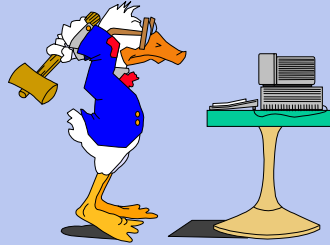


Mind versus Machine: Using Artificial Intelligence for Decision Making by Professional Accountants



Professor Stewart A Leech

Professor of Accounting and
Business Information Systems

The University of Melbourne, Australia



Outline and Aims

A report of research on:

- the development of a knowledge based expert system (KBES) or “intelligent decision aid”, built with the aim of understanding the decision making processes of professional accountants in dealing with companies in financial distress (design science)
- understanding the impact of KBES on professional accountants’ judgments (behavioral science)



Part 1: Design Science

The development of a KBES, built with the aim of understanding the decision making processes of professional accountants (“insolvency experts”) in dealing with companies in financial distress.

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Introduction

- **Artificial Intelligence**
- **Knowledge Based Expert Systems (KBES)**
- **Role of KBES Research in Accounting**

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Building a KBES: Four Stages

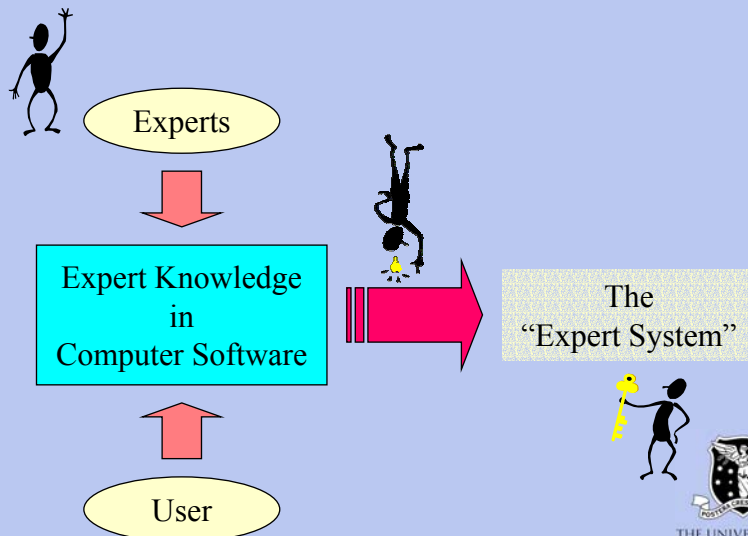
- Acquiring the expert knowledge (knowledge acquisition)
- Developing a model of the decisions (knowledge representation)
- Developing the computer software (computational modelling)
- Validating the model and the software (validation)



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The KBES Environment



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Role of KBES in Accounting

(Bailey et al. 1987)

1. Development Role

- provide an 'end product' for use in an accounting domain.

2. Research Role

- using the development process as a means of understanding knowledge about the problem domain.
- aims at understanding the decision making processes of an expert.
- the result is a 'theory' of the expert's decision making processes in a testable form.



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Some KBES Studies with Development Aims

Study	System	Task	Developer	Subjects
Hansen & Messier (1986) Messier & Hansen (1992)	EDP-XPART	Reliability of Controls in Advanced Computer Environments	Academics	Practising Auditors
Shpilberg & Graham (1986)	ExperTAX	Tax Accrual	Coopers & Lybrand	Practising Accountants, Consultants and Specialists
Graham et al. (1991)	Risk Advisor	Audit Risk	Coopers & Lybrand	Practising Accountants, Consultants and Specialists

Some KBES Studies with Research Aims

Study	System	Task	Subjects
Dungan (1983) Dungan & Chandler (1985, 92)	AUDITOR	Allowance for Bad Debts	Practising Auditors
Steinbart (1984, 87)	AUDITPLANNER	Materiality Judgments	Practising Auditors
Gal (1985)	INTERNAL-CONTROL-ANALYZER	Internal Control Evaluation	Practising Auditors
Meservy et al. (1986)	NA	Internal Control Evaluation	Practising Auditors
Dhar et al. (1988) Peters et al. (1989) Peters (1990, 92)	INHERENT RISK EVALUATOR	Risk Assessment during Audit Planning	Practising Auditors
Biggs et al. (1993)	GCX	Going Concern Judgments	Practising Auditors
Leech et al. (1998, 1999) Collier et al. (1999)	INSOLVE	Insolvency Judgments	Practising Accountants

The Domain: Companies in Financial Distress

- **Company referred to an accountancy firm who specialize in insolvency**
- **Taking into account various factors, an initial decision is made to either:**
 - liquidate - close the business
 - trade on - continue operating the business.



