Haps: Habits for synthetic characters

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October, 2010

Abstract

The modeling of synthetic characters might consider the question of survival in living organisms. Based on survival, appear many homeostatic variables that define the balance of an organism. The lack of balance of an organism requires its regulation and, so, interferes with the way of life. A synthetic character might also have homeostatic properties that define its balance on its way of life. The character can react to the lack of balance of those properties using a deliberate planning at the time or recurring to known behaviours, favourable, and even seen as preferential. Regarding the second one it is possible to say that it matches to the concept of habit. If the character can adapt to the environment where acts and demonstrate a behaviour that allows an external observer to detect habits on its behaviour, is believed that the level of credibility might increase. Therefore, it is proposed a model to the adoption of habits from the synthetic characters. The model was implemented on architecture for synthetic characters and evaluated. From the evaluation is it possible to conclude that the model is adequate so that external observers detect habits on the characters and, sometimes, even increase its credibility.

Keywords: habit, synthetic characters, homeostasis, credibility

1 Introduction

The continuous development of synthetic characters on virtual worlds tries to bring these characters high levels of autonomy and credibility. The efforts made on the intentionality of their actions, intelligence, ability to adapt, interaction and expression of emotions are only possible through the inspiration obtain on the human behaviour as well as the behaviour of the other living creatures. The understanding of their behaviour on a wide range of circumstances and their organisms enlarges the approaches for synthetic characters. As we will realize, the biological functioning and the cognitive processes in humans are the foundation for this work's approach.

Applying on synthetic characters the topics approached by Di Paolo[5] on robots, we can try to give the characters a "way of life", on which relies the purpose of survival that interferes with the characters' behaviour through the accomplishment of their goals. Survival calls for the ability to adapt, which can be based on the connection between plasticity and behaviour.

Therefore, is intended that the architecture of a synthetic character possesses a structure that allows the transition from actions taken previously by deliberation to actions performed in a direct and habitual way - the notion of habit - until this approach be defied, causing again the need to deliberate. More specifically, the architecture should have a deliberative layer that is always able to plan when a new situation appears but it should also have an anticipatory mechanism in order to make possible for recurrent plans, considered habits of response, to be selected without the need to deliberate. Through the attempts of results' anticipation and actions' effects, the need of adopting new habits will appear without forgetting the permanent purpose of survival that will lead to the break or adoption of habits. Still, we want to increase credibility of a character's behaviour.

Next, we start by refer about some concepts and related work. This is followed by a description of the proposed model. Section 4 presents an evaluation using the proposed model and Section 5 concludes the paper.

2 Concepts and related work

2.1 Homeostasis

As pointed out above, on a living organism survival seems to be the answer to the origin of the natural rules that interfere with that organism's behaviour. As said in [5], Ashby [1] indicated that the condition for the survival of an organism is represented by the status of what we named "essential variables" (for example, for the mammals is the concentration of blood-sugar, their body temperature, the amount of water on their body, etc). If these variables go out of bounds the organism's survival system is consequently challenged. So, the purpose of survival appears as the foundation for the regulation of the organism's internal status with the objective to maintaining a stable condition according to dynamical adjustments controlled by regulation mechanisms. This property of organisms is named **Homeostasis** and the variables that trigger this regulation process can be named **homeostatic variables**.

Based on these principles, Avila-García and Cañamero[2] developed a mechanism for robots which have by main goal surviving and to accomplish that need to maintain the homeostasis. In other words, robots must maintain their essential variables on a certain range of viable values. On this mechanism are used approaches between motivational states - impulses by physiological needs - and emotions - cognitive response to the recognition of an event. In this approach, the emotions send "hormones" that affect the intensity of the selected behaviour, activating on inhibiting it, modelling the perception to internal and external stimulations. This architecture possesses two layers: motivational and behavioural. The motivational layer is composed by motivational states that define the system's objectives - the tendency to satisfy internal and physiological needs - connected with the homeostatic variables. Therefore, each motivation is connected to the tendency of behaving in a specific way as consequence of internal factors (physiological drives) and external factors (environmental stimulations). Each motivation controls one homeostatic variable. The behavioural layer implements different ways to satisfy the need mentioned on the previous layer. The execution of this layer's behaviours influences the environment as well as the specific homeostatic variables.

2.2 Habits

One of the important points of this essay is the concept of habit. So, using as base the article written by Verplanken[6], it is possible to analyse how habits can be defined on human activity in order to define it later in the context of an agent for synthetic characters.

