum effort from the user to achieve this adaptability. Using this model, ECA can also acquire their own personalities and learn the personalities of other agents (human or artificial) and act accordingly. We believe that this will be of interest for researchers for years to come, especially in the domains of Human Computer Interaction (HCI) and social applications of intelligent agents and robotics.

Section 2 contains a brief historical background followed by detailed description of the personality typing method we employ, the Enneagram, and a description of the types and the relationships between them. Section 3 presents the multimodal architecture with integrated adaptation components. The architecture uses an example of a Telematics (inCar Multimodal Systems) to emphasize adaptability. The paper is closed with an evaluation and conclusion section.

2 Background

The Enneagram is a psycho-spiritual model for personality recognition. Based on the Sufi Philosophy the theory was brought to the West by an American mystic called George Gurdjieff (Gurdjieff 1963) in the beginning of the 20th century. The theory has gone through some changes in the writings of Claudio Naranjo e.g., (C. Naranjo 2000 and 2002), and Hellen Palmer (Palmer 1991) and others. It has been extensively used by psychologist and psychotherapist to teach self-balancing. The Enneagram's integration into modern sciences however has been limited to few business and management applications (Enneagram Inst. 2003). Its applications in engineering and computer science however are still unseen. The Enneagram takes human egoistic fears and desires as the source of the formation of the *personality* and *behavior*. In order to 'survive' these fears and experience the desires, humans build fixations in form of habits, which helps them achieve satisfaction. It is this satisfaction which shapes the very nature of emotions leading to personalities and behaviors being different from one person to another[1].

2.1 Specific traits

There are nine personality types in the Enneagram. Every type exhibits a particular set of emotion repeatedly, and few other emotions rarely. The personality types are thus known as the *Performer*, the *Helper*, the *Motivator*, the *Romantic*, the *Thinker,* the *Skeptic*, the *Enthusiast*, the *Leader* and the *Peace-Maker*. We will not go into the psycho-spiritual details as to how these personalities came to be, however we will discuss how these personalities shape the activities of their holders. Most importantly, we will demonstrate how we can capture the behavioral patterns exhibited by humans that relates to every personality type and how that can be modeled in order to for agents to

[1] There are different personality typing methodologies such as (Briggs Meyers 1997). We chose the Enneagram for it is the basic starting point for many other methods. Its generality also matches the broad architecture we present. In future works we will tackle the application of other methods in more specific areas.

acquire personalities. The nine personality types are based on three main concepts or trait classes. They can either be *fear driven*, or *pleasure seeking* and they can be *instinct* based (see Figure 1, -b-) with different degrees each. Furthermore, all the types have a strong viewpoint about the world leading them to also exhibit these traits with varying intensities. Using the terminology of (John Oldham 1995), characteristics of the nine personality types usually exhibited in the environment can be summarized broadly as following[2]:

#1. The Performer. The *World View* of the performer is that the world is an ill perfect environment, and his/her job is to make it perfect. The *Basic Desire* is to be right and the *Basic Fear* of #1 is the fear of being condemned. This type's *basic behavior* is perfectionism, orderly, hard working, ethical and conscientious. Can be rational and idealistic, and can also be judgmental, some times convinced they are always right. Their *basic motivation is* to be right ethical and perfect.

#2. The Helper. His/her conviction that the world depends on them in order to function (*World View*). They think: I am needed. Their *Basic Desire* is to be loved, and *Basic Fear* is to be unloved. Helpers *basic character* are generosity, friendliness, pridefulness, seductive and reassuring. They can be very loving and dedicated, but also possessive and manipulative.

#3. The Motivato. *World View*: The motivator believes that the world gives great consideration and respect for a champion and that is why, motivators try to avoid failure at all costs. Their *Basic Desire* is to be admired and *Basic Fear*: is the fear of being rejected. The *Basic Character* of this type is ambitious, goal-oriented, adaptable, deceiving, and presentable. They can be exemplars of "all you can be", but also shallow and arrogant. Their *motivation* is to be admired by others, to be successful, and by winning all the time.

