# MCIS 2009

## The Effect of DQ Tag Values and Usable DQ Tags on Decision-Making*

*Rosanne Price and Graeme Shanks*
The University of Melbourne

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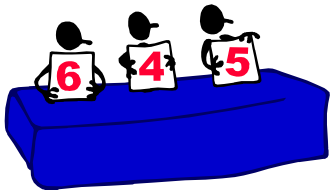




## Overview

1. Understanding data quality (DQ)
2. DQ tags and decision-making
   - Context & definition
   - Previous work
   - Research question addressed by current work
3. Experimental Design
4. Experimental Results
5. Conclusion

## 1. Understanding Data Quality (DQ)

Data Quality Perspectives

- Objective
  - **Conformance** of data to defined integrity rules
  - **Correspondence** of data to Real World
- Subjective
  - **Usefulness** of data as perceived by data consumers
- Criteria definition/evaluation depend on data use/users?

Data Quality Frameworks

- Desirable DQ criteria grouped "logically" by categories
- Intuitive, Theoretical, Empirical research approaches

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## *InfoQual* DQ framework: using semiotics for scope & rigor

- Price & Shanks
  - A semiotic information quality framework: development and comparative analysis, JIT (2005) 20, 88-102
- Semiotics:
  - Theory of communication using signs
  - Use to derive DQ categories & integrate research approaches
- Combine DQ perspectives: objective/subjective
- Combine research approaches
  - Theory: derive categories & objective criteria
  - Empirical: derive subjective criteria
- Consistent criteria classification
  - automatic & theoretically-based using category definition

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## 2. DQ Tags & Decision-making

Data Warehouse or Decision Support System:
decision-makers don't know data context & quality

Supply DQ information as metadata?: *DQ tags*

- Data is not of uniform data quality
- Knowing DQ may change decision!???
  - decision made (ignore less reliable data?)
  - decision time, consensus, confidence
- Display DQ for decision-makers using DQ tags?
  - But: deriving, storing, maintaining tags are costly!

To justify use of DQ tags, must understand their impact!

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## Previous Work: 1999-2003

- Lab studies showed impact in certain conditions
  - conflicting evidence as to which conditions!
- Chengular-Smith et al (1999), Fisher et al. (2003)
  - 8 alternatives & paper-based: generalizable?
  - decision strategy not controlled: causality?
- Shanks and Tansley (2002)
  - address previous limitations using on-line interface
    - 100 alternatives, built-in decision-making strategy
  - minimal consideration of usability and DQ tag semantics
    - No evaluation of usability outside artificial context of pilot test
    - DQ tag semantics (meaning) not specified to users
    - DQ tags are novel, so representation & semantics are unfamiliar

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## Previous Work: Price & Shanks 2009

- Address usability limitations of previous work
  - DQ tags semantics specified, based on Price & Shanks (2005)
  - Find usable experimental design: support exp. soundness
    - Relevant to current work practice (supports generalizability)
    - Understandable (supports causality)
      - different interpretations of tags may impact results
- Evaluate usability of experimental design components
  - Software artifact used for decision-making
  - DQ tag design
    - meaning (DQ tag type—base on *conformance, correspondence* or *usefulness?*)
      - Difficult to find participants: focus on most "effective" DQ tag types
    - representation (name, value, explanation)
- How should we evaluate usability in cost-effective manner?

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## Usability Study

- Goals:
  - understand current work practice
  - find relevant & understandable experimental design
- Usability study based on Contextual Inquiry
  - on-site interviews with users at their work place
    - users demo decision-making task
    - add subsequent evaluation of exp. Materials
  - evaluate design usability in actual context of work!
    - Work artifacts & processes serve as reminders
- Price & Shanks, Data Quality Tags and Decision-making: Improving the Design and Validity of Experimental Studies, CDM'08, 233—244.

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## Usability Study: Design Recommendations

- Preferences:
  - DQ tag semantics based on *RW correspondance*
    - with nomenclature *accuracy*
  - DQ tag value represented as a range using traffic light
  - Explicit documentation of DQ tag semantics/derivation
    - brief explanations using pop-up windows
  - Desirability scores not be included in software artefacts
- Consensus despite diverse interview contexts!
  - Point-based numeric tag values & scores used previously!
- Shanks & Price 2009:
  - Revise Shanks & Tansley (2002) interface based on usability recommendations

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## Price & Shanks 2009: Results

- No evidence of DQ tagging impacting outcomes
  - Except decision time increased with tags for 1 decision strategy
- Decision-makers ignore DQ tags
  - Use attribute tagged as poor quality (*commute-time*) in decision
  - Explain that *commute-time* was too critical to ignore!
    - Given current high petrol prices & important environmental considerations
- New research question:
  - Does the relative importance of tagged attribute to the decision:
    - affect the impact of the DQ tag on decision outcomes?
    - account for differences in observed results compared to 1999-2003 work?
  - Repeat exp., tagging less important attributes as poor quality…!
    - explain previously observed effects on outcome

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# 3. Experimental Design

- Change DQ Tag Values: which attribute should be tagged as poor quality?
  - Important attribute: used regardless of tags (from previous exp.)
  - Find less important attribute…
    - Unimportant attribute: ignored regardless of tags? (expected)
    - Goal is to find *moderately* important attribute to tag as poor quality
- Finding *moderately* important attribute(s)
  - Attributes ranked by importance in previous experiment
  - Analyze rankings to find less (moderately) important attribute(s)
    - *Floor space & Parking*
  - Use both (only 1 person regarded both as critically important)

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# Use Price & Shanks(2009) design

- On-line database of 100 alternative rental apts.
  - Separate interface for each decision-making strategy
    - Alternative (row) vs. Attribute (column) based
    - Compensatory vs. Non-Compensatory (minimum acceptable values)
    - Used Additive and EBA (Elimination-by-Attribute) strategies
  - Attribute (column) level tags
- Maximize chance of DQ impact (aka. previous results)!
  - Select "simple" task complexity & "experienced" participants
- Dependent variables
  - Decision strategy (additive or EBA) & Tagging (present/absent)
- Independent variables
  - Decision complacency, consensus, efficiency, confidence
  - Complacency: does the preferred apartment change?
  - Consensus: does the % selecting the preferred apartment change?

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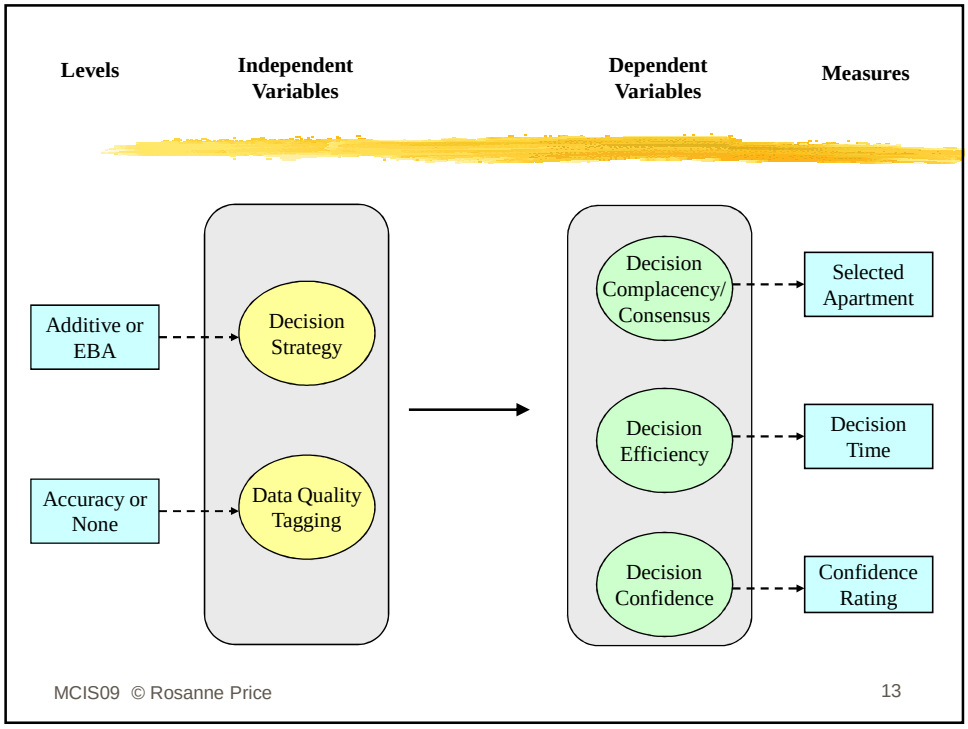
Levels
Independent Variables
Dependent Variables
Measures
Additive or EBA
Accuracy or None
Decision Strategy
Data Quality Tagging
Decision Complacency/ Consensus
Decision Efficiency
Decision Confidence
Selected Apartment
Decision Time
Confidence Rating
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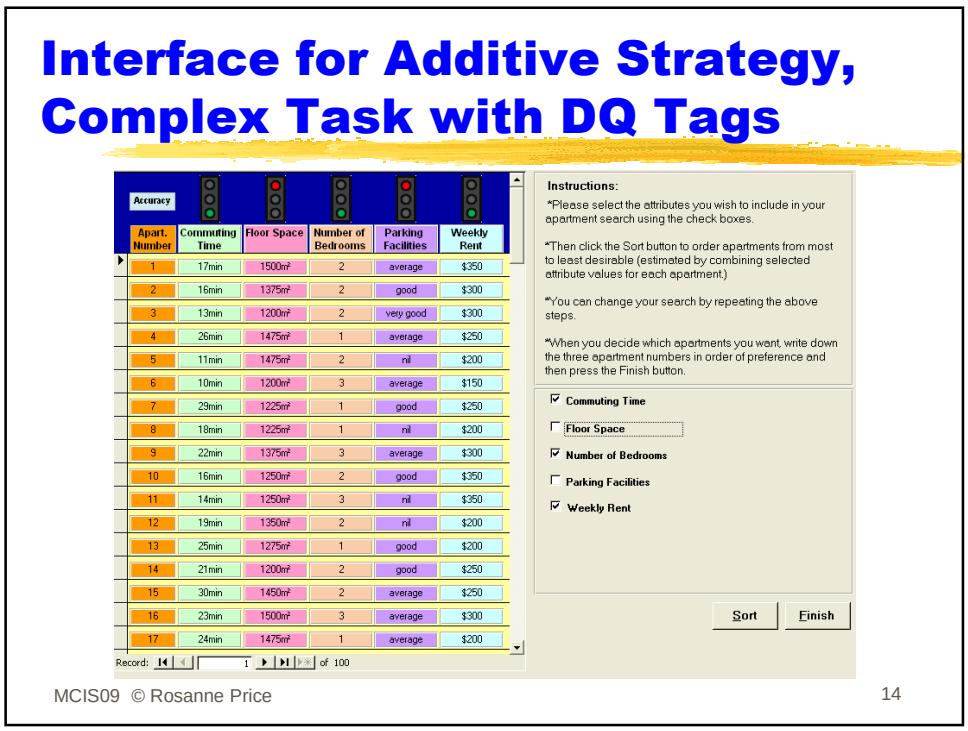
Interface for Additive Strategy, Complex Task with DQ Tags
Accuracy
Apart. Number
Commuting Time
Floor Space
Number of Bedrooms
Parking Facilities
Weekly Rent
Instructions:
*Please select the attributes you wish to include in your apartment search using the check boxes.
*Then click the Sort button to order apartments from most to least desirable (estimated by combining selected attribute values for each apartment.)
*You can change your search by repeating the above steps.
*When you decide which apartments you went, write down the three apartment numbers in order of preference and then press the Finish button.
Commuting Time
Floor Space
Number of Bedrooms
Parking Facilities
Weekly Rent
Sort
Finish
Record: 1 of 100
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# 4. Experimental Results

## Complacency and Consensus

| | Decision Strategy | |
|---|---|---|
| | Additive | Elimination by Attributes |
| Complacency | $\chi^2 = .000$ | $\chi^2 = .896$ |
| | p = 1.000 (H1a) | p = .344 (H1b) |
| Consensus | $\chi^2 = .000$ | $\chi^2 = .896$ |
| | p = 1.000 (H2a) | p = .344 (H2b) |

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## Apt. Selection: detailed analysis

| | | Number of Participants Selecting Apartment (% in treatment group selecting from set of specific apartments listed) | |
|---|---|---|---|
| | | No Tags | Tags |
| Additive | Preferred | 7 (41% for apt 83) | 6 (35% for apt 83) |
| | Other | 10 (59% for apt 29,57,70,90 or 91) | 11 (65% for apt 36,70,90,91 or 98) |
| | Alternate | 3 (18% for apt 57 | 4 (24% for apt 70) |
| | Total | 17 | 17 |
| EBA | Preferred | 13 (76% for apt 67) | 10 (56% for apt 67) |
| | Other | 4 (24% for apt 1,5 or 44) | 8 (44% for apt 1,5,44 or 88) |
| | Alternate | 2 (12% for apt 44) | 5 (28% for apt 5) |
| | Total | 17 | 18 |

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## Time and Confidence

| | | Decision Strategy | | | | | |
|---|---|---|---|---|---|---|---|
| | | Additive | | | Elimination by Attributes | | |
| | | Mean rank | Mean | SD | Mean rank | Mean | SD |
| Time | No Tags | 16.75 | 8.59 | 5.48 | 18.53 | 5.53 | 2.50 |
| | Tags | 15.20 | 8.44 | 6.46 | 17.50 | 5.44 | 3.48 |
| | | p = .633 (H3a) | | | p = .763 (H3b) | | |
| Confi-dence | No Tags | 17.56 | 2.41 | .71 | 18.32 | 2.00 | .61 |
| | Tags | 17.44 | 2.35 | .70 | 17.69 | 2.00 | .84 |
| | | p = .970 (H4a) | | | p = .839 (H4b) | | |

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## 5. Conclusion

- Confirm results of our previous study (except time)
  - Differ from previous DQ tagging results
- No significant evidence of DQ tag impact
  - Some indications of reduced consensus with DQ tags
- Changed DQ values did not change results
  - Poor quality attributes not important enough?
  - Difficult to find a moderately important attribute
- No support for use of DQ tags
- Future work: protocol analysis, other domains

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