We humans don't do a lot of things for the first time, but some of them stay in our memory, for example the first day of school or the first driving lesson. However, the majority of our day-to-day activities are behaviours that we repeat multiple times. The majority of things we do for the first time have in common the fact that we do them deliberately and consciously: search for information, planning when, where and how to do it, we are careful or we ask for help. Afterwards, we can rethink about what we have done, evaluate and plan if we will act the same way of differently the next time but this process changes completely when we start to repeat our behaviour: we stop planning, thinking or evaluating. When the time comes for us to act, we simply act and so, we create a habit. The more we repeat a certain behaviour, more its control stops being guided internally to be controlled by the suggestions of our surroundings.

Verplanken & Aarts defined a habit as being:

> "*(...) a learned sequence of acts that have become automatic responses to specific cues, and are functional in obtaining certain goals or end-states*"

Many behaviors may fall under this definition, varying from being very simple (as it is greeting someone you know) to being complex (such as going on a diet).

Analysing this definition, we realize that, if habits are a learned sequences of acts, then it is necessary a certain level of practise to acquire them but it is hard to quantify that level of practise. Some habits are harder to acquire, such as changing eating pardons while other may be acquired with few practise, for example, having lunch at a new school. On either case, habits have a story of repetition whether is long and painful or short and easy. Since they are an automatic response to suggestions, it is possible to say that habits are triggered by suggestions of different kinds, whether it is objects, the weather, geographical characteristics, people or internal motives such as hunger or pain. It is absolutely safe to say that these responses occur without thought or reflexion and most of the time, without consciousness but it is necessary to refer the fact that they are functional to accomplish goals. The fact that we acquire habits means that these serve us, in other words, the behaviour that brings us positive consequence is more likely to be repeated than the one that brings negative outcomes. So, the habits serve a determined goal, for example, the habit of practising physical exercise allows us to maintain a healthy lifestyle or the habit of driving to work because it is more comfortable.

In summary, habits appear due to the repeating of thought responses to a certain goal on a certain context. From the moment we acquire a habit, we respond to suggestions of the context without much thought or deliberation. So, a habit has three characteristics: frequency, since there is repeating; automacity, since there is a connection between context and response; and functionality because it allows accomplishing a goal.

2.3 PSI

However, the model we propose later in this essay has some assumptions. One of them is that in order to be successfully implemented in an agent's architecture an agent should contain an internal system based on homeostatic variables and its regulation interferes with his behaviour. And based on this principle of homeostatic variables, we mention the **PSI** architecture that appears from the theory of Dietrich Dorner[3].

From the field of psychology, focuses on behaviour, intentions and regulation of the human actions. This theory draws a wide model of human cognition including mental representation of memory, perception, motivation, solve of problems and emotion. This model allows the creation of autonomous agents which can adapt their internal status in a dynamic environment. From an emotional point of view, all actions produced by an agent are based on a limited number of basic needs modulated by the existence of homeostatic variables that define the homeostatic balance of the agent. Those needs are: maintenance of existence (physiological need for food, water...); maintenance of the species (reproduction); relationships (need for social experiences); certainty (being able to predict what will happen and predict the consequence of their actions); competence (being able to solve problems and tasks). A devein from the limier set for each homeostatic variable will origin an intention to satisfy that homeostatic need.

Regarding the perception and memory, in this architecture are represented in memory the objects, environments, actions and the connections between objects and/or actions and/or needs. Actions have represented the satisfaction or insatisfaction on contribute to achieve goals and satisfy needs. On a completely new and unknown environment will prevail the principle of try and error that allows learning with successful experiences and with the consolidation of relationships that work as pointers to the possibility of specific needs being satisfied.

On another aspect defined by architecture, solving problems consists on a definition of actions to maintain an auto-regulation of the homeostasis. The needs of regulating one homeostatic variable influence the behaviour and in order to satisfy that need on a specific situation are created intentions. Intentions are the connection between needs and goals to satisfy them. They might be different intentions simultaneously that compete with each other and from the time one of them is selected are also selected and executed actions according with that intention.

3 Conceptual Model

The point that is commonly observed on the attitudes and choices of the planning agents is their constant change on choosing plans, since they always try to achieve the "best choice" for the moment or, in other situations, they have already preferences pre-defined. However, from the human point of view, we don't always go for the "best choice" on each moment and we prefer something that we usually do that satisfies us, even if it is not the "best choice". Therefore, if we can achieve on the planning agents a resemblance to the human behaviour, on this subject, is it possible to say that the level of credibility and resemblance to the reality increases.