#4. The Romantic. *World View*: Something's missing in themselves and others have it. *Basic Desire*: to understand self and *Basic Fear*: is the fear of being defective. The romantics are creative, depressive, romantic and shy. They can be profound artists who express the inexpressible, but also self-hating and clinging. To understand the self, be unique, express themselves are their primary motivations.

#5. The Thinker. *World View*: The world is invasive and confusing. I need privacy to think. *Basic Desire*: to understand the world *Basic Fear*: is to be overwhelmed by the world. This type is insightful, theoretical, detached, eccentric, and intense. They can be extremely brilliant and inventive, but also can be alienated. Their primary motivation is to understand the world, find safety from it, become skilled.

#6 The Skeptic. *World View*: The world is a threatening place and need to look to authority, but even that authority should be questioned. Their *Basic Desire* is to be secure and *Basic Fear*: is the fear of being abandoned. The *Basic Character* of 6s: they are loyal, skeptical, complex, paranoid, dependable. They can be excellent team players but get lost in scapegoating and fear. They primary *motivation* of this type is to find security, resolve their paranoia.

#7 The Enthusiast. *World View*: The world is full of opportunity and options. I look forward to the future. Their *Basic Desire* is to be happy and *Basic Fear* is fear from of being deprived. The *Basic Behavior* of the enthusiastic is that they are worldly, optimistic, scattered, accomplished. They can truly love life like no one else, but can fall victim to hedonism and excess. The *motivation* of this type is to experience life, be happy, not miss out.

 # The Leader 8. *World View*: 8s believe that the world is an unjust place. I am strong and I 'defend the innocent'. Their *Basic Desire* is to be self-reliant. 8's *Basic Fear* is the fear from submitting to others. Their *basic character* is that they are powerful, leading, aggressive, cruel, and protective. They can be 'magnanimous leaders' who get the job done, but can become violent and terrorizing. *Basic Motivation*: to be in control, strong, independent.

#9. The Peacemaker. World View: My efforts won't matter to the world. It's best to keep the peace. Basic Desire: to find union and peace Basic Fear: fear of separation. Their *basic behavior:* Peacefulness, receptiveness. They are also complacent, forgetting, and gentle. They can be relaxed and good friends, but can become unaware of reality and problems. *Basic Motivation*: To be at peace, be in harmony with the universe.

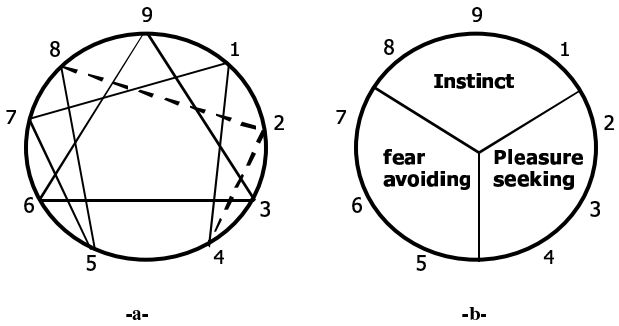

Figure 1. The nine personality types of the Enneagram.

Every one of the above types can be in state of balance and imbalance (healthy/unhealthy). The states are behavioral loops or habits, which every person with a particular type might follow. Both these states are interchangeable and the person can move between the two states more than ones in a lifetime. For example, in the healthy loop of the personality type #6 is: *Need to understand the world* > *observe* > *analyze* > *understand the world* > *Need to understand the world.* As for the unhealthy loop: *Need to understand the world* > *observe* > *analyze* > *understand the world* > *Need to understand the world*. See (John Oldham 1995) for a comprehensive review about the 9 types state of balance and imbalance. When taken in consideration the Enneatypes (usually referring to the types of the Enneagram) behavioral loop can help in making the system adapt to the user needs in both cases. In different applications, such as automated therapy, this can also be used to direct the user to migrate towards the healthy state.

[2] Note we will not discuss how these traits are specifically represented or captured in this work.

