Agents who build their own identity

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Abstract

The aim of this work is to provide a new approach on the study of identity applied to agents, taking in consideration the strengths, reviewing some weaknesses of other novel approaches, and congregating the existing models into a robust model, with the intent of using it in (but not limited to) virtual simulations of social interactions, for example, serious games. We will develop a model for identity, based upon several aspects that constitute identity described in related investigations. The idea is to integrate this model, called IDeA Model, into an architecture of a society of agents, enabling the agents to handle and comprehend identity, providing context for the behaviour of each agent. It is our belief that games which feature social interactions such as conversations, like role-playing games or simulation games, would benefit from our model to increase the idiosyncrasy of characters. Our research focuses on the dynamism of identity through the evaluation of social contexts and how an agent can use identity processes as a tool for behaviour filtering. The agents active identity is dependent on the agents resources and goals, its known social categories and the context features in which it finds itself in. It is our intention for this model be used in serious games of Project RAGE and, as such, the agents believability in its behaviour is also part of the focus of this research.

Keywords: Agent-based Model, Social Identity, Identity Processes, Decision Making, Serious Games

1. Introduction

1.1. Agent-Based Models.

The process of identity acquisition was not always a matter of consensus, with some arguing identity as primordial, innate or a naturally occurring phenomenon. These views, however, have since then been considered old-fashioned and obsolete. Nowadays, psychologists, sociologists, anthropologists and researchers in many other fields such as [7][6][3][1], agree when it comes to think about and describe the overall process and aspects of identity, namely, the consensus resides in the identity constructivism theory, described by [8] as a paradigm focused on identity fluidity, choice, instrumentalization, response to change in relevant incentive structures and being susceptibility to manipulation due to cultural or political entrepreneurship.

Many researches have been made regarding human behaviour applied to agents, mostly in the field of emotion and interaction, wielding remarkable results which forward the agent cause. Fewer researches, however, are made in regards of identity, which results in sparse conclusions. The aim of this work is to provide a new approach on the study of identity applied to agents, taking in consideration the strengths, reviewing some weaknesses of other novel approaches, and congregating the existing models into a robust model, with the intent of using that model in (but not limited to) virtual simulations of social interactions, for example, serious games.

Agent-based model's interest in regards of studying human psychological phenomena and behaviour, as stated previously, has been increasing over time, making it a useful tool for that purpose. An Agent-Based Model (or ABM) is a simulated multi-agent system, i.e. a computational reproduction, constructed to grasp key elements of processes which occur in real life, in this case human social processes and behaviour. In these systems, each agent serves as a representation of an individual human, constrained by behavioural rules, which intend to reflect individual-level processes studied by sociologists, psychologists, etc. In an ABM, the goal is to provide interaction between agents, as well as the environment itself, over a period of time, using the aforementioned sets of behavioural rules to achieve emergent outcomes which reflect how these individual-level processes come into play with other agents, in the sense that an agent's goal is dependent on its own actions as well as the other agents' actions, as explained by [10].

1.1.1 Identity

According to [6], identity is a concept rooted in language used to describe the human capacity "to know 'who's who' (and hence 'what's what'). This involves knowing who we are, knowing who others are, them knowing who we are, us knowing who they think we are, and so on". To Jenkins, identity is not something that one possesses (or lacks), identity is rather "something that one does", a behavioural phenomenon.

How individuals identify themselves is related to how they define their interests, how one defines their interests encourages one to identify in particular ways, and how one identifies others has a bearing on which interest one pursues, argues Jenkins. Thus, in order for individuals to begin grasping their social identity they require others, to establish similarity or difference, and consequently social groups are formed.

As an example, a study from 1998 by McKenna and Bargh [9], shows that the use of internet news groups was "a crucial part of the demarginalization process", a claim I believe still holds today, just the names for these groups have changed. The aforementioned study states that 37% of individuals 'came out' as homosexuals directly influenced by their participation on these virtual groups. The pluralization of self-expressionism is rampantly becoming part of modern society as people strive to affirm themselves on the current fora, mainly social media, (and also the Internet as a whole, used by virtually everybody) the virtual news groups of today. Thus, the variety of identities, is becoming part of the everyday experience, bleeding into mainstream society, reaching everyone, becoming known and demarginalized. Today's usage of the internet demonstrates how individuals are practising and exerting identity, which transpires into everyday social life.

These processes of identity forming and sharing, the way groups are formed and for what purpose are all aspects that could benefit from agent models in order to be tested and studied.

