

Linköping Studies in Science and Technology
Thesis No. 2264

Empirical Studies in Machine Psychology

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Preface

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CHAPTER 1

Introduction

CHAPTER 2

Background and Preliminaries

CHAPTER 3

Operant Conditioning

3.1 Introduction

Operant conditioning is a type of learning that can be observed in most species, from fruit flies [1], invertebrates [2], to rats [3] and human beings [4].

3.2 Method

3.3 Results

3.4 Discussion

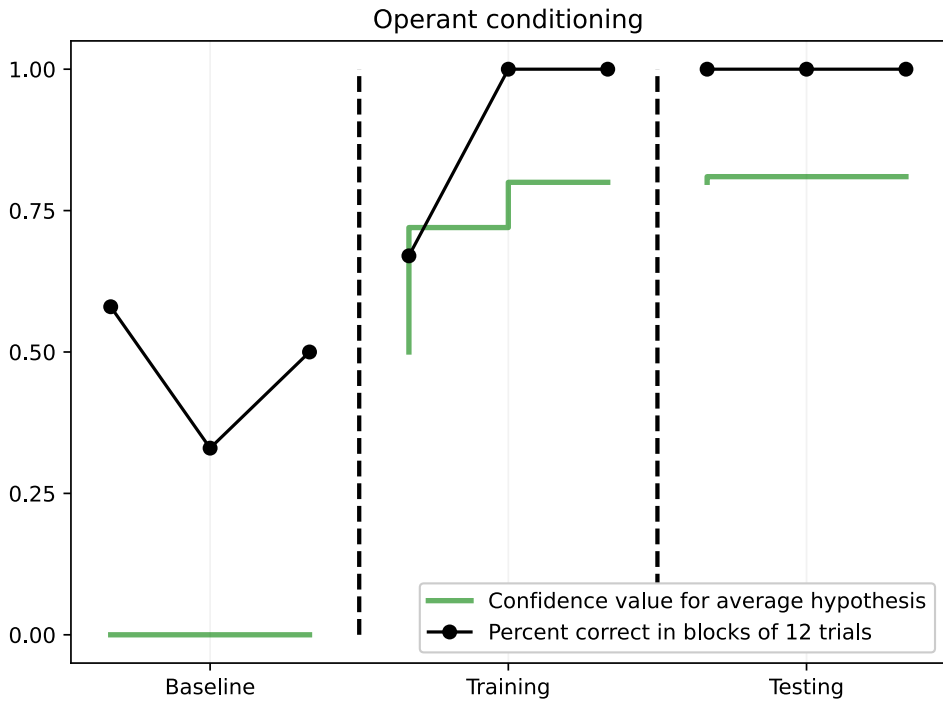


Figure 3.1. Learning in the form of operant conditioning. Dots illustrate the percent of correct in blocks of 12 trials. The solid line shows the NARS confidence value for specific hypotheses.

CHAPTER 4

Generalized Identity Matching

4.1 Introduction

4.2 Method

4.3 Results

4.4 Discussion

The results from the four phases are illustrated in Figure 4.1.

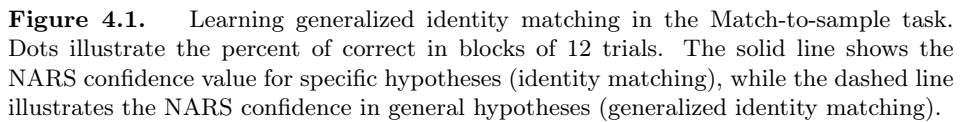


Figure 4.1. Learning generalized identity matching in the Match-to-sample task. Dots illustrate the percent of correct in blocks of 12 trials. The solid line shows the NARS confidence value for specific hypotheses (identity matching), while the dashed line illustrates the NARS confidence in general hypotheses (generalized identity matching).

CHAPTER 5

Stimulus Equivalence

5.1 Introduction

5.2 Method

5.3 Results

5.4 Discussion

CHAPTER 6

Beyond Equivalence

6.1 Introduction

6.2 Method

6.3 Results

6.4 Discussion

CHAPTER 7

Conclusions and Future Work

7.1 Conclusions

7.2 Future Work

Bibliography

- [1] HA Mariath. “Operant conditioning in *Drosophila melanogaster* wild-type and learning mutants with defects in the cyclic AMP metabolism”. In: *Journal of insect physiology* 31.10 (1985), pp. 779–787.
- [2] Björn Brembs. “Operant conditioning in invertebrates”. In: *Current opinion in neurobiology* 13.6 (2003), pp. 710–717.
- [3] Burrhus Frederic Skinner. *The behavior of organisms: An experimental analysis*. BF Skinner Foundation, 1938.
- [4] Jan De Houwer and Sean Hughes. *The psychology of learning: An introduction from a functional-cognitive perspective*. MIT Press, 2020.