2.2 Broad traits

The Enneagram also represents few other relationships between the nine types. Using the terminology of (Palmer 1991 and Renne Baron 1994) the following is a summary of some traits and characteristics which can be exhibited by different types. Any given type can *integrate* or *disintegrate* [Hellen Palmer]. When the helper (#2) integrates, they tend to exhibit some of the characteristics of #8 positively and #4 negatively. For example, because 2s are usually seekers of admiration, they tend to refrain from disagreements, and during integration phases, 2s they learn to do so. The lines linking the numbers in Figure 1, -a- exhibits this phenomena for every personality type. The Enneagram also divides the nine types in into three main groups. Those are #8, #9, #1 who usually relate to their instincts differently. These three type tend to either over rely on their instinct (#8), be out of touch with their instinct (#9) and under-express their instinct (#1) (John Oldham 1995). The group of numbers #2, #3 and #4 on the other hand are pleasure seeking. These tend to have issues related to their feelings and image. The #2 is overly emotional. #3 suppresses their feelings in order to get things done, and #4 communicates in a subtle way and thus suppresses their feelings. Finally the group #5, #6 and #7 are the group which is based on fear. #5 over express their thoughts because they live in their minds out of fear of the outside world. #6 can't trust themselves or any body and thus are out of touch with their thoughts and finally the 7s are afraid of introspection, turn to the outside world for action and experience. 7s under express their thoughts.

3 The Model

Now that we have defined the main identification characteristics of each personality type, we define here through the model for representing these characteristics in a multimodal environment. The architecture employs a Frame Based Dialogue Management Technology (FBDM) (Bernsen 1999) with two main objectives in mind. The first objective is that of achieving the applications' main purpose. For instance, in an inCar Navigation Systems (iCNS) we can imagine a simple goal of directing the driver into a particular destination or keeping the driver from falling asleep while driving. The second objective of the dialogue manager is to identify the personality of the driver. This is a hidden long term goal designed to make the user experience a smooth interaction by inferring the driver's personality type seamlessly. That is without necessarily directly conducting a survey or ask the user a long list of questions. We intend to do this by embedding personality recognition inference tools within the Multimodal (MM) dialogue manager as show in Figure 2. Naturally, the MM architecture is designed such that several Input Modalities (IM) and Output Modalities (OM) such as face recognition module, Automatic Speech Recognition (ASR), etc., are present. The OM can be Text, Text to Speech Synthesis (TTS), Graphics or Braille, etc. For each of the IM and OM there is a Multimodal Input Fusion (MMIF) and Multimodal Output Generation module (MMOG). The role of the MMIF is to combine the output from the input modalities (e.g., if the user touches the screen and says "*please take me here*") while the role of MMOG is to choose a suitable way to convey the "intention" of the dialogue manager to the user using the OM. The technology involved MMIF and MMOG however is not the main concern of this work.

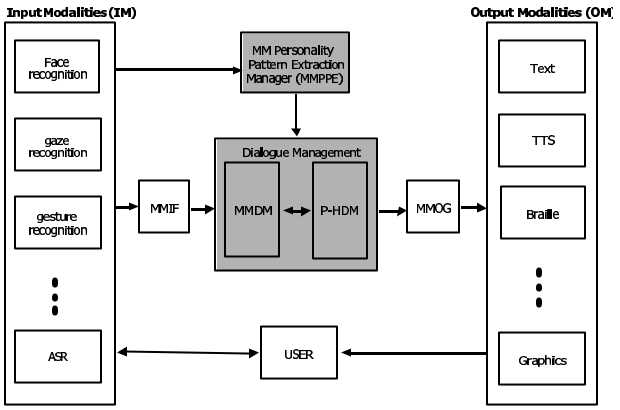

Figure 2. Multimodal Enneagram based Personality Adaptation Architecture.