1.2. Problem

In the context of games, a character which the player has no control over is referred to as a non-playable character, or NPC as it is most commonly used. NPCs benefit immensely from AI in order to give them more interest and believability. The main focus of AI in NPCs is usually the spatial and environmental awareness, which resolves issues regarding path finding or understanding the environment the agent is in so it can use the environment to its advantage. A good example are first (or third) person shooting games, such as *Mass Effect* [2], where you have allies that follow you in battle. These allies are NPC with AI which enables them to perform ideally complex behaviours, allowing them to follow the player's commands and movement, whilst aiding in the fight, either by shooting or providing support to the player and staying alive, by seeking cover, among other behaviours. However, when it comes to social awareness, NPCs lack a great deal.

The concern of this work is the NPC agents' social awareness, particularly regarding social identity aspects. The problem that it aims to tackle is the following:

How can we create autonomous agents, in a game context, that display believable behaviours stemming from their salient social identity?

The approach to solve this problem will be achieved by investigating which are the most important characteristics of identity in individuals in interactions within a social context. These characteristics apply to situations that range from group formation/dissolution, identity change, role performance, decision making and behaviour stemming from identity. We will focus particularly on the processes surrounding identity driven behaviours, such as identity salience and role evaluation, and its effects in individuals. We will develop a model for identity, based upon several aspects that constitute identity described in related investigations. The idea is to integrate this model, called IDeA Model, into an architecture of a society of agents, enabling the agents to handle and comprehend identity, providing context for the agents' behaviours. This model is intended to be integrated to agents existing in Role Playing Game (RPG) scenarios, for example, or pedagogical simulations/interactions such as serious games.

2. Background
2.1. Agent Based Model Representation
Through the analysis and discussion of four texts [7][1][3][6], Frank [4] is able to conclude that in order to be able to treat and represent individual identities an ABM must overcome a set of major challenges. When endogenizing identities in the context of ABM's, one must take in consideration the following challenges, which Frank divided into two categories: representational and behavioural.

2.1.1 Representational Challenges.

These challenges reside in the architectural side of agents. The choices regarding the way different agents interact are able to make or break particular behavioural events, achieved by either enforcing particular interaction rules or by providing a freer space state propitious for the emergence of rich behaviours depending on defined parameters.

Idealized Identities. A model must allow the agents to store their own idealizations, which are able to evolve, thus allowing the agent to locally compare itself to others, establishing difference and diversity of ideals for the present socials categories.

Heterogeneous Social Ontologies. Agents must be able to store local information regarding self-identity and which groups they believe to be a part of as well as a classification scheme to be able to identify others.

Hierarchy and Networks Among Identities. Identity models must be able to account for the internal distinction between primary and secondary identities, as well as provide structures to establish prominence between identities to agents and to capture the salience of those identities to the agent.

Emotional States and Rationality. Agents should possess emotional states, which affect the roles the agents perform and are able to control the externalization of their behaviours when there is no feedback on their performance. They should be able to change their emotional state, thus altering the context of their decision making process.

Symbolic Communication. Agents require a communication system in order to operate their social identity. However, communication is not strictly verbal, and can use non-verbal symbols such as body language, clothes and ornamentation like make-up, tattoos or piercings.

Status, Power and resources. Identity models must provide a mechanism that allows agents to access or deploy resources correlated to their power and social status. This mechanism must also include means for the frequency of affirmation of status, i.e. individuals of higher status are target of frequent scrutiny, or individuals of lower rank have more chance to fly under the radar.

Social Networks and Role Definition. A network of interactions based on identity should constitute a discernible and instrumented social structure, in order to be used for social analysis and model validation.

2.1.2 Behavioural Challenges

As stated in [6], identity is behavioural, and thus behavioural regulation is a crucial part of identity agents. Frank [4] states that behaviours must reflect the dynamic processes associated with social identities, much within agents, as they develop and adapt their identity repertoire, as between agents as they perform identity roles.

Deontic Logic. Frank states that "Deontic agents compare their option to internal representations of an external idealization of model of behaviour". This kind of logic is used in situations where behaviour is regulated by normative motives and commitments, rather than by maximizing utility or resources or minimizing risk.

Role performance and Validation. Agents perform roles that correspond to an identity standard, while evaluating the behaviours of other agents according to how they are categorized. In order for realistic behaviour, it must be deontic in motivation and be mediated by an abstract communication language.

Perceptions and Adaptation. Agents with identity must possess a mechanism that would allow for adaptive searches on the agent's identity space according to positive or negative feedback received, that would confirm or criticize the agent's performance of roles and emulation of idealized models of behaviour.

