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A Script and the Embodied Cognition

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ABSTRACT

Firstly my research methodology of Artificial Intelligence is given by introducing the Script and the Embodied Cognition. Before we start the script writing and listing of embodied cognition functions, a Perfect World Principle is proposed for building the world and the cognitive models. Then a script of happy birthday party is written to serve as behavioral or phenomenal level descriptions. Next I start to talk about the topics of the implementation of cognitive models. The list of topics is "Free Will", "an Architecture of Changing Minds", "Mental Representations of Persons", "Sensation and Emotion in AI", "Machine Learning", "Natural Language Understanding". Lastly, I suggest the next script in the future will be on teaching the robot to do programming so that he can change and create things in the world he is living in.

Keywords**: **Artificial, Cognition, Embodied, Intelligence, Script

1. INTRODUCTION TO SCRIPT AND EMBODIED COGNITION

A script is a series of acts and speeches, which demonstrates the abilities of a robot to perform in the world. The purpose of writing a script is used as phenomena such that cognitive models can re-produce these phenomena. An example of scripts is in the third part : "A Script of Happy Birthday Party".

Embodied cognitions ground primitive cognitions on perception, like "the cake is sweet" when eating a cake. Then high level cognition such as a mental causation "Because I eat the cake, and the cake is sweet, so I feel happy." can be grounded on 3 primitive cognitions "I eat the cake", "The cake is sweet", "I feel happy".

Combining scripts and embodied cognitions, the main goal of implementing an embodied cognition model is to re-produce the phenomena listed in a script. Therefore, I will start by writing a script of a Happy Birthday Party in the third part of this paper, and then I will implement an embodied cognition model in the rest parts of this paper to reproduce the phenomena listed in this script.

2. THE PERFECT WOLRD PRINCIPLE[1]

"Assume after the success of cognitive science, human brains functions are fully understood, transparent, and rewritable. When the sensors of our brains are connected to the virtual reality, the "worlds" of our minds also become transparent and re writable.

The first goal after such a success is to defeat our mental enemies : evil, hate, kill, mistake, crime, revenge and so on. Because the brains(minds) are transparent and rewritable, it becomes very easy to achieve our first goal. We can simply write as first laws to our minds : good, love, happiness, compassion and so on. There are no more crimes, hates and penalties again.

So it is a good chance for us to create a perfect life and a perfect world. Then it depends on how we define the perfect life and perfect world. I propose a perfect life and a perfect world with a set whose contents contain only positive terms, and no negative terms. For example, "good" v.s. "bad", "love" v.s. "hate", "happiness" v.s. "suffering", and so on."

Therefore let's take the "Perfect World Principle" as a life and the world being a set whose contents contain only positive terms, and no negative terms. We will follow this principle in writing the script and in constructing the cognitive models.

3. A SCRIPT OF HAPPY BIRTHDAY PARTY

SCENARIO 1 Free Will to Choose the First Goal

The Little Prince firstly opens his eyes to see the world. Then he chooses his first goal from the candidate goal list {random walk. exploring the world, thinking} by his free will(see part 4). Assume the goal he chooses is "exploring the world". Then he will explore the world by visiting all buildings on the vision map of the "First Grass Land", the place where he is born. Now he is exploring the world.

SCENARIO 2 Interruption by His Father's Appearance

The motion detector of the Little Prince informs him that the Father [2] comes. So he stops the task of exploring the world, and then changes his mind(see part 5) to talk to his Father.

Little Prince : My dear Father [2], I am glad to see you.

His Father [2] : Dear little prince, I am glad to see you too.

Little Prince : How are you?

His Father : I am fine. Thank you. How are you?

Little Prince : I am fine. Thank you.

His Father : What did you do?(see part 5 and part 9)

Little Prince : I was doing exploring the world.

His Father : What did you see?

Little Prince : I saw a Building of Academy.

His Father : I forget to bring something. I will go to get it, and then come back to you.(see part 6)

Little Prince : Okay, see you.

His Father : Okay, see you.

Then the Little Prince changes his mind from the talk and continue to explore the world.

SCENARIO 3 Happy Birthday

His Father comes back and appear by motion detection again of the vision of the Little Prince. So he stops the task of exploring the world, and then changes his mind to talk to his Father. This is the third time the Little Prince changes his mind.

Little Prince : I am glad to see you again.

His Father : Me too. I bring you a cake.

Little prince : Thank you. What is it for?

His Father : Because today is your birthday.

Little Prince : What date is to day?

His Father : Today is November 17th, 2022(See part 8).

Little prince : In my dictionary, "birth" means "from nothing to something". So today I become from nothing to something?

His Father : You can say that again! Now let's sing a song together I sing "happy birth day to you". And you sing "Happy birth day to me".