This essay is the result of the study and research to obtain a way to incorporate on the agent's architecture the concept of a human habit. Human habits appear by repeatedly being a favourable response to a certain goal that might or not have as end the satisfaction of a need from the human organism. On this essay, the goals for which is proposed a model for treatment and re-use of knowledge and experiences of the agent are motivational, in other words, have as purpose the response to the needs of the agent's organism.

3.1 Haps

The model proposed to define a habit and promote the sense of habitual response is done by the storage in memory of response plans to certain goals and with the required information in order to predict and anticipate results from executing those plans. This model focuses on motivational needs, the regulation of the internal status of an agent which, throughout time, has as goal the satisfaction of these motivational needs (homeostasis). As it was stated on Section, if we consider desires as being the representation of the agents' needs and the intentions as the commitment between tasks and actions to do in order to the agent achieve a goal, then it is possible to identify relations between the actions done and the needs that these satisfy. Throughout time, and by obtaining new knowledge and experiences, it is possible to detect repetitions of responses to a certain goal.

Habit

As stated on Section, from the human point of view, the more we repeat certain behaviour, with the purpose of achieving a goal, the more that behaviour stops being guided internally, not being evaluated or planned anymore, to become controlled exclusively for the suggestions that surround us. So, it is possible to think of a habit as a sequence of actions, which level of occurrence can be an indicator of the existence or not of a habit. However, it is hard to quantify if certain actions are easier or harder to be learned and become automatic and, consequently, if they switch to a habitual process faster or slower, not being necessary the planning of a response. Therefore, to an architecture of agents able to plan and act, a habit is identified by a response plan, in other words, for each habit there is a group of actions clearly identified as responses. Since it is not possible to identify when a plan is or not a habit, each plan is related to strength, which will show the relation between frequent repetitions and the success related with the goals wanted at the time of the planning. The repetition of one successful response cause the increase of the strength associated to that response, which results on a higher level of automatism of that response. Therefore, a known plan - meaning that was previously executed and has expected results already known- will influence the choice of behaviour, in order to achieve a certain goal, over other alternatives that are unknown. All the plans elaborated by the agent are by themselves habits, in which the plans that were not tried are "habits without strength", without much influence on the deliberative process of selecting a response. This strength of habits becomes important when there are alternatives, where the plans with the highest strength - more usual- have a higher probability of being selected. In situations where alternatives do not exist, the strength level of the only possible plan becomes meaningless.

Variation of Strength and Completeness

After mentioning the concept of strength of a habit, it is necessary to demonstrate the way how that strength varies and how it is calculated. Therefore, it is necessary to return to the internal needs of an agent. This model assumes the existence of homeostatic variables on an agent's architecture so that it can be implemented. These homeostatic variables must have a level of variation on a well defined scale. Let us consider a scale from 0 to 100, in which 100 represents the level that each variable must have, meaning that the agent does not have any need to regulate it and 0 represents that the agent urgently needs to do something in order to regulate that variable. Throughout the agent's life, the levels of these variables will decrease, causing the agent's need to place them on the wanted level. However, not all behaviours, to the same goal, have the same effects. For example, let us consider that an agent has a homeostatic variable related to its "energy", which in a certain moment is under 100, and needs to increase this value to a higher one. If the agent has different alternatives to increase this value, the effects resultant of one or the other alternative would result in different values for its homeostatic variable. So, we can logically say that each choice has a different level of completeness on variable regulation. For example, if its "energy" variable had a value of 50, on the previously stated scale, means that the agent would try to refill the value up to 100, meaning that there would be a need of energy of 50 values. If the value increases to 60, we can say that the agent's behaviour made him achieve 20% ($10/50 = 0.2$) of its goal - which would be to re-establish the variable to 100. On the other hand, if the increase of its energy level up to 90, then would achieve 80% ($40/50 = 0.8$) of his expectation to regulate the variable. So, considering the existence of a completeness level to a homeostatic variable (i), this can be calculated on the following way:

$$Completeness(i) = \frac{\Delta Gain_i}{\Delta Need_i} * 100$$

In which $\Delta Gain_i$ corresponds to the value that the homeostatic variable increases by the choice of the behaviour and $\Delta Need_i$ corresponds to the value that is intended to increase the homeostatic variable in order to regulate it.