2.2. An Overview of the Schwartz Theory of Basic Values

In this work, Shalom Schwartz describes his theory of basic human moral values and how these can be used to characterize individuals, consequently social groups, and illustrate the motivational reasoning behind their behaviours and attitudes. The author's most recent theory involves the moral values which are found in all individuals, regardless of their culture. Schwartz enumerates ten types of such values and determines relations between these types, be it of accordance or conflict. This enables the definition of a structure of values, in turn present in groups of disparate cultural background.

This theory states that it is probable that values are universal, since they are tied to one or more of three universal requirements of human existence: "the needs of individuals as biological organisms, requisites of coordinated social interaction and survival and welfare needs of groups".

The pursuit of some values is compatible with others, however the opposite is also true. Actions promoting a determinate value result in conflict with some values but are congruent with others, according to the author. This compatibility (or disagreement) between values is noticeable in the circular design present in figure 1. Values that share boundaries have compatible meanings, whereas values that are opposite one another are in disagreement and have divergent meanings.

As shown in figure 1, values are organized in four super-categories: Openness to change, Self-transcendence, Conservation and Self-Enhancement. Super-categories opposed to one another are composed of contrasting values. As Schwartz exemplifies, Openness to Change and Conservation's opposition captures the conflict between values of "independence of thought, action and feeling" and values of "order, self-restriction, preservation of the past, and resistance to change". Two special occurrences appear in the circular
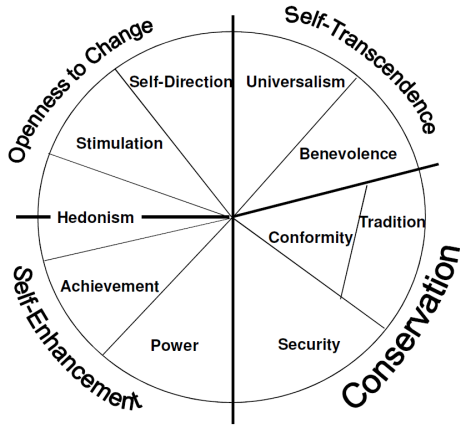
Figure 1: Schwartz's theoretical model of relations between types of value.

design: Hedonism is simultaneously part of self-enhancement and openness to change, as it shares components with both super-categories; Tradition and Conformity are paired due to their sharing of motivational goal Conformity appears closer to the centre as its values have a greater conflict with the opposing super-category its values.

3. Implementation

The IDeA simulation is an application that was designed to put the model into practice, namely, granting agents processes of identity, and through that, granting the agents a mechanism of decision making (based on their identity traits).

This simulation consists in a text based experiment where the user is presented with a short story wherein a character (or a group of characters) interact with other characters. Each story's protagonist is the agent in the simulation with identity processes and is faced with a decision. By taking in account the agent's identity (its moral values, its knowledge of existing social categories), and the story's social context characteristics, the model is able to determine the agent's salient identity and, from a set of outcomes, choose the one that is more appropriate for the agent to carry out in that situation.

The version of the simulator presented in this document consists of a prototype (currently in development) meant to demonstrate the identity model in action and its role-playing story/game capabilities, thus it does not represent a final version.

The IDeA demonstrator is the application where we evaluated our model. The demonstrator consists on a text-only storybook where we use our model to manipulate the ending of the story according to the character's identity salience and social context.

In the application, the user can advance the story once they read the screen, much like we turn a page

on a book. We divide each story in six screens (or pages) where we describe the story's setting, the main character, the social categories present known to the character, the social context, the decision and the conclusion respectively. As said before, our model is responsible to manipulate the ending of the story, in other words, what ending page appears on the story where we describe the behaviour selected.

3.1. Demonstrator's Architecture

IDeA's application was created with Unity 5, a tool for game development, taking advantage of it simplicity and ease to work with. The scripts for the application were developed in C# programming language. The idea behind the demonstrator was to create a mechanism that could tell a story while using the model we developed. To achieve that we decided to look at books as a metaphor.

The application starts with a introductory screen, where the user can select to start the experiment or quit the demonstrator, much like the cover of a book. Each scenario is the story contained in the book and each screen of the application serves as a "chapter". As means to standardize the progression of each scenario we divided the story into six "chapters": Story introduction, protagonist definition, social categories definition, context definition, decision point and finally the conclusion.

Each scenario is composed of four different components, as seen in figure 2: the *GUI*, the *Level Manager*, the *Contexts* and the *Characters*.
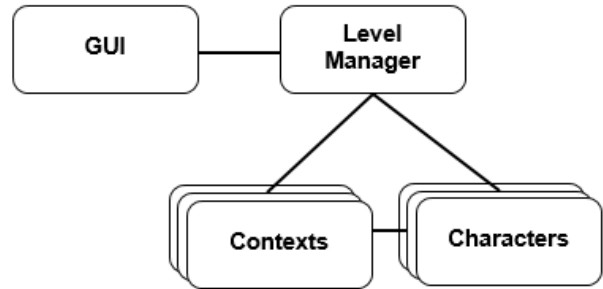

Figure 2: IDeA Demonstrator Architecture

The *GUI*, or *Graphical User Interface* component is, as the name suggests, responsible for presenting the simulators interface with the user, namely the buttons, images and text that is necessary on screen. This component is linked with the *Level Manager* in order to receive the text that is dynamically added according to the progress of the scenario.

The *Level Manager* works as a mechanism for controlling the progress of the story in each scenario. As stated before, it communicates with GUI, but also communicates with both the Contexts and the Characters, in order to assess the scenario state

- if characters are interacting with one another, if they are present in the context, or if a behaviour has been chosen - and presents text accordingly.

As stated previously, the Level Manager is responsible for the progress of the story in the sense that it contains the first five (out of the six) "chapters" of the story which are predetermined to each scenario and iterates between them according to the user's interaction. The final "chapter" is added to the Level Manager according to the result of the model regarding the salient identity.

The *Contexts* are invisible entities in the simulation that delimit the area of influence of a certain social context. These are used to dynamically instil in the agent which are the relevant resources and the affordable goals of that situation. An agent only knows which are the relevant resources and afforded goals while in the area of influence of a *Context*. Abandoning a *Context* makes the agent forget the corresponding features, however, in a future version of IDeA, those informations could be stored in the agent's knowledge base in order to be recalled when needed.

The *Characters* are the actors of the story. The story's protagonist is an agent with identity processes, while the other characters are simple NPC's without identity features. The agent *Character* contains a "children" component which functions as its knowledge base, where it stores his knowledge of the existing social categories and moral values of the simulation world and can in future versions be used to store other informations, as suggested before.

3.2. Example

In summary, the necessary components for the determination of the most accurate identity salience are the agent's definition (its resources, goals and commitments to each social categorie), a knowledge base of the existing Social Categories (SC's) (which contains the moral values, resources and goals of each SC), and finally the social context definition (with the relevant resources and affordable goals for that context).

Having defined these three components we can now perform the calculations needed, namely, the *adequacy*, *affordance*, *fit* and finally *salience* for each SC.

To calculate the *adequacy* we look at each of the resources of the three components defined previously, one SC at a time. We take, let's say, SC_1 and we compare each of the agent's resources with the resources of both the context and the SC's. A resource that is matched in all three components gets an *adequacy* score of 1. The final score of *adequacy* for that SC is the sum of all the matches with that SC, the agent's and context's resources.

To calculate the *affordance* we use the same pro-

cess, only now looking at the goals of the three components.

$$fit_{\langle SC_i, Ctx_j \rangle} = \frac{adequacy_{\langle SC_i, Ctx_j \rangle} + affordance_{\langle SC_i, Ctx_j \rangle}}{2} \tag{1}$$

$$salience_{\langle SC_i, Ctx_j \rangle} = fit_{\langle SC_i, Ctx_j \rangle} + c_{SC_i} \tag{2}$$

Once we have these two values for each SC, we can calculate the *fit*, by averaging the two, as shown in equation 1. Lastly, we can calculate the *salience* for each SC, by taking the SC's corresponding fit and commitment (c_{SC_i}), which in our case are fixed values, and adding the two (2). These values can be seen on table 1.

	SC_1	SC_2	$SC_{...}$
$Adeq_{\langle SC_i, Ctx_{\{\}} \rangle}$	$\cdots$	$\cdots$	$\cdots$
$Aff_{\langle SC_i, Ctx_{\{\}} \rangle}$	$\cdots$	$\cdots$	$\cdots$
$Fit_{\langle SC_i, Ctx_{\{\}} \rangle}$	$(\cdots + \cdots)/2 = 0.5$	$(\cdots + \cdots)/2 = 1$	$\cdots$
$Sal_{\langle SC_i, Ctx_{\{\}} \rangle}$	$0.5 + c_{SC_1}$	$1 + c_{SC_2}$	$\cdots$

Table 1: Example of salience calculations

4. Evaluation

The experiment consisted on having the participant access the IDeA demonstrator application through an *URL* provided in the invitation. In the application, users would be presented an introductory screen before they would start the experiment, then we presented a text-only short story, which we asked that users read carefully. After having read all story elements, we ask that they fill in an online survey.

4.1. Test Conditions

To test our hypothesis, our experience consisted on a between-groups evaluation, where each group was asked to try one condition of the model. Members of these groups were assigned randomly depending on which version of the application they received when loading the application.

The test conditions that the experiment participants were asked to try are described as follows:

4.1.1 Contextualized or Full Model Conditions

The contextualized condition represents how an agent should behave when using our identity model by rooting its decision making process and subsequent behaviour in its identity, which in turn is connected to the social context of the situation.

In the story we present to the experiment's participants, our agent, Ace, encounters a homeless-looking man while wandering around during his day

off and questions himself whether this man could be a thief in disguise or if he should donate him some money. On each of the two alternative developments of the story, the social context's characterization changes, and as such causes the character's salient identity to change accordingly, this, in turn, leads to different behaviours.

The first alternative is marked by a fight between Ace and a fleeing thief, making the context in this situation to be characterized by fighting elements. This propels the emergence of an identity of a Niceville guard, Ace's profession, even though it is his day off. Being his duty as a guard Ace helps the old man with money.

On the second alternative the situation is similar to the previous one, however, while chasing the thief to confront him, Ace is reminded of a fighting tournament he wishes to participate in and that fills him with determination for practising his skills against this thief. As such, this leads Ace's salient identity to be that of a fighter. When encountering the homeless-looking man Ace confronts him denies giving him money.

4.1.2 De-Contextualized or Simplified Model Condition

In this version, the contextual component of the model was deliberately shut down and as such the character is not able to determine its fitness to the situation. This means that the character is not able to determine which social category (SC) is more appropriate to the situation. As such, the character's behaviour is derived solely from the internalized commitments it keeps with each SC, namely, whichever has a higher commitment. This can be considered the "neutral" response or behaviour in our model. This condition serves as our baseline for our hypothesis, as to compare with the Contextualized Model condition.

On the first development, Ace identifies no noteworthy characteristics to the surroundings, i.e. no context, as such his salient identity is that of his highest commitment, namely a Nicevile citizen, which are benevolent by nature. As a Nicevile citizen first and foremost, Ace decides to donate money to this man disregarding the possibility that this man could be a thief in disguise.

On the second alternative, we present a story where Ace is chasing the thief to confront him, he is reminded of a fighting tournament he wishes to participate in and that fills him with determination for practising his skills against this thief. However no contextual features are inserted into the model, as such, this leads Ace's salient identity to be that of a citizen due to its highest commitment value. When encountering the homeless-looking man Ace

decides to give him money.

4.2. Results

In order to perform a comparative analysis between the two conditions (agents with the model's context option activated and deactivated) we performed a series of Wilcoxon-Mann-Whitney tests and other descriptive statistical analyses to the responses we obtained with the experiment detailed above. We decided to use the Wilcoxon-Mann-Whitney test since it do not require the assumption that the data follows a normal distribution.

Following, we present the results we obtained with the aforementioned analyses and the conclusions we were able to draw from those results.

4.2.1 Groups

The groups are characterized by the aspects detailed in table 2.

By condition we are referring to the two test conditions described in Section 4.1. Described context refers to the context conveyed to the user through the story that is either inserted in our model for the contextualized groups, or left empty for the de-contextualized groups. Salient identity represents which identity was salient in that group, namely, the identity which was calculated as the most adequate given the situation. Decision refers to the behaviour performed by the agent. A total of 84 people (59 males and 25 females, with ages comprehended between 19 and 66) participated on our experiment, being that of the 84 people, 21 were part of group 1, 21 were part of group 2, 22 of group 3 and 20 of group 4. The few amount of people in each group make that the statistical analysis can only be interpreted empirically as the samples provided is not large enough to perform accurate statistical tests.

4.2.2 Set 1 - End State Questions

With this set of questions we intended to determine appropriateness of the end result and was composed of two questions (Q1 and Q2), being that the second question (Q2) regarded the users written opinion on the behaviour produced and thus no statistical analysis can be performed. Q1 was intended as means to explore the participants' perception over the overall believability of the behaviour produced by the model.

Through figure 3 we can see that groups 1, 2 and 4 opinion is consensual and the results are not that different, while group 3 produced a somewhat different result.