Companies in Financial Distress

- **Objectives of trading on are:**
 - reconstructing the business prior to returning the business to directors
 - enhancing and/or preserving the sale value of the business as a going concern
 - complete work prior to liquidation
- **Decisions may extend over a considerable period of time**
- **Decisions are made on the basis of both financial information and qualitative judgments about the business, stakeholders and the business environment**



Development of the KBES: INSOLVE

- **INSOLVE**
 - Leech, Collier & Clark (1998,1999)
 - Collier, Leech & Clark (1999)
- **Knowledge acquisition:** 23 experts
- **Validation:**
 - Conceptual model: 6 experts
 - KBES: 17 experts



Recommendations Produced by INSOLVE

- liquidate;
- sell the business as a going concern; or
- hand back the business to the directors

If INSOLVE cannot recommend one of these immediate actions, it will advise trading on using one or more of the following paths:

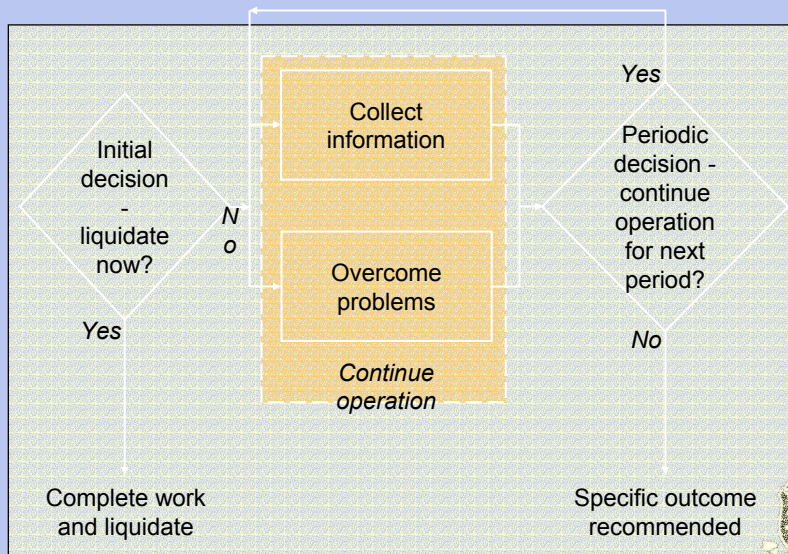
- complete work and then liquidate;
- reconstruct/hand back; or
- enhance/preserve the sale value.



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Top-Level MODEL



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Liquidate Now?

The initial decision - liquidate now?

the business has ceased and the business cannot become viable

there is no cash to continue and there is no way to generate cash

the business is specialized and the director will have no further involvement in the business

key staff vital to the business have left and they cannot be replaced

essential customers will not support continued operation of the business

essential suppliers will not support continued operation of the business

there is serious risk of personal liability for the insolvency practitioner

the insolvency practitioner will not be paid

Liquidate



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Identifying the Stakeholders

- **Directors**
- **Staff**
- **Secured creditors**
- **Unsecured creditors**
- **Customers**
- **Unions**
- **Media**



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Assessing the Directors

- **Assessment of ability**

- assessment of cooperation
 - take advice as required
 - a bad influence on potential purchasers of the business
- assessment of honesty
 - wilfully contravened the law
 - wilfully misstate the financial position
 - using business assets for private purposes
- health is satisfactory
- competent as a manager
- not the primary cause of business failure

- **Assessment of attitude**

- assessment of motivation
 - prepared to change
 - planning to improve the business
- realistic and positive attitude
 - lost confidence with little hope of recovery
 - tired and discouraged

- **Assessment of priorities**

- assessment of personal relationships
 - if married, is the marriage in difficulties?
 - personal problems between directors
- are there other major interests to the detriment of the business?

