

THE RESEARCH PROGRAMME OF COGNITIVE SCIENCE.

Cognitive science is *characterised* by its research programme and *motivated* by its research paradigms. The research programme is a set of interrelated assumptions about the nature of intelligence or cognition on which there is substantial international consensus in the sense that these assumptions are being considered the ones to agree or disagree about when dealing with the nature of cognitive science. I shall briefly describe the research programme and explain the motivational mechanism mentioned. The programme can be summarised in 9 points, as follows.

(1) Intelligence or cognition is physically realised or implemented. But there is a central level of analysis in addition to the level of physical implementation, and that is the description of cognitive systems as systems for the manipulation of information in the form of representations of reality. It is for the future to decide whether and to what extent the level of representations can be reduced to the level of physical implementation.

(2) Widely different types of physical implementation are in principle capable of manipulating the same representations in the same way. A simple inference from, say, the facts that proposition A is true and that proposition B is true to the fact that the proposition "A and B" is true, can be implemented in silicon chips, in optical, mechanical, and hydraulic devices as well as in complex organic molecules and in living biological systems.

(3) Artificial, i.e., non-biological intelligence is therefore possible in principle. This implies that cognitive science includes the study of both biological and artificial intelligence as well as the study of abstract intelligence in logic, probability theory, and similar domains. It is unknown whether human intelligence can be practically realised in artificial systems.

(4) The level at which some cognitive system is described as manipulating representations is irreducible to:

- (a) The physical implementation of the system (cf. (1) above);
- (b) the behaviour of the system, i.e., behaviourism is false;
- (c) possible conscious experiences had by the system, as already proposed by Helmholtz.

(5) Cognitive science is mechanistic (cf. (1) above). This point is seen as provoking by many people, just as Darwinism created quite some stir by maintaining that humans are the descendants of apes.

(6) A full-scale cognitive system consists of a number of cooperating sub-functions for perception, memory, thinking, language understanding, action, etc. A description of, or a blueprint for, the system comprising its functionality

and information processes and their implementation is a complete description. This is a version of "functionalism" which co-emphasises the importance of studying implementational mechanisms.

(7) In many different respects, both historically and with respect to scientific substance and methodology, cognitive science is inconceivable without the computer and the study of computation in computer science and artificial intelligence (including artificial neural nets).

(8) Cognitive science is multidisciplinary, comprising core disciplines such as cognitive psychology, cognitive neuroscience, linguistics, logic, and the philosophy of mind and language as well as related disciplines such as computer science, mathematics, physics, engineering, anthropology, and others. These disciplines all apply their specific methods in order to contribute to the construction of common models and theories of cognitive functions and sub-functions.

(9) Cognitive science exemplifies a new combination of basic and applied research. The new, characteristic feature is that information technology defines a large number of new, potential applications whose practical realisation typically requires substantial basic research. Applicational aspects include:

(a) the development of intelligent systems components for, e.g., vision, speech, natural language dialogue, robotics, reasoning, and decision making;

(b) research on human-computer interaction;

(c) the development of prostheses for defects in the human cognitive system.

Cognitive scientists are not motivated by this research programme. In their scientific practise and they are usually not required to reflect on it. Their motivation stems from the fact that the programme actually works. That the programme works is demonstrated by the emergence of a wealth of results on cognitive information processing and its implementation in terms of data, models, theories, simulations, and working technological systems to which the disciplines involved are contributing in increasingly close collaboration. The best of these results establish concrete paradigms which serve to inspire further investigation.

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