SURVEYOR ELEMENT LIFETIME PREDICTIONS AND THE ANCHORING AND ADJUSTMENT HEURISTIC

Jim Kempton[1], Keith Chapman[2] and Amir Alani[2]

[1] *Touchstone Housing Association, Whitley Village, Coventry, CV2 4JB, UK*
[2] *Faculty of Environment, University of Portsmouth, Portland Street, Portsmouth, PO1 3AH, UK*

The propensity for individual surveyors to be variable when estimating building element lifetimes has been noted in the literature. An experiment was conducted to investigate the particular 'rule of thumb' known as the Anchoring and Adjustment Heuristic in relation to lifetime estimation. The results indicate that the heuristic could be a factor in the inaccuracy of element lifetime estimation by surveyors. The results have implications for Housing Association and Local Authority long term business planning

Keywords: adjustment, anchoring, element lifetimes, surveyor variability.

INTRODUCTION

Surveyor Variability

Surveyor Variability is defined as the situation where two or more surveyors, surveying the same building and having the same evidence of that buildings condition available to them, arrive at different survey judgements (Kempton *et al.* 2000).

There are many ways in which these differences manifest in surveys, including differences in observation, differences in diagnosis, differences in prognosis and differences in the treatments recommended to defects. Another manifestation is in the estimation of the remaining lifes of building elements. The various factors contributing to variability can, of course, be correlated. If a surveyor considers that an element is in a 'worse' state of repair than another surveyor, it would be likely that he would give the element a shorter lifetime (Kempton *et al.* 2001). This paper concentrates on the element lifetime estimation aspect of surveyor variability.

Element Lifetimes and Condition Surveys

An important part of a condition survey is the estimation of remaining element life. This information is critical in asset management functions for housing stock, particularly in the development of maintenance plans. For example, recent UK Central Government initiatives (DETR 2000) mean that Local Authorities are required to produce business plans for 30-year periods. Such business plans include a projection of the repair and replacement requirements of building elements. It is therefore critical that the lifetimes estimated by surveyors are accurate. Dissatisfaction amongst clients of stock condition survey data has been noted (Chapman and Beck 1998; Chapman 1999).

[1] jkempton@touchstone.org.uk

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Previous Research

The Royal Institution of Chartered Surveyors (BCIS 2001) undertook a study into the opinions of surveyors as to 'rule of thumb' lifetimes. A questionnaire was distributed to building surveyors asking for their opinions as to the lifetime of certain building elements. The results showed that different surveyors had sometimes widely different views on element lifetimes. As an illustration, Table 1 shows the mean, minimum and maximum lifes for a selection of elements.

Table 1: Differences in responses to lifetime questionnaire (Source: BCIS 2001)

Element	Mean (Years)	Min (Years)	Max (Years)
Windows (s.w)	35	20	55
Roof Covering (natural slate)	75	45	110
Wall Finish (masonry pointing)	85	45	125

The RICS/ BCIS publication only gives the data from the questionnaire. It does not include any information on why the differences occurred.

HUERISTICS AND BIASES

It has been recognised that surveyors can be variable in their decisions relating to condition surveys (e.g. Douglas 1992; O'Dell 1996; Hollis and Bright 1999). Some of the reasons may be put down to pragmatic factors such as a lack of knowledge, badly designed survey forms, or simply a surveyor having a 'bad day'. In addition to these pragmatic issues, the use of Heuristics ('rules of thumb') and biases (a leaning towards a particular opinion regardless of the available evidence) was identified during discussions with practising surveyors. The cognitive psychologists Amos Tversky and Daniel Kahneman published a paper in 1974 (Tversky and Kahneman 1974) and gave the first classification of the heuristics and biases defined at that time. Tversky and Kahneman proposed three 'main' categories and a number of 'sub' biases under these. The three main categories were:

> 1: Representativeness - This heuristic implies that an event, V_1, originates from or is caused by, another event, V_2, in terms of probability.
>
> 2: Availability - This heuristic states that people are likely to judge the probability or frequency of an event based on the ease with which they can recall instances of the event in question.
>
> 3: Anchoring and Adjustment - When people make certain types of judgements they can tend to mentally consider a baseline (i.e. they 'set an anchor'), and then adjust their estimate around that baseline

The number of recognised heuristics and biases has increased substantially over the last 25 years. The sheer scope of the literature has been described as 'unmanageable' as far back as 1986 (Edwards and Von Winterfeldt 1986). Arnott (1998) drew on the work of Tversky and Kahneman (1971; 1973; 1974), Hogarth (1987), Bazerman (1998) and others to categorise the 'known' heuristics and biases, and more than 48 were identified.

Heuristics and biases have been investigated, to varying degrees, in the broad field of property and construction. Such work has usually been focused towards those professions based on estimating financial values for building projects (Skitmore *et al.*

1990; Birnie 1996; Fortune and Birnie 2000) and the accuracy of property valuations e.g. (Northcraft and Neale 1987; RICS 1996). Work has been undertaken investigating a particular bias in condition surveys (Kempton *et al.* 2002).

THE ANCHORING AND ADJUSTMENT HEURISTIC

As stated, when people make certain types of judgements they can tend to mentally consider a baseline (i.e. they 'set an anchor'), and then adjust their estimate around it. It is obvious then that the point at which an anchor is set affects the adjustments around it. This is shown in Figure 1.

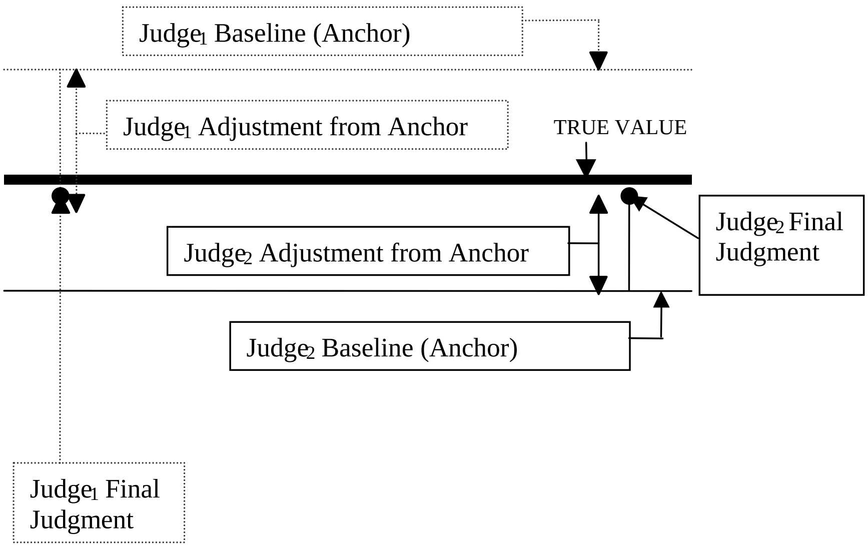


Figure 1: Anchoring and Adjustment

From Figure 1 it can be seen that $Judge_1$ has set an anchor above the true value and adjusted downwards. It can be seen that $Judge_1$ has over-adjusted so that his final judgement is actually lower than the true value. $Judge_2$ set his anchor below the true value, and adjusted upwards. It can be seen that in the case of $Judge_2$ his adjustment was insufficient to reach the true value, he under-adjusted.

Potential implications of Anchoring and Adjustment

The hypothesis considered in this paper is that the anchoring and adjustment heuristic could come into play in condition surveys by a surveyor having a preconceived notion as to a lifetime of a building element. For example, if a particular surveyor thinks that a typical concrete tiled roof will last for 50 years from new, but a particular roof he is viewing has weather damage and is 20 years old, perhaps he may give the roof a remaining life of, say, 10 years. A different surveyor having a notion that a concrete tiled roof will last 70 years, and viewing the same roof, may give the roof a remaining lifetime of, say, 30 years. Their baseline had been set at different levels.

DIFFERENCES IN ELEMENT LIFETIMES

A housing survey carried out in the North West of England incorporated a quality control mechanism, whereby a surveyor resurveyed a sample of dwellings that had been surveyed (by a different surveyor) as part of a program of stock appraisal. This mechanism gave an opportunity to investigate the differing judgements of surveyors in terms of element lifetime estimation.

The survey methodology required a surveyor to assess the condition of an element, record any remedial work required to that element, then give an estimation of the remaining life of that element once those remedial works had been undertaken. The data was filtered to only include pairs of surveyors, surveying the same dwelling, where both surveyors recommend no remedial treatment to a particular element. This shows the level of (dis) agreement between two surveyors for an element lifetime without the complications of correlated variability. The data is presented as histograms in Figures 2 – 5. The number of cases where both surveyors recommended no remedial treatment is shown in the heading of each histogram.

Figure 2: Roof Covering

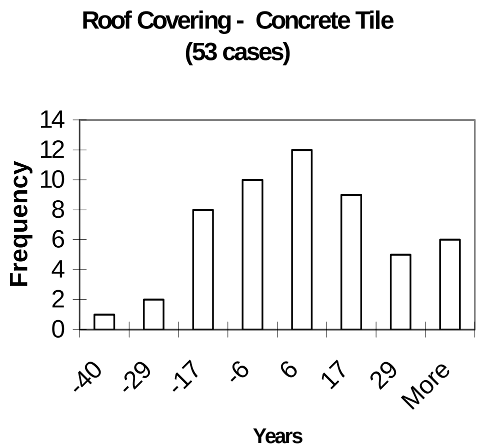


Figure 3: Doors

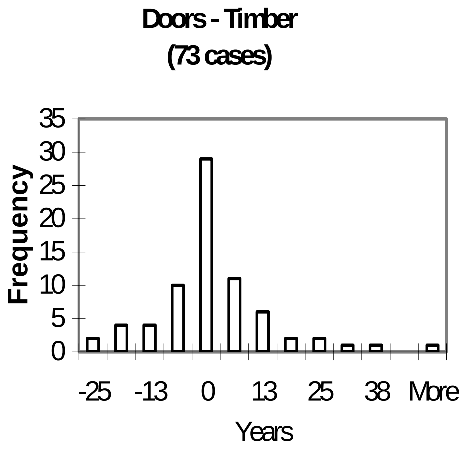


Figure 4: Windows

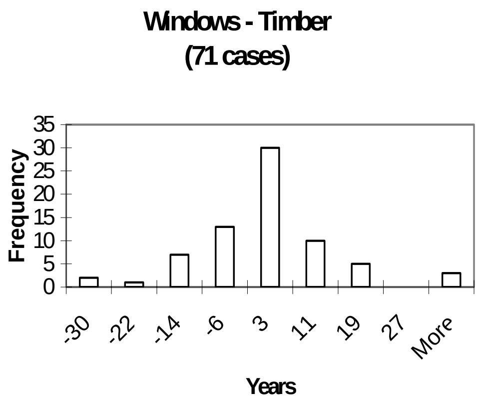
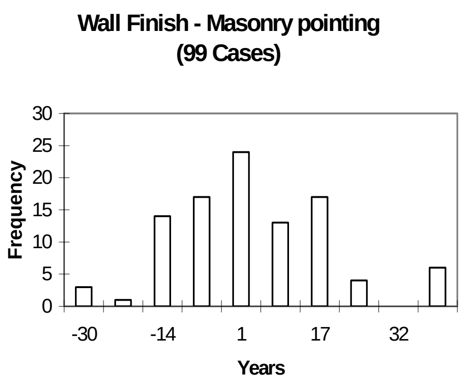


Figure 5: Wall finish



Although the histograms broadly conform to a normal distribution it can be seen that significant differences in the lifetimes given to building elements by the two surveyors exist. An experiment was designed to try and quantify the propensity for surveyors to employ the anchoring and adjustment heuristic in their element lifetime estimations.

EXPERIMENT TO TEST ANCHORING AND ADJUSTMENT

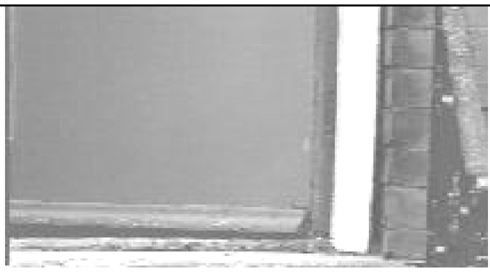
Methodology

The experimental hypothesis was that participants (a mix of final year undergraduate surveying students and practising maintenance surveyors) would give the remaining life of particular building elements by anchoring on a given guide life and adjusting from that point. Three participant groups were formed, called the 'Low Guide Group', 'High Guide Group' and 'No Guide Group'. The Low Guide Group was shown photographs and a brief condition description of four building elements, with a simple 'survey record' to complete for each one and a guide remaining element lifetime. The High Guide Group was shown exactly the same set of photographs, with exactly the same description but the guide remaining element life was put at a higher point. The No Guide Group was shown exactly the same photographs and descriptions as the other two groups but they were not given any guide as to the remaining life of the elements. Each group consisted of 9 participants. Figure 6 and 7 show the roof covering and door photographs and descriptions respectively.

Figure 6: Roof Covering

Photograph	Description
	Slate roof in generally good state of repair. Minor delamination of a few slates observed

Figure 7: External Door

Photograph	Description
	S.W. Timber door, paintwork in poor condition. Opens and closes satisfactorily. Some soft spots and minor quantities of damage due to damp

A set of instructions was also provided. A clear part of the instructions stated that the guide lifetime was indeed just that – a guide only, and encouraged participants to give a remaining life that they thought appropriate (of course the 'No Guide Group' were not provided with a guide lifetime at all).

A summary of the descriptions of the elements and guide lifes is shown in Table 2.

RESULTS

The small sample size of each group dictated that a non- parametric test was undertaken on the data generated by the experiment. The procedure used was the Kruskal-Wallis Test for Several Independent Samples. The Kruskal-Wallis test is a non-parametric method of testing the hypothesis that several populations have the same continuous distribution versus the alternative that measurements tend to be higher in one or more of the populations. The test is held to be most appropriate for ordinally scaled data, however, it has been used to analyse ratio data in previous research. A simple descriptive table of the mean lifetime for each element by each group, and the standard deviation within each group, is shown in Table 3.

Table 2: Element Descriptions and Guide Lifetimes

Element	Description	Guide Life No Guide Group	Guide Life Low Guide Group (years)	Guide Life High Guide Group (years)
External Doors (softwood)	S.W. Timber door, paintwork in poor condition. Opens and closes satisfactorily. Some soft spots and minor quantities of damage due to damp	No Guide	15	30
Windows (softwood)	S.W. Paintwork in very bad condition. Soft Spot/ damp particularly on window cill, but also on frame. Putty requires replacing. Window is stuck in the shut position and requires easing	No Guide	20	40
Roof Covering (slate)	Slate roof in generally good state of repair. Very minor delamintaion of a few slates observed.	No Guide	50	80
Wall Finish (masonry pointing)	Masonry pointing wall finish. Mortar is crumbling. No spalling bricks observed	No Guide	20	40

Table 3: Mean Lifetimes

	Element											
	Roof Covering			**Doors**			**Windows**			**Wall Finish**		
	No Guide	Low Guide	High Guide	No Guide	Low Guide	High Guide	No Guide	Low Guide	High Guide	No Guide	Low Guide	High Guide
1	20.56	32.22	56.11	3.33	6.44	13.67	4.89	11.67	20.11	10.78	11.89	24.44
2	1.12	5.50	10.77	10.65	9.89	17.67	8.46	14.17	17.99	14.22	7.17	8.08

1: Mean **2**: Standard Deviation within Group

Table 4: Kruskal-Wallis Test

	Element			
	Door	**Windows**	**Roof Covering**	**Wall Finish**
Chi-Square	8.16	7.13	14.40	8.86
df	2.00	2.00	2.00	2.00
Asymp. Sig.	0.02	0.03	0.00	0.01

The Kruskal-Wallis Test for Several Independent Samples was then applied; the results are shown in Table 4, which shows that the differences between the groups was significant at the 5% confidence level for all elements

Relevance of the Results

The results seem to indicate that the anchoring and adjustment heuristic is coming into play in the context of participants estimations of the remaining lifetimes of the elements described in the experiment. The results particularly indicate that a 'high' guide has the most impact on participants' judgements.

If the anchoring and adjustment heuristic is a real issue in surveying, what can be done to control it? One suggestion is that, rather than letting a surveyor set his own anchor, the survey form could contain a guide life for the surveyor to work from. This however raises the question of what the 'right' lifetime guide is. A review of literature and other sources produced the varied 'standard' element lifetimes in Table 5

Table 5: Different element lifetimes

	Source of Element Lifetime Guide			
	HAPM Manual [1]	**HA[2]**	**NBA [3]**	**BSI [4]**
Doors (Timber)	35	25	30	20-40
Windows (Timber)	35	25	50	40
Wall Finish (Pointing)	N/A	60	50	50
Roof Covering (Slate)	35	35	60-80	50

1: HAPM (Housing Association Property Mutual) is a an insurance element lifetime guide for Housing Associations (HAPM 1992)

2: HA are the element lifetimes developed by a particular Housing Association

3: NBA Consultants report on life expectancies of building components (NBA 1985)

4: British Standards Institute guide to durability of building elements (BSI 1992)

Given the evidence in this paper, a given lifetime guide could help to achieve consistency in surveyors' judgements as to the remaining lifetime of building elements. From Table 5 however, the lifetime guide given could be used to 'skew' overall survey results in a certain direction. For example a higher guide could be given to make a sample of housing stock appear in 'better' condition. Alternatively a low guide could be employed to make the same stock appear in 'worse' condition.

Impact on Life Cycle Models (LCM's)

Many Local Authorities and Housing Associations employ computer driven LCM's to assess the future repair needs and costs of housing stock. A critical component in the generation of future repair and replacement strategies is the estimated lifetime of building elements (Thomas 2001). From Figure 2, as much as a forty year difference between two surveyors for a roof covering can be seen. The implications of such variability could be further exacerbated if the condition survey is a sample survey of the total stock (a very common methodology). In cases of sample surveys the results of the sample are extrapolated to represent the whole stock and the variability in the sample is magnified accordingly.

It may be a case that survey methodologies should not incorporate the facility for a surveyor to record the remaining life of an element. It may be better to allocate a remaining life to an element at the survey data analysis stage. Mechanisms could be built into a data analysis program that used a 'standard tariff' of element lifetimes, alongside another tariff of 'years to be deducted'. For example, a slate roof could be given a standard life of say, 60 years. The 60 years would be reduced by, say, 40 years if the surveyor observed serious tile delamination. The idea of modelling element lifetimes was proposed by, amongst others, Tucker (1990).

A word of caution is needed, however. Surveyors are employed because they have the expertise to make judgements of building elements in-situ. In the field of maintenance planning for housing stock a surveyors view on any peculiarities to an element can be essential, if the scarce resource of a maintenance budget is to be used effectively. By employing 'standard' lifetimes, we would potentially negate an area of surveyor expertise. We may therefore achieve consistency in element lifetime estimation, but at the expense of accuracy. O'Dell (1990) made the comment:

> *"It is important to make use of the professional skills of the surveyors, in the way they are able to examine a building and see below the survey; but to ensure consistency…"*

DISCUSSION

The findings presented in this paper are part of a program of PhD research being undertaken by the main author. Whilst this paper has investigated the impact of the anchoring and adjustment heuristic on the judgements of surveyors, there are many other factors contributing to surveyor variability. We could place the reasons for variability into two (very) broad categories

1. The 'Practical' aspects – for example, failure of survey equipment, training requirements, survey form design etc.

2. The 'Cognitive' aspects – for example, surveyor values, beliefs, risk tolerance etc.

It is important to realise that the problem of surveyor variability, in all its guises, is difficult to identify and, perhaps, even more difficult to control. Most professions that require human beings to make decisions in situations of uncertainty are prone to variability, from social workers (Gordon and Gibson, 1998) to accountancy (Zopounidis, 1999) and occupational therapy (Bellini *et al.*, 1996). The field of medical decision making has proved a rich source of information. Ravitch (1989), summed up the decision-making problem faced by professionals with the statement:

> *"Surgeons share a common dilemma faced by decision makers in all professions – they must make decisions even though the information they have is imperfect and the outcomes of these decisions are important"*

FURTHER RESEARCH

The experiment described in this paper involved low numbers of participants in a contrived experimental condition. It is hