The Dynamics of Reasoning: Chronometric Analysis and Dual-Process Theories

Linden J. Ball

Department of Psychology

LANCASTER
UNIVERSITY

DUAL-PROCESS THEORIES AND THE FLOW OF CONTROL

- **Dual-process theories differ in their specification of the flow of control between System 1 and System 2**

- **Some theories emphasise *sequential* progression from System 1 to System 2**

- **Other theories describe parallel streams of processing that *compete* for control**

Sequential flow from System 1 to System 2?

OR

Competition between System 1 and System 2?

Sequential Control in the Selection Task: The Heuristic–Analytic (H–A) Theory

Evans and Over (1996)

STAGE 1

System 1
heuristic processes
determine what is
'relevant'

STAGE 2

System 2
analytic processes
act on
relevant task features

Indicative Selection Tasks

'Matching' and 'If'
heuristics determine
card relevance

Deontic Selection Tasks

Cards that could reveal
a costly outcome have
high 'goal relevance'

In selection tasks
analytic processes
rationalise decisions
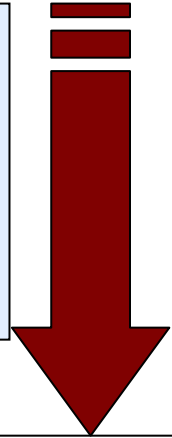made on the basis of
heuristics

System 1 provides default responses

System 2 tends to rationalises default responses for both indicative and deontic selection tasks

Competetive Control in the Selection Task: Alternative Task Construals

Stanovich and West (1998, 2000)

System 1 cues a **contextualised** task construal based on pragmatic processes

System 2 cues a **decontextualised** task construal based on rule-based processes

Indicative Selection Tasks

Both systems cue opposite responses, and System 2 differentially cues those of higher analytic power who can inhibit System 1 responding

Deontic Selection Tasks

Both systems cue the same response, therefore no cognitive ability differences

Downplays the **rationalising** role of System 2

Emphasises System 2's potential to produce **normative** task construals

System 2 over-rides default responses in a minority of individuals on the **indicative task**

Can Empirical Data Distinguish Between Sequential and Competition Accounts?

Evans (1996), Roberts (1998), Ball et al. (2005)

CHRONOMETRIC EVIDENCE AND DUAL-PROCESS THEORIES

- **Differentiating between sequential-processing versus competitive-processing accounts is difficult using card-selection data**

- **Chronometric analysis using response latencies and inspection times is more useful**

- **E.g., card inspection-time studies have clarified the nature of dual-system involvement in indicative and deontic selection tasks**
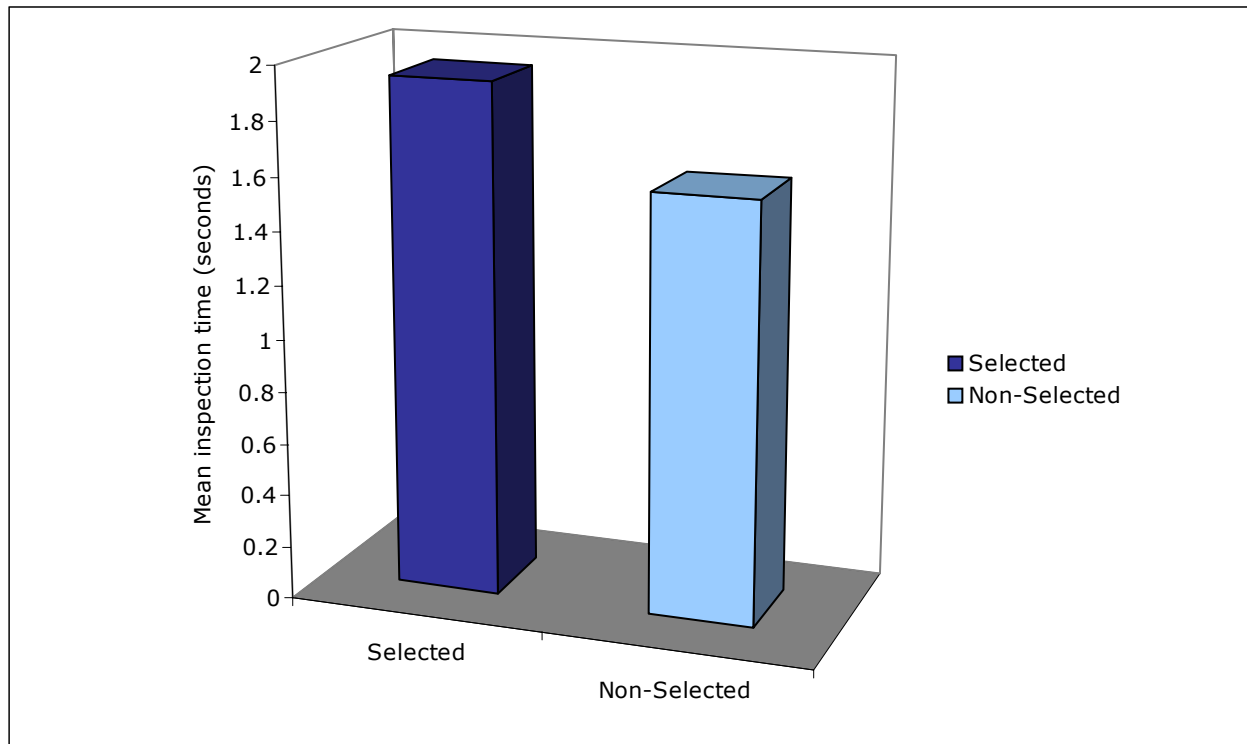
Response latencies

Inspection times on task components (e.g., cards)

Fixation durations

Chronometric Studies of Indicative Selection Tasks (Negations Paradigm)

Ball et al. (2003)

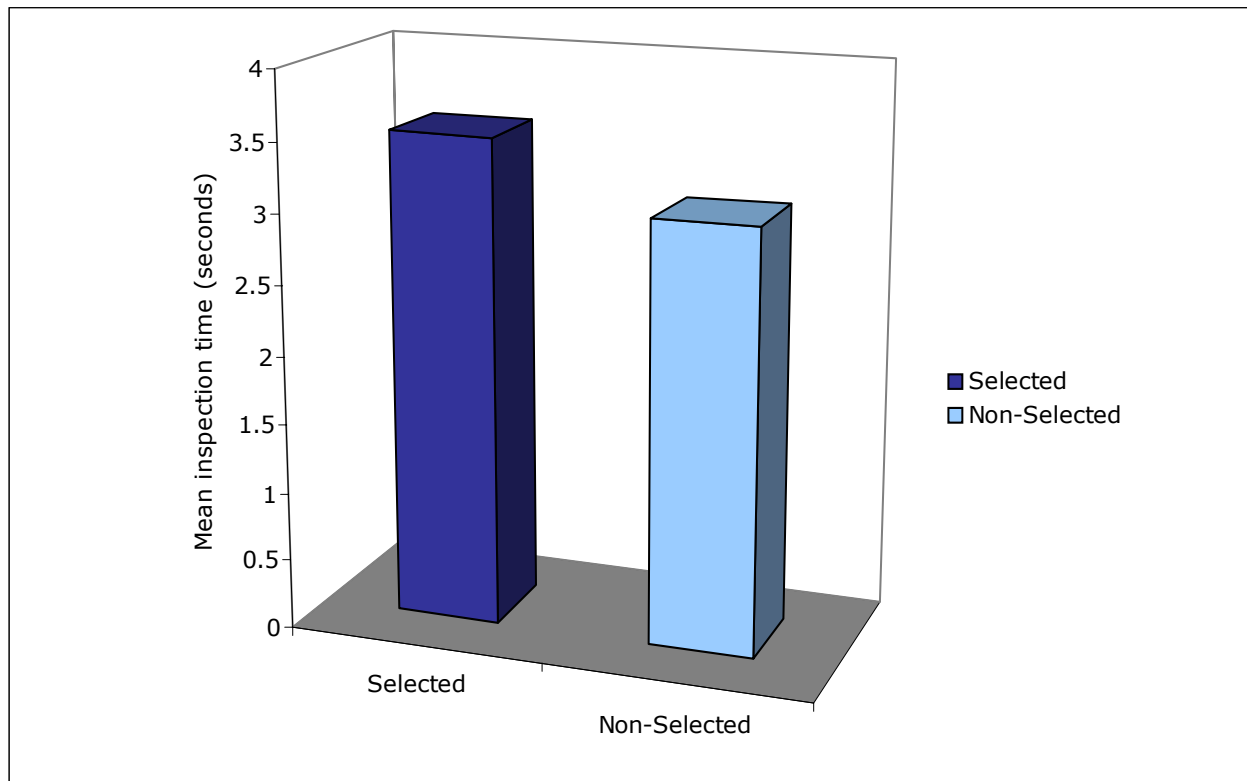**MEAN CARD INSPECTION TIMES IN INDICATIVE TASKS**

Selected cards inspected for **longer** than rejected ones

Magnitude of inspection-time effect: **0.36 s**

Chronometric Studies of Deontic Selection Tasks (Inc. Social Contract Problems)

Ball et al. (2005)

MEAN CARD INSPECTION TIMES IN DEONTIC TASKS

Selected cards inspected for **longer** than rejected ones

Magnitude of inspection-time effect:
0.48 s

Conclusions

The flow of control?

IMPLICATIONS FOR SEQUENTIAL-PROCESSING VS. COMPETITIVE-PROCESSING THEORIES

- The similar magnitude of the inspection-time effect for indicative and deontic tasks suggests a role for System 2 in rationalising heuristically-cued response

- Accounts emphasising rationalisation seem to fit better within a sequential processing framework

- Since deontic tasks should produce equivalent System 1 and System 2 responses it is unclear how a competition theory would explain the inspection-time effect on these problems

Sequential-processing accounts may explain inspection-time effects better than competitive-processing accounts

Future Prospects for Chronometric Analyses of Reasoning Dynamics

CHRONOMETRIC TECHNIQUES CAN BE:

- **Extended to examine individual differences in System 1 and System 2 reasoning (cf. Inglis et al., 2006)**

- **Used to examine dual-process accounts of belief bias (e.g., Ball et al., 2006; Thompson et al., 2003)**

- **Combined with verbal protocols to provide converging data on the time-course of System 1 and System 2 processes (Lucas & Ball, 2005)**

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