- **Assessment of personal funds at stake**

- assessment of personal wealth in business



Financial Assessment



Projected Future Cash Flows and Profitability

compared to



Sale Value

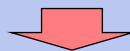
compared to



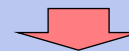
Auction Value of the Assets



“Trade-on Value of the Business”



“Value of the Business as a Going Concern”



“Realization Value”

Implications

- **In-depth understanding of how insolvency experts make decisions**
- **Insolvency experts rely heavily on non-financial information (as well as financial information)**
- **Possible to develop a generalized computational model of decision making in a domain that requires high levels of expertise using:**
 - multiple experts
 - numerous cases

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Part 2: Behavioral Science

Understanding the Impact of Intelligent Decision Aids on Professional Accountants' Judgments

(Arnold, Collier, Leech and Sutton: 2004)

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KBES in Practice

- **Past experience**
 - adopted
 - failed
 - abandoned
- **In the future**
 - knowledge management
 - assurance services



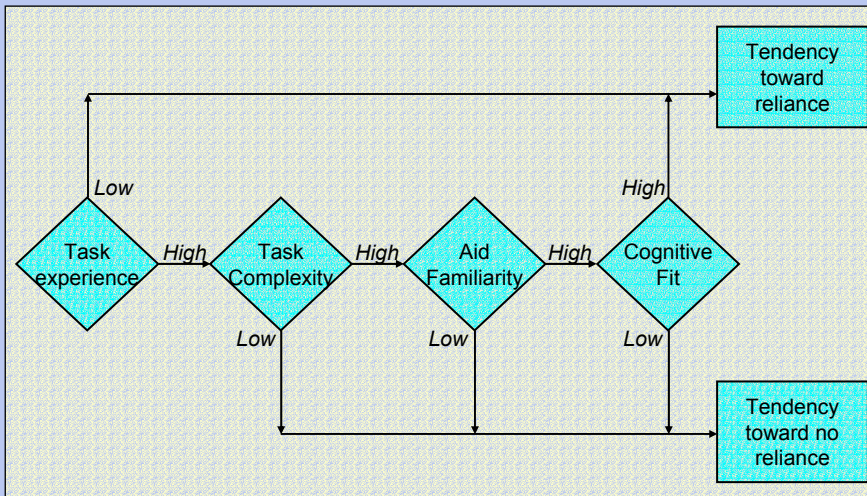
The Theory of Technology Dominance

Understanding the Impact of Intelligent Decision Aids on Decision Makers' Judgments (Arnold & Sutton, 1998).

- **When there is a mismatch between the user and an intelligent decision aid (KBES) in terms of expertise, the risk of poor decision making increases.**
- **When there is a strong match between the user and an intelligent decision aid (KBES) in terms of expertise, the judgment of the user will improve when using the system.**



Factors Affecting Reliance

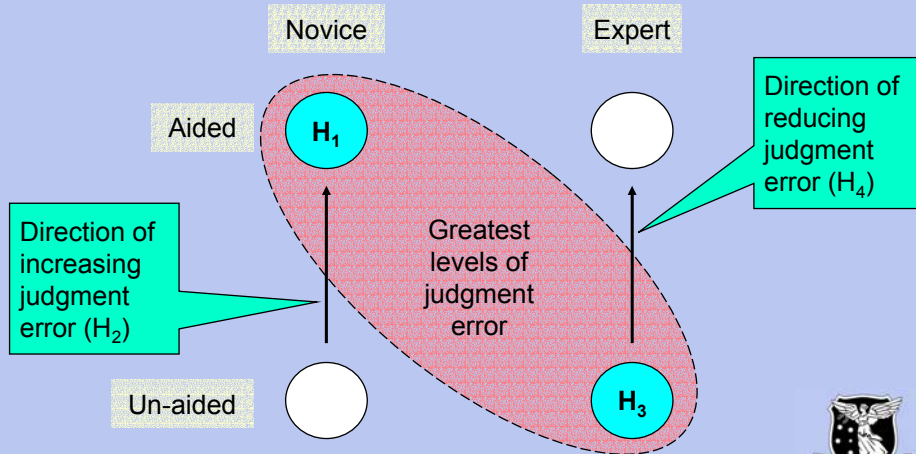


The Theory of Technology Dominance

- When there is a mismatch between the user and an intelligent decision aid (KBES) in terms of expertise, the risk of poor decision making increases.
- When there is a strong match between the user and an intelligent decision aid (KBES) in terms of expertise, the judgment of the user will improve when using the system.



Arnold, Collier, Leech and Sutton (2004) Summary of Research Hypotheses



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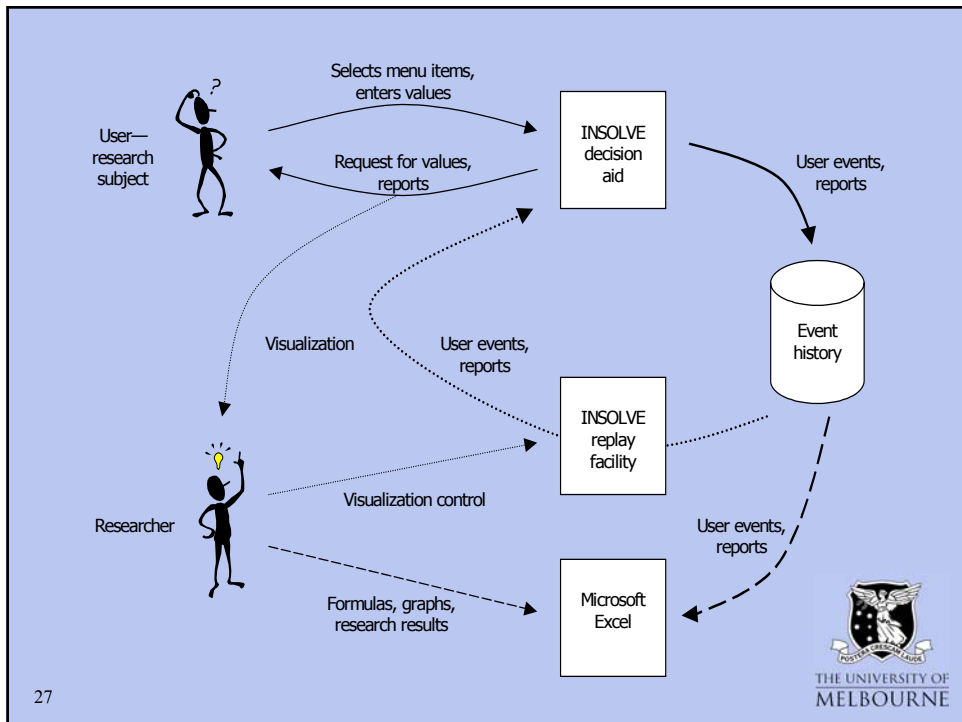
Preparing INSOLVE for Behavioral Experiments

Replay Process Tracing Examining the black box of human-computer interaction

- **Capturing the human-computer interaction**
 - Captures the interactive dialog
 - Captures the temporal aspects of the decision process
- **Recreating the interaction *ex post* as an “over-the-shoulder” replay**

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Case Study

- **Three stage, complex case**
- **Pretested case - 1 Partner, 1 Senior, 1 Faculty member**
- **Second pretest with and without KBES**
 - with KBES - 1 Partner and 1 Manager
 - without KBES- 2 Managers

Participants

- **Aided Group - 80 Insolvency Practitioners**
 - 43 Novices
 - 37 Experts
- **Unaided Group - 87 Insolvency Practitioners**
 - 39 Novices
 - 48 Experts

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Results

- **For novices, INSOLVE exacerbated the judgment error**
- **For experts, INSOLVE mitigated the judgment error**

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Implications

- Support for the *Theory of Technology Dominance*
- Some support that firms have used the wrong approach when implementing KBES in the past
- Some support that KBES may be used by experts to improve decision making

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Conclusion



An Electronic Colleague

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