For group 1, the results were within our assumptions. Since this was considered our baseline group, we can see that the group 2, which read a response

Group	Condition	Described Context	Salient Identity	Decision
Group 1	De-contextualized	Empty	Citizen	Donate money
Group 2	Contextualized	Fight	Guard	Donate money
Group 3	Contextualized	Fight and Trophies	Fighter	Do not donate money
Group 4	De-contextualized	Fight and Trophies	Citizen	Donate money

Table 2: Experiment group characterization

Figure 3: Experiment structure

haviour (Identity, Context and Basic Human Values) are relevant to the decision process and consequent behaviour.
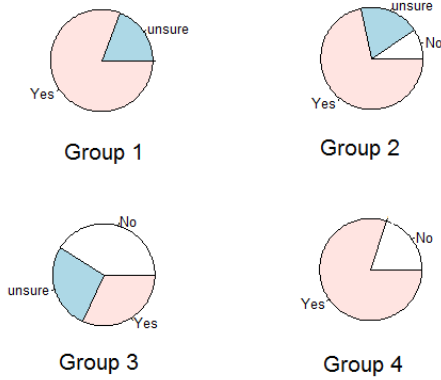
Figure 4: Experiment structure

given by the model, felt generally the same way as this group, which read a predetermined ending, indicating that the behaviour generated had a degree of believability.

For group 3, however, even though the proportions are similar, the "No" slice is evidently larger comparing with the other slices of that graph and even comparing with "No" slices from other graphs. This is an unexpected result as in this case the contextual hints in the story were evidencing an identity that was not benevolent enough to donate money however people found that the action of not giving money was inappropriate given the situation.

For group 4, the results are very similar to those of group 1, given that both these groups are from the de-contextualized condition. However, the textual hints regarding the context features (even though turned off in the model) were very distinct, which, along with the responses from group 3, leads us to believe that participants are disregarding the context features.

4.2.3 Set 2 - Character's Behaviour Questions

The questions on this set (Q3 and Q4) were meant to assess the user's perception of the agent's behaviour. These questions asked participants to choose a social role that would encompass the answers made previously and the agent's behaviour (Q3). After that, we survey the participants' awareness on which of the three "areas" regarding behaviour
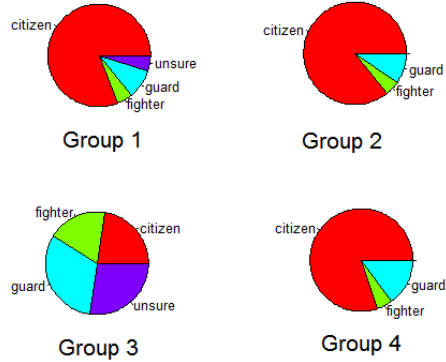
As can be seen in figure 4, the results for Q3 follow the same exact pattern as those of Q1 having groups 1, 2 and 4 produce very similar results and group 3 standing out.

Overall we can determine that participants chose the social category of "citizen". We theorise that, although we present several other features of identity for the agent, people gave more importance to the fact that the agent was from Niceville, acting in Niceville, and thus it is their duty being nice. This is in accordance to what we concluded with the Q1 (participants are disregarding context in favour of identity) and when the decision goes against that of being a model citizen of Niceville (Group 3), the participants were confused and divided between the possible answers.

The results of Q4, which can be seen in figure 5, once again follow the same pattern as the previous questions (Q1 and Q3).

We theorise that people were focused on the fact that the agent was nice and since he gave money he followed his morals. In the situation where he did not give money (Group 3) people attributed the situation (or context) for his behaviour. In a sense this is a good result, which indicates that context is powerful enough to steer behaviour but also, together with the previous answers, indicates that the readers might have been biased by the story regarding the importance of being nice.
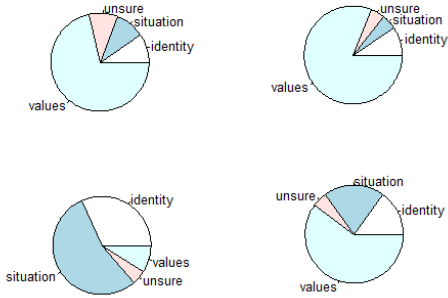
Figure 5: Experiment structure

4.2.4 Set 3 - Story and Character's Questions

In this set of questions, we aimed at perceiving the participants' awareness to the agent's identity and the situational context where the agent is in through questions Q5 to Q7. As stated previously, the first and second questions of this segment (Q5 and Q6) address the awareness to the agent's identity elements during the events of the story, while question (Q7) regards the context features which sets up the decision for behaviour.