Still, both examples present levels of completeness below 100 but it is mandatory to mention the situations in which the level of completeness is above that value. As it was said, if we consider level 0 of a homeostatic variable as the level of urgent need and level 100 as the satisfaction level, then everything that overcomes that level can be considered excessive. In this way, is considered that there should be a penalty on the calculation of the completeness level on these circumstances. So, we have that the completeness of a homeostatic variable i is:

$$Completeness(i) = \begin{cases} \frac{\Delta Gain_i}{\Delta Need_i} * 100 & \text{se } \frac{\Delta Gain_i}{\Delta Need_i} \leq 1 \\ 100 - (\Delta Gain_i - \Delta Need_i) & \text{se } \frac{\Delta Gain_i}{\Delta Need_i} > 1 \end{cases}$$

In this way, considering that it is possible to quantify on which way a behaviour benefits [1] the regulation of variables that define the agent's homeostasis and, based again on the human study, that the behaviour which has more positive consequences is more likely to be repeated we get to the formula to update the strength of the habit (F^H):

$$F_t^H = F_{t-1}^H * (1 - \alpha) + \frac{\sum^n Completeness(i)}{n} * \alpha$$

where $\sum^n Completeness(i)$ matches the addition of completeness from all the habit regulated variables, $\boldsymbol{n}$ matches the number of homeostatic variables regulated by habit and α matches the factor of "forgetfulness" - what is done in the past is forgotten throughout time and also because we do new things - that varies between 0 and 1. Therefore, the new value of the strength of habit (F_t^H) is calculated considering the current strength of habit (F_{t-1}^H) and the average level of completeness on the affected homeostatic variables ($\frac{\sum^n Completenees(i)}{n}$) at the end of the plan execution. The α factor promotes the consideration of the strength of habit in the past, but the recent behaviour has more influence than the past one, using the same plane. The biggest the factor α is, the most importance of the recent behaviour has considering the history of that behaviour. So, the strength of a habit will vary between 0 and 100. Still, this update only corresponds to a selected behaviour that is successful. If the selected behaviour fails, the way of updating is done by giving 0 to the second part of the addition of the formula, since that in case of failure we have $Completenees(i) = 0$ and consequently, $\sum Completenees(i) = 0$ resulting in:

$$F_t^H = F_{t-1}^H * (1 - \alpha)$$

However, when the agents select a habitual behaviour instead of others just as valid, it means that the behaviours that were not selected lose some of their strength as habit. From that perspective, it should exist a penalty on strength that is done by applying a multiplication factor on the habit strength. That factor can result of the multiplication of another factor ρ by each existent action on the plan, meaning that the bigger plans lose more strength as habit than smaller plans when are not selected. This penalty is expressed on the following way:

$$F_t^H = F_{t-1}^H - (F_{t-1}^H * M * \rho)$$

where M equals the number of actions which complete the plan that identifies the habit. The ρ factor must be defined so that $(M * \rho)$ is minor or equals 1.

Motivational Strength

As it was described on the previous section, to an agent's architecture, a habit can be defined by an action plan and an associated dynamic strength, the strength of habit. However, in human behaviour, the decision between different action plans is not only based on the amount of times that we repeat behaviour. Another influence on the human behaviour is suggestion, meaning that besides the acquired experience, the circumstances also function as suggestion for us to choose a certain habit, which could be a different one in other circumstances. So, the type of suggestion that can influence the decision is the person's internal status or, more specifically, the need to regulate the internal status.

So, we can say that to an agent the way of selecting a habit might be related with the momentary values of their homeostatic variables, which means that we can assume the existence of a motivational strength that influences the selection of behaviour. Therefore, for the behaviours already experienced by the agent there could be an expectation on the regulation of its variables.