The bulk of the architecture is in the two remaining modules. The Multimodal Personality Pattern Extraction Module (MMPPEM) is responsible for extracting the personality traits which the user conveys through the IMs. Input of this module can be text or image, or an output generated from a specific sensor, depending on the interpretation of the MMIF, and the output is a personality patterns or traits. Every pattern belongs to one of the three main characteristics or traits classes of the nine personality types, described in section 2.1 above, classified as world view, basic desire, basic fear and basic motivation. For instance, if the IMs generated an *image* and a text *sentence,* a *motivation pattern* of the world view can be generated by the MMPPEM if and only if the image exhibited *surprise* (De Carolis 2002) and text sentence exhibited *encouragement,* with a particular degree of certainty. Next is the Dialogue Management Module. This is a complex module comprising a Multimodal Dialogue Manger Module (MMDM) and a Personality Hidden Dialogue Manager (P-HDM) module. The former is a frame-based dialogue management whose main role is to carry out the dialogue of a particular application. It receives the user and environment input combined by the MMIF and responds according to a well defined mixed initiative dialogue. See (State of Art in DMS 1999) and (Bernsen 1999) for more details about frame-based dialogue management systems. The P-HDM is a central module in this architecture. It's role is to mach the patterns generated by the MMPPEM with the personalities types leading to finally link the user with only one personality type in the most seamless way possible. This role can be accomplished through a silent dialogue where the traits of every personality are hierarchically represented in the form of frames. The goal of P-HDM is to *collect* the values of the slots within every frame. If all the slots are collected then the person's personality type is known. Because the frame based dialogue management allows mixed initiative capabilities, this gives the possibility for the system to silently infer the personality of the user based on the interaction initiated by the user during the normal dialogue activities and, rarely, by the P-HDM

asking direct questions. The hidden dialogue is considered to be finished, i.e., the personality of the user is known, when a minimum threshold of the traits in identified. In other words, only asks the user a direct question if crucial steps are required to reach a decision, and this is done in coordination with the MMDM. Otherwise the rest of the hidden slot values are collected indirectly during the normal dialogue and sensors, ensuring by that greater user experience. There is trade-off between time and seamlessly-ness. If we accelerate the time required to identify the user's personality type, further direct questions ought to be asked. Otherwise the systems follows the normal procedure in identifying the personality type. Applications of agents with personalities and the interaction with humans based on their personalities are enormous. They range from entertainment and media to health and military domains. After the personality of the user has been identified, the system would respond to the user's needs in a way that most suites his or her style. Sticking with the iCNS, the systems could effectively plan a long trip in a way that 'it' knows will be suitable for the user and at the same time meeting the trip goal. The system can suggest motivating events during the trip and arranging the interaction in way that leads to effectiveness and satisfaction. It can entertain the driver in ways that best suites his or her emotional status and need. For instance, after using the same car for a certain period of time, the system would know what kind of music to download and when to play this music to motivate or bring happiness to the driver in a long trip or when to answer the phone.

4 Evaluation and Conclusions

The representation and identification of personality traits are beneficial in multimodal user interfaces. An initial model for using specific and generic traits to adapt a machine to user's personality was discussed. The traits used are extracted using the Enneagram which gives a very clear picture of the motivations behind every human emotion, allowing by that the possibility for scientists to take full advantage in applications of human personality both at the recognition and simulation levels. The advantages of the Enneagram are its scalability and durability. Even though a person may exhibit several types with different degrees, in fact they always have one single main type. For every personality type, there is a healthy and unhealthy cycles. In other words, any given person with one of the nine types will always exhibit certain characteristics even during the healthy or unhealthy phases. These traits can be captured using new technologies, using sensors, image and speech analysis. The application of personality typing using the Enneagram also has an impact on the research in other domains such as ECA where it will be possible to build believable characters by synthesizing their personalities (Briggs Meyers 1997, J. Wiggins 1996 and among others). We believe applications of this line of research are varied and particularly interesting in multimodal environments. In Computer Aided Instruction (CAI) where the personality of the student and the teacher (the ECA in this case) plays a big role in the way the material is presented and for achieving the final goal of the lesson. Another interesting applications is in form of mobile agents acting to assist humans. An agent can clone itself in different machines such as cellular phone, PC, iCNS, wearable computers, homes, and dynamically learn personality type of the user in nontrivial complex environments. The immediate work we intend to follow is to define a precise representation for the traits and the dynamics of expressing emotions thought action and inaction, posture, voice and facial recognition. The Enneagram is the most generic of all personality typing theories. Others theories the same personality shaping based on the egoistic fears and desires. We intend to study and compare these theories hoping to further build models on how decisions are made and how people prefer to order their activities in a particular way. Our main objective put this to test Multimodal interactions.

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