































$F$		
$F \vee H \rightarrow G$		
$G \rightarrow K$	38.9	33.9
$K \vee L$		

Rips thinks about the development of PSYCOP as a universal deductive theory, containing e.g. rules for modalities (the ghost of *mathesis universalis* seems to be invincible.)

## 5. An outlook

What are the results of our “stocktaking” of logical investigations concerning human reasoning within psychology? The situation we have met resembles the one of an earlier excursion to artificial intelligence (cf. [19]). The specialists investigate classes of systems which are well known in logical literature for a couple of years. The logician finds with a blend of amusement and respect that parts of the logical apparatus, relevant to the problems under investigation, are, so to say, reinvented on overdrive. This way highly interesting examples, metaphors and formulations appear.<sup>4</sup> Rips’ above mentioned monograph ([17]) ends in 1994 somewhere between non-monotonic reasoning and knowledge revision. As a hole, one is convinced about ones own approaches; critical remarks are hardly ever noticed. In Rips, for instance, there is no discussion at all of the fundamental critique of the possibility of a description of human thinking by means of abstract symbol manipulation.<sup>5</sup> In logical psychology, one prefers to stay in the realm of what John Hauge-land called Good Old-Fashioned AI.

All this leads to the conviction that these investigations of psychologists are — from our point of view — the far less interesting part of the contribution of psychology. Even if it were possible to develop a deductive calculus widely applicable to human reasoning (and, PSYCOP is a fairly promising candidate for that aim), this would not yield any of the expected essentially new stimulation for logic and artificial intelligence. What really is of interest is not the work of the logically inclined psychologist *qua* logician, but

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<sup>4</sup> There are curious examples revealing the different standards in both psychology and in logic. For instance, when Rips gives no less than four references to prove the elimination of double negation in classical, while being incorrect in intuitionistic logic. [17, p. 378]

<sup>5</sup> “After fifty years of effort, however, it is now clear to all but a few diehards that [...] the research program based on the assumption that human beings produce intelligence using facts and rules has reached a dead end, and there is no reason to think it could ever succeed.” [6, p. ix]

*qua* psychologist. It is far from obvious whether — in order to get findings about hidden thought processes — one should directly model empirical data by logical means, or to try to better understand these processes through further psychological analysis and neurological investigations first. (It might be very enlightening, e.g. to understand the transition from deduction to reasoning by means of mental “pictures”, which in some situations seems to be much a more effective method of problem solving.)

One has to confess, of course, that similar questions are far away from getting precise and useful answers. Contemporary investigations concern problems of how the most primitive organisms realize very simple memory processes. The favorite object of investigations is *Aplysia Californica*, a naked snail with altogether 20.000 neurons. That is the amount contained in one thousandth of a gram of human brain substance.

The methodology of experimentation on the open human brain seems to be not yet fully developed. The extreme complexity of the matter can hardly be overestimated. For example, in order to find out the relevant areas in brain surgery one encircles them by touching some place on the cortex and asking the patient what effect this has. Some neurosurgeons are astonished by the observation that touching “the same point” of the cortex twice brings about quite different reminiscences from e.g. the patient’s childhood. This recalls the traveller who wonders why during each visit to N.Y.C. he meets different people on Times Square. The only encouraging fact I can see so far follows from Rips’ investigations on the PSYCOP system. One has the clear impression that here one found some regularity. In other words, one must probably accept a hidden connection between the psychological process of deductive reasoning and a formal calculus which by far exceeds casual correlation.

One conclusion is certainly reasonable: the investigation of the mechanism of human thinking is *par excellence* an interdisciplinary problem. As such, it should be best advanced within cognitive science.

### References

- [1] Ajdukiewicz, K., “Klasyfikacja rozumowań”, *Studia Logica* 2 (1955), 278–299.
- [2] Braine, M. D. S., “The ‘natural logic’ approach to reasoning”, in: Overton (ed.), *Reasoning, Necessity, and Logic: Developmental Perspectives*, Erlbaum 1990.
- [3] Braine, M. D. S., B. J. Reiser, and B. Romain, “Some empirical justification for a theory of natural propositional reasoning”, in: Bower (ed.), *Psychology of Learning and Motivation*, vol. 18, Academic Press 1984.



- [4] Cheng, P. W., and K. J. Holyoak, “Pragmatic reasoning schemas”, *Cognitive Psychology* 17 (1985), 391–416.
- [5] Cosmides, L., “The logic of social exchange: Has natural selection shaped how humans reason?”, *Cognition* 31 (1989), 187–276.
- [6] Dreyfus, H. L., *What Computers Still Cant’t Do. A critique of artificial reason*, The MIT Press Cambridge, Mass., London 1992.
- [7] Frege, G., *Grundgesetze der Arithmetik*, Jena 1893–1903.
- [8] Husserl, E., *Logische Untersuchungen*, Halle 1900–1901.
- [9] Jackson, S. L., and R. A. Griggs, “The elusive pragmatic reasoning schemas effect”, *Quarterly Journal of Experimental Psychology* 42A (1990), 353–373.
- [10] Johnson-Laird, P. N., and R. M. J. Byrne, *Deduction*, Erlbaum 1991.
- [11] Lehman, D. R., R. O. Lampert, and R. E. Nisbett, “The effects of graduate training on reasoning”, *American Psychologist* 43 (1988), 431–442.
- [12] Morgan, J. J. B., and J. T. Morton, “The distortion of syllogistic reasoning produced by personal convictions”, *Journal of Social Psychology* 20 (1944), 39–59.
- [13] Morris, M. W., and R. E. Nisbett, “Tools of the trade: Deductive schemas taught in psychology and philosophy”, in: Nisbett (ed.), *Rules for Reasoning*, Erlbaum 1993.
- [14] Newell, A., “Reasoning, problem solving, and decision process. The problem space as a fundamental category”, in: R. S. Nickerson (ed.), *Attention and Performance VIII*, Erlbaum 1980.
- [15] Newell, A., J. C. Shaw, and H. A. Simon, “Empirical Explorations with the Logic Theory Machine: A case study in heuristics”, in: *Proceedings of the Western Joint Computer Conference* 1957.
- [16] Osherson, D. N., *Logical Abilities in Children*, vol. 1–4, Erlbaum 1974–1976.
- [17] Rips, L. J., *The Psychology of Proof. Deductive Reasoning in Human Thinking*, MIT Press 1994.
- [18] Stelzner, W., *Epistemische Logik*, Akademie Verlag, Berlin 1984.
- [19] Urchs, M. P., “Artificial causality”, in: Faye, Scheffler, Urchs (eds.), *Logic and Causal Reasoning*, Akademie Verlag, Berlin 1994.

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