[1] there are only considered the variables that are benefit by behaviour, which means only those which behaviour does not imply the decrease of their level

Depending on the motivational strength a habit can gain more or less strength than other habit. Given a habit h and a homeostatic variable i, the motivational strength match the relation between the expectation of h regulates i, and the need of i:

$$F^M(h,i) = \frac{\Delta Expectation_{h,i}}{\Delta Need_i} * 100$$

The motivational strength varies between 0 and 100, and so it is necessary to have a penalty on calculating the strength to excess situation. When the expectation on the contribution of the behaviour to a variable ($\Delta Expectation_{h,i}$) is higher than the need felt by the agents for that variable ($\Delta Need_i$). If we think that a habit gains more strength if it is more adequate to the situation, then it is easy to understand that if the situation is not most adequate to certain habit, that habit shouldn't gain strength by the circumstance and the motivational strength should be penalty on the excess situation for each variable that is expected to regulate in excess. So, the motivational strength for a homeostatic variable i, considering a habit h, is:

$$F^M(h,i) = \begin{cases} \frac{\Delta Expectation_{h,i}}{\Delta Need_i} * 100 & \text{se } \frac{\Delta Expectation_{h,i}}{\Delta Need_i} \leq 1 \\ (2 - \frac{\Delta Expectation_{h,i}}{\Delta Need_i}) * 100 & \text{se } 1 < \frac{\Delta Expectation_{h,i}}{\Delta Need_i} \leq 2 \\ 0 & \text{se } \frac{\Delta Expectation_{h,i}}{\Delta Need_i} > 2 \end{cases}$$

meaning that, if the expectation value is bigger than twice the value needs, then the habit is considered completely inappropriate to that situation and, therefore, the motivational strength for that variable is 0.

In conclusion, to a certain habit h, its motivational strength matches the average of all motivational strengths calculated for the variables that will be regulated through behaviour:

$$F_h^M = \frac{\sum^n F^M(h,i)}{n}$$

where n is the number of variables regulated by the habit h and i is the different variables regulated by habit h.

Selection of behaviour

As it was seen on the previous sections, is described a proposition about the way how a habit should be composed, with an associated plan and strength, and also how the circumstance of the agent's motivational needs might influence the choice of a habit. However, is still needed to indicate in what way the selection of a behaviour is made, considering what was previously stated. According to the previously stated strengths, the selection of behaviour must consider on one hand the strength of habit to each behaviour and on the other hand the strength of motivational circumstances. After considering both strengths, the resulting one is that which will be given to the behaviour at the time of behaviour selection from the agent. To a habit h, the resultant strength F^R is defined by:

$$F_h^R = F_h^H * (1 - \beta) + F_h^M * \beta$$

where β has a value between 0 and 1. After obtaining the resultant strengths for each behaviour, the selection is done by using a probabilistic method, in which each behaviour has a certain probability of being selected. The probability of a behaviour c is defined by relating its resultant strength F_c^R and the total of resultant strengths from all behaviours $\sum F_h^R$.

$$P(c) = \frac{F_c^R}{\sum F_h^R}$$

For example, let us assume that the agent already has expectations on each of the next behaviours - which means that these were already chosen and we have $F_h^H \neq 0$ and $F_h^M \neq 0$ - and have the following resultant strengths:

$$F^R_{h1} = 27$$
$$F^R_{h2} = 40$$

With the presented values, the probability of choosing each of the plans would be:

$$P(h1) = \frac{27}{67} \approx 0.40 \Rightarrow 40\%$$
$$P(h2) = \frac{40}{67} \approx 0.60 \Rightarrow 60\%$$

meaning that the same value of resultant strength might mean different probabilities to certain behaviour, depending on the number of alternatives and their strengths at the same time. At last, to select a behaviour is determined a random number between 0 and 100. The determined number will match one of the behaviours (plans) and that will be the one chosen.

Note: as can be obviously deduced by the selection of behaviour, the using of this model forces that every inexperienced behaviour by the agent has an habit strength higher than 0 ($F^H_0 > 0$) since, by never being experienced, there is no expectation, which results on a motivational strength equal to 0 ($F^M = 0$). If the strength of habit and the motivation strength are both 0, the resultant strength (F^R) will also be 0, meaning that the probability of selection of a behaviour ($P(c)$) is also 0. So, when calculating the resultant strength it should always be added a values γ[2] bigger than 0. Therefore, the strength of habit, at the moment of the calculation of the resultant strength will be:

$$min(F^H + \gamma, 100)$$

The highest the value chosen for Y, more strength will have a never before selected behaviour.

4 Evaluation

This chapter describes the evaluation done on the implementation of the Haps model. The main goal was to understand if the model's implementation could transmit the concept of habits' existence in characters. Another goal was try to understand if the characters' behaviour was credible using the same model. The experience was done on generated simulations with and without the Haps model implemented on the FAtiMA[4] architecture, on a specific scenario.