Following, we present a set of tables which contain the $p-values$ determined from the comparative analysis between the groups using the Wilcoxon-Mann-Whitney test to the results from Q5, Q6 and Q7, respectively. With this test, we work under the assumption that the responses from different groups are equal. This constitutes our *null hypothesis*.

With this test, $p-values$ that are below (or near) 0.05 reject the null hypothesis by a strong decision, that means, there is evidence that there are significant differences in those comparisons. In order to establish conclusions regarding the differences between the groups, and thus, concluding if those differences were warranted by the test conditions of the groups, we focused on those cases. We believe this will enable us to reach conclusions regarding the evaluation of our hypothesis.

In Q5 we address the importance of the agent's identity features. Table 3 shows that only a few comparisons reject the null hypothesis.

We can see that the feature of "Is a fighter" indicates that there are significant differences between groups 2 and 3 and 2 and 4. With the evidence mentioned above we can conclude that, despite people in group 2 finding the importance of being a fighter averagely central do the agent, their opinion was lower than the remaining groups, particularly group 3.

The importance given to the features of being a guard and a citizen were overall higher and consen-

sual than those of being a fighter for groups 2 and 3, which is also corroborated by the results above. This result is in accordance to the group characterization, in the sense that in the story of group 2 being a fighter is not as important as being a guard, and vice-versa in group 3.

The results of this question indicates that the differences identified might stem from the differences in contexts presented to those groups, in turn, giving indications of fulfilling our test hypothesis.

In Q6 we address how effective are the agent's identity features in regards of the behaviour chosen. Table 4 shows that many comparisons violate the assumption that the groups are equal, providing us with significative differences between the answers of each group.

In this question, we can see that opinions diverged in regards of which identity was effective in the agent's behaviour. There is a very large discrepancy in responses regarding how effective being a fighter was to the agents decision. First, we can see that there is evidence groups 1 and 2 and groups 3 and 4 agreed in their decisions. Evidence suggests that this feature mostly did not define the effectiveness, while 3 and 4 both believed this feature to be very defining. This result is congruent with our hypothesis, in the sense that since the story of groups 3 and 4 both reflected the agent's pursuit of trophies (a trait of fighters), this means that the users took the context in consideration. Furthermore, groups 3 and 4 are from different test conditions (as can be seen in table 2), providing even more indication that the story using the model working with context features is having the same impact than a story without, contributing to believability.

Overall, the results of this question leads us to the conclusion that the contextual features are being responsible for the agent's identity, however, people still do not find the resulting behaviour adequate and always expect the donation of money to happen.

In Q7 we address the participants perception on the importance of the contextual features behind the behaviour of the agent. Table 5 shows that almost all comparisons violate the null hypothesis, having a $p-value$ <0.05.

According to table 5 we can see that, regarding the context "Usage of weapons" the responses from group 1 present significant differences from all the groups. Participants of this group found that the usage of weapons on the story they read was not important for the decision made by the agent. This was an expected result, since the agent does not make use of its weapon in that story and makes in the remaining. The same results can be said for the context feature of "A fight" and "Score settling".

Regarding the feature "Winning trophies", we

	Null Hypotheses					
Identity Feature	$G_1 = G_2$	$G_1 = G_3$	$G_1 = G_4$	$G_2 = G_3$	$G_2 = G_4$	$G_3 = G_4$
Is a fighter	0.1561	0.8509	0.9032	**p <0.05**	**p <0.05**	0.9574
Is a citizen	0.2440	0.1502	0.1449	0.4974	0.7016	0.4364
Is a guard	0.3908	0.3209	0.9550	0.0519	0.2186	0.3176
Has battle scars	0.1206	0.6467	0.5156	**p <0.05**	0.2925	0.2149
Has tattoos	0.0305	0.4827	0.2726	0.2055	0.2137	0.8188
Uses weapon	0.2850	0.0919	0.9682	**p <0.05**	0.3170	**p <0.05**
Likes trophies	0.8788	0.8788	0.5695	**p <0.05**	0.2337	**p <0.05**
Enjoys day off	0.0518	0.0518	**p <0.05**	0.4167	0.2889	0.2269

Table 3: $p-values$ obtained through Wilcoxon-Mann-Whitney test for participants' perception regarding Ace's identity features

	Null Hypotheses					
Identity Effectiveness	$G_1 = G_2$	$G_1 = G_3$	$G_1 = G_4$	$G_2 = G_3$	$G_2 = G_4$	$G_3 = G_4$
Is a fighter	0.1261	**p <0.05**	**p <0.05**	**p <0.05**	**p <0.05**	0.4408
Is a citizen	0.2357	**p <0.05**	0.3384	**p <0.05**	0.7945	**p <0.05**
Is a guard	**p <0.05**	**p <0.05**	**p <0.05**	0.3364	0.1515	0.7420
Has battle scars	0.5511	0.1108	0.7859	0.1704	0.8409	0.1722
Has tattoos	0.7152	0.6595	0.7443	0.3868	1.0000	0.4294
Uses weapon	0.5276	**p <0.05**	**p <0.05**	0.1289	**p <0.05**	0.9796
Likes trophies	0.2822	**p <0.05**	**p <0.05**	0.1776	0.1808	0.5383
Enjoys day off	0.1384	0.5459	0.1074	0.3601	0.8618	0.2852

Table 4: Experiment group characterization

	Null Hypotheses					
Context Importance	$G_1 = G_2$	$G_1 = G_3$	$G_1 = G_4$	$G_2 = G_3$	$G_2 = G_4$	$G_3 = G_4$
Usage of weapons	**p <0.05**	**p <0.05**	**p <0.05**	0.1889	0.0915	0.8186
A fight	**p <0.05**	**p <0.05**	**p <0.05**	0.09431	0.05071	0.8577
Winning trophies	0.1623	**p <0.05**	**p <0.05**	**p <0.05**	**p <0.05**	0.7407
Peace keeping	0.2024	0.4217	0.5009	**p <0.05**	0.3857	**p <0.05**
Score settling	**p <0.05**	**p <0.05**	**p <0.05**	**1.0000**	0.4192	0.7305

Table 5: Experiment group characterization

can see that there were differences in most comparisons except group 3 and 4 due to the fact that those stories allude to a tournament, and group 1 and 2, due to the fact that those stories made no mention of trophies. This can be corroborated with the frequency of responses from users.

The aforementioned conclusions, again, indicate that the context influenced the perception of users regarding the behaviour, however, they still found the behaviour was wrong in the case where the agent did not donate money.

4.2.5 Set 4 - Character's Morality Questions

Given our intentions with this measure, the result obtained did not provide any significant result for the evaluation of our model.

5. Concluding Remarks

By comparing the results detailed above, we were able to reach some conclusions. Statistical analysis indicated that, regardless of test condition, participants found the behaviour was appropriate in all groups with the exception of group 3. This raises the suspicion that the story's description of Niceville heavily induced participants perception on the identities described in the story, and since the decision of all stories (except group 3) ended in the donation of money, we feel that participants directly attributed that to the agent acting as a citizen, disregarding the context. The questions in the next set of questions also corroborated this finding.

The questions regarding the agent's identity and the context characterization provided some interesting results. We were able to conclude that people were characterizing the importance given to agent's features, the effectiveness they had on the behaviour and the context's features according to

our expectations. What is interesting behind these results is that they are somewhat in contradiction to what the majority's opinion regarding the behaviour. We would expect that having identified, within our expectation, what defined the character in that situation and what were the features behind the behaviour, the participants would also be able to discern the salient identity, which is intrinsically tied to context.

In conclusion, we are led to believe that the lack of participants across the different groups, and the possible bias the story introduced in our readers, only enables us to partially validate our hypothesis, in the sense that we have some indications that the identity and the context is being understood and playing a role in the decision, however not enough to change people's perception into accepting the result as credible.

6. Conclusions

To demonstrate and evaluate our model, we implemented the IDeA demonstrator, in which we told a story which ending would be dependent on the agent's behaviour, which was determined by the development of the story.

In order to validate the hypothesis we identified in the beginning oh this document, we performed a between groups experiment. We achieved a total of 84 participants, distributed evenly between four groups. In light of the results obtained from the evaluation of our model we feel that there were no sufficient indications whether the model is being responsible for credible behaviour, however there are no indications it is not either. We feel that the model itself is on the right track, however, our demonstrator and how we structured our evaluation might have not been appropriate.

As such, in order to guarantee that our model produces credible results, many opportunities for future work are presented.

6.1. Future Work

It is our opinion that we need to rethink the evaluation of our model. We believe that the outputs of our model are on the right path, however the way we proposed to evaluate it might not have been the best. Other additions to the processes of identity such as dynamic knowledge bases or contexts could also prove to be interesting additions.

Regarding Project RAGE, our application requires some future work, namely:

- Integrating IDeA's into FAtiMA's [5] architecture in order to be applied to be standardized in regards of inputs and outputs of other assets within the project.

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