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A Cognitive Architecture Consisting of Human Intelligence Factors

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Abstract

While there are many types of cognitive architectures available today, one thing common to all of them is the need to cover the maximum number of the human intelligence factors used for solving various tasks. However, the currently existing cognitive architectures were developed based on a variety of aspects other than the human intelligence factors. One famous model of human intelligence factors is the CHC model which is studied in psychology. When it is used as the basis of a new cognitive architecture, the architecture will cover all the known human intelligent factors used for solving various tasks. In this paper, we propose a new cognitive architecture for dialogue situations based on the CHC model as the first step towards the formation of a comprehensive cognitive architecture. We will also outline the initial architecture using a case study.

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Keywords: Cognitive Architecture, CHC model, Intelligence Factor, Dialogue

1 Introduction

Research into cognitive architectures aimed at the creation of artificial intelligence that would work on and handle tasks in manners similar to human beings has been ongoing for many years, with a variety of different approaches being taken. For example, the ACT-R model[1] uses production rules that require cooperation among several modules, while CogPrime[3] uses numerous cognitive processes cooperating with atom space, which includes large amounts of knowledge. In addition, the LIDA model[2] uses numerous memories cooperating within a global workspace. These examples show that the existing cognitive architectures were developed on the basis of different aspects, so it is difficult to say which is the best. Indeed, we cannot even say whether the existing cognitive architectures cover all of the human intelligence factors used for solving various tasks, which is one of the fundamental requirements of a comprehensive cognitive architecture.

Over the years, psychology researchers have made numerous efforts to identify human intelligence factors. Of these, the CHC model[6] of intelligence factors based on the integration theory of intelligence is one of the most well known for showing human intelligence factors.

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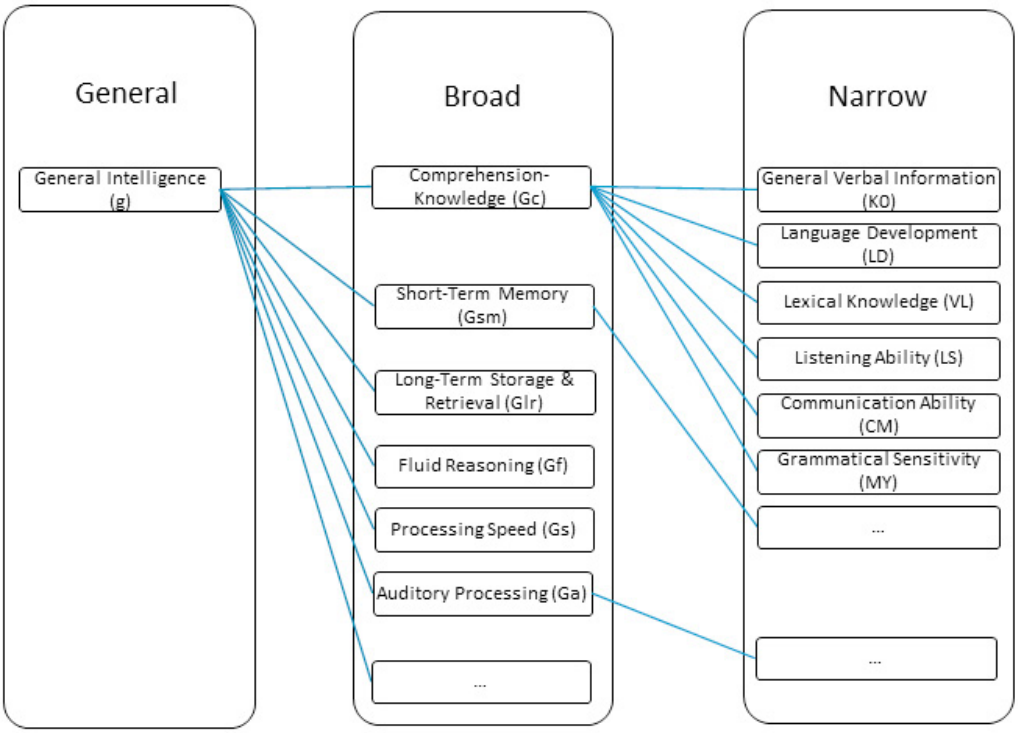

Figure 1: CHC model

Since the CHC model classifies factors used for human intelligent activities, it can be assumed that the model covers all related factors. Furthermore, while it is true that this model can be used for evaluating the existing cognitive architectures [4], if we want to build a cognitive architecture that covers all of the intelligence factors included in the CHC model, it would naturally be more logical to use the model directly when creating the new cognitive architecture.

With that point in mind, herein we propose a new cognitive architecture based on the CHC model, one of the advantages of which is, since we can directly map cognitive architecture components to human intelligence factors, we can guarantee that the cognitive architecture includes those factors. However, since there are numerous complicated factors in the CHC model, it will take significant amounts of time and effort to create an architecture that includes all of them. Therefore, as the first step towards the formation of a comprehensive cognitive architecture, this paper reports on an analysis of CHC model factors related to dialogue, and the creation of the initial cognitive architecture components for that factor.

The rest of this paper is organized as follows. We will briefly describe the idea behind the CHC model in Section 2. Next, we will analyze the CHC model in order to create a cognitive architecture for dialogue in Section 3. Then, we will discuss our approach using a case study in Section 4. Finally, we will give our conclusions in Section 5.