The created simulation scenario is based on the definition of two agents with a specific set of homeostatic variables, each of them has a distinct profile, and they share the same space, without interacting directly with each other. Each simulation allowed extracting information, with the registration of events and dada, throughout time. That information was later used to generate diagrams, giving graphically the status and the behaviour of the agents throughout the simulation. The evaluation of both simulations was done through a quiz to each one of them, obtaining two independent samples, in a total of 35 participants with ages under 34 years old. To each of the simulations was created a quiz where was asked that the participants analysed the behaviours of both characters, through the diagrams and identified habits on their behaviour, if they consider that such habits existed. It was also requested that each participant indicated the degree of agreement (Agree completely; Agree; neither agree nor disagree; disagree; disagree completely) regarding several aspects of the characters' behaviour and its credibility.

Habits

On the first case, without model, the ideal result would be for the participants to say that they did not detect any habit but even without the model, the participants indicated some situations as being n habit on behaviour. Still, this situation might not be good in comparison to the defined

[2]defined on the implementation

model. On the second case, with model, to verify habits, marked by the participants, were or not correct, it was necessary to select the more significant habits at the end of the simulation, meaning, those that stood out for having a higher strength of habit than the others possible of being considered habits. In this way, were compared the number of habits indicated on the first situation with the "correct" number of habits indicated on the second one. As the sample to each of them is lower than 30, the statistic test of Mann-Witney U is used to compare the differences between the results of each situation.

	Descriptive Statistics		Differences between
	Without model (N=19)	With model(N=16)	Mann-Whitney samples
Habits	Median[Quartiles]	Median[Quartiles]	U = 69.000
	1[0,2]	3[1,5]	p = 0.002 (< 0.01)

Table 1: Mann-Whitney statistics to both samples

The Table 1 shows the application of the Mann-Whitney method to compare the total number of habits from both samples removed from the quizzes. As we can see there is a significant difference ($p = 0.002$) between both samples, with 99% of trust, which allows us to say that, by the obtain answers, that the model seems to have helped the participants to observe habitual behaviours on the characters.

Credibility

The other important point of analysis was the credibility that each participant gives to the characters. According to the degree of agreement indicated (Agree completely; Agree; neither agree nor disagree; disagree; disagree completely), the participants of the evaluation of the simulation with the model did not found a higher level of credibility for both characters than the participants who evaluate the simulation without the model.

Simulation	Disagree completely	Disagree	Neither agree nor disagree	Agree	Agree completely
Without model (N=19)	0%	21%	21%	53%	5%
With model (N=16)	0%	23%	23%	41%	11%

Table 2: Statistics of the answers about Pedro's levels of credibility

Simulation	Disagree completely	Disagree	Neither agree nor disagree	Agree	Agree completely
Without model (N=19)	27%	27%	19%	27%	0%
With model (N=16)	0%	31%	25%	37%	7%

Table 3: Statistics of the answers about Joao's levels of credibility

To confirm the possible difference of credibility between the different simulations were made statistic tests for Pedro and Joao. In order to do so, there were given the following values to the levels of agreement: (-2) Disagree completely; (-1) Disagree; (0) Neither agree nor disagree; (1) Agree; (2) Agree completely;

Just as previously, was made the Mann-Whitney statistic test for both situations. First, it was verified in Pedro's case if the level of agreement was smaller in the simulation with the implementation of Haps. The Mann-Whitney test indicated a value of p= 0.44, which is superior to 0.05, which means that is possible to conclude that the implementation of the model did not harm the credibility level on the simulation. Next, for Joao's case, it was verified the hypothesis that in the system with the model of habits the level being superior to the one without model. On the statistic test, was obtained a value of p= 0.043, smaller than 0.05, which implies that we can say that, statistically with a trust of 95%, that the simulation with the habits' model increased the system's level of credibility.

5 Final remarks

The goal of this essay was a proposed model to the adoption of habits from the synthetic characters. Through the evaluation, we obtained on what way external observers analysed the behaviour and detected the concept of habit. The evaluations were done through two quizzes, one for a simulation with the model and other for a simulation without the model, where the participants indicated which habits had recognized and the credibility of behaviour of the characters on an agreement scale. The statistic analysis made regarding the number of detected habits seems to indicate some advantage of using the model for both agents. However, according to the participants, regarding the credibility level, the advantage is not very evident, being visible only on one of the agents. In conclusion, the analysis done suggests that the model is adequate to an external observer. Sometimes, the use of the model might lead to an increase on the perception of credibility.

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