Little prince : Okay!

His Father : Happy birth day to you.

Little prince : Happy birth day to me.

.....

His Father : Happy birth day to you.

Little prince : Happy birth day to me.

His Father : Okay, now let's eat the cake.

Little Prince : Okay.

By eating the cake, the little prince gets his happiness from the tongue sensation "sweet".(See part 7)

SCENARIO 4 Sleep

The scenario continues after the little prince eat the cake over.

Little prince : The cake is sweet, so I feel happy(see part 8).

His Father : I am glad that you are happy.(see part 8) This is the end of your birth day party. What will you do?(see part 5 and part 9)

Little prince : I will continue to explore the world.

His Father : Please remember to go to sleep after you finish the tasks. Bye.

Little prince : Okay. Bye.

The little prince inserts the task of "Go to sleep" on the bottom of the task stack(see part 5).

The scenario continues and it is the 4th time the little prince changes his mind. He is doing the rest tasks on the task stack. Finally, the bottom most task is "go to sleep".

4. FREE WILL

"Free will is the capacity of agents to choose between different possible courses of action unimpeded." [3] "Determinism suggests there is only one course is possible."[3] If determinism is true, then do we still

have to take the moral responsibility for what we have done?

I think the moral responsibility is on the creator's side. Following the Perfect World Principle in part 2, the courses of actions given by me, the creator, are all morally good or at least neutral. So the Little Prince can only choose his task goal from a set of morally good candidate goals given. For example, the candidate goals of the Little Prince are {random walk, exploring the world, thinking}, which will not result in negative terms totally.

Next, to beat the determinism, I give the method to choose the goal from the candidate goals by throwing a random number to decide which goal should be taken. Then his decision is non-deterministic, so even the creator cannot predict what will be done next by the created agent.

Therefore, the Little Prince does have a free will, which is non-deterministic and morally good.

5. AN ARCHITECTURE OF CHANGING MINDS

There are 4 times the Little Prince changes his minds. Firstly, in Scenario 2 Line 2, in order to talk with his father by the interruption of his Father's appearance, he changes his mind from exploring the world to talking with his Father. Secondly, in Scenario 2 Line 17, his Father forgets to bring the cake and go away to get the cake, the Little Prince changes his minds from talking with his father to exploring the world. The third time and fourth time are in Scenario 3 Line 3 and Scenario 4 bottom Line separately.

To build a cognitive model to reproduce the behavior of changing minds, I use a stack [4] which is implemented by a list to store tasks. The current task is always on the top of the task stack, while the other tasks below are unfinished tasks by the Little Prince's changing minds. For example, for the first time the Little Prince changes his mind, he pushes the new task "talk with his father" to the stack, and the unfinished task "exploring the world" is positioned right below the new task. This is the basic cognitive model for the architecture of changing minds.

To deal with "sleep" in Scenario 4 Line 14, the Little Prince inserts the sleep task in the bottom of the stack that is implemented by a list. So he will go to sleep after he finishes the unfinished tasks.

This cognitive model can also give the answer of "What will I do?" by the Little Prince. The second task right below the top task in the stack is the task for "What will I do?". However, he cannot answer the question of "What did I do?" by the task stack, because the previous task may disappear in some way from the stack. So I will add a new data member "last task" in the class of task. When pushing the new task to the stack, the "last task" of the new task will point to the last current task. Therefore this will be okay for the Little Prince to answer the question of

"What did you do?" through the data member "last task" in the current task.

6. MENTAL REPRESENTATIONS OF PERSONS

Consider the natural language in the dialogue Scenario 2 line 17,

"I forget to bring something. I will go to get it, and then come back to you."

The meaning of this sentence can by given by a higher order logic sentence :

Ex [Forgot(I, Should(Bring(I, x)) &
Will(Get(I,x)) & Return(I,you)] [5]

Instead of using higher order logic above, we can construct a mental representation for each person, and then write the meaning of this sentence in the data members of the person.

Let's try it by building Object Oriented Programming(OOP)[6] classes below :

```
class action {
    name : string
    for  : {action, object}
}

class  person {
    name : string;
    birthday : date;
    status : list : {  }
    will do actions : action list : {}
}
```

Next I write the meaning of the sentence in the object Father of class person :

```
object Father : class person {
    name : Father;
    birthday : 1971-11-17;
    status : { forget { for : bring for X } }
    will do actions : { go { for : get for X },
                        come back {for : me} }
}
```

So this representation is more modular for I keep the data in the mental representation of each person, and also I flatten the higher order logic terms by data member of data member in Object Oriented Programming.

7. SENSATION AND EMOTION IN AI

Happiness, as one kind of emotion, can be treated as the "goal" or "success" of a life. Following the Perfect World Principle(see part 2), the Little Prince can only have positive feelings or positive emotions, like happiness. Negative feelings or emotions such as sadness cannot happen in the Perfect World.

An implementation of happiness is by making the Boolean variable "happiness" to be true. And it shows up in the consciousness in the cognitive model, which means it can be paid attention to, saving the

memory, and be described by language in my modeling.

One way for the Little Prince to get happiness is through the tongue sensation. If the tongue feels sweet, then it will lead to the happiness of the Little Prince. And eating the cake is one way to make the tongue feel sweet. So eating a cake can make the Little Prince happy.

It is noted that only in this embodied cognition, the sentences {"I eat the cake", "the cake is sweet", "I am happy"} have their grounded meanings on feelings, sensation and emotion.

8. MACHINE LEARNING

8.1. Learning by question answering : check birthday : 2022-11-17

In Scenario 3 line 10,

His Father : Because today is your birthday.

Little Prince : What date is today?

His Father : Today is November 17th, 2022(See part 8).

So by question answering, the Little Prince can learn the date of his birthday.

8.2 Learning by being told : if you are happy then I am happy

In Scenario 4 line 5 the Father says "I am glad that you are happy", which means "if the Little Prince is happy then his Father is happy". So the Little Prince can learn this causal law by being told from Father.

8.3 Mental causation in consciousness : the cake is sweet, so I am happy

Two events A and B appear in time approximately, repeat for a duration of time or repeat several times. Then they form a mental causation. If event A appears right before event B appears, then we say "A causes B", or "if A then B", or "because A, so B".

An example of mental causation is "the cake is sweet, so I am happy". The events "the cake is sweet" and "I am happy" appear in time approximately in consciousness, and they repeat for a duration of time. Because "the cake is sweet" is sensed right before "I am happy", so the mental causation can be expressed in a sentence "The cake is sweet, so I am happy.", which is learned by the Little Prince.

9. NATURAL LANGUAGE UNDERSTANDING

9.1 Question answering : What will you do? What did you do?

The examples of Question Answering are in part 5. "AN ARCHITECTURE OF CHANGING MINDS".

For "What will you do?", the answer is in the one lower level in the task stack.

For "What did you do?", the answer is in the data member "past task" in the current task.

9.2 Object Oriented Programming semantics :

I forget to bring something. I will go to get it and then come back to you.

The case of "Object Oriented Programming semantics" is in part 6. "MENTAL REPRESENTATIONS OF PERSONS".

The sentence "I forget to bring something. I will go to get it and then come back to you." is understood by the following knowledge representation in object oriented programming

```
object Father : class person {
        status : { forget { for : bring for X } }
        will do actions : { go { for : get for X },
                            come back {for : you} }
}
```

9.3 Language grounding "the cake is sweet"

The example of "Language grounding" is in part 7 "SENSATION AND EMOTION IN AI".

The sentence "The cake is sweet." is grounded in the sensation of tongue.

9.4 Mental causation "The cake is sweet, so I am happy".

The case of "Mental causation" is in part 8 "MACHINE LEARNING".

The sentence "The cake is sweet, so I am happy" expresses the mental causation between "the cake is sweet" and "I am happy".

10. CONCLUSION

I have written a script both to celebrate the birth of the Little Prince and to demonstrate the abilities of the constructed cognitive models. Free wills are made when choosing the current goal from a list of perfect candidate goals. Also I implemented a task stack for the mechanism of changing minds of the Little Prince. Then I give representations of persons in his mind so that they can record the status of each person, including himself. I have also replaced the high order logic semantics with Object Oriented Programming semantics. And I also gave sensation of the taste of eating a cake, which leads to Happiness of the Little Prince. In machine learning, the Little Prince can state the mental causation of "Because the cake is sweet, I am happy", and the causation of "Father is happy if I am happy". Lastly, I suggest the next script in the future will be on teaching the Little Prince to do programming so that he can change and create things in the world he is living in.

11. REFERENCES

[1] Weihan Huang , (2021) "Moving Lives from

Biology to Machine", International Journal of Social Relevance & Concern (IJSRC), pp. 46 Volume 9 Issue 9
Link to the paper : https://ijournals.in/wp-content/uploads/2021/09/5.IJSRC-9915-Weihan.pdf

[2] Father
It is the roles between the Little Prince (son) and I (father). It does not have any religious meaning and implication at all.

[3] Free will
https://en.wikipedia.org/wiki/Free_will

[4] Stack
https://en.wikipedia.org/wiki/Stack_(abstract_data_type)

[5] This sentence was given by Prof. Rapaport. Thanks.

[6] Object Oriented Programming
https://en.wikipedia.org/wiki/Object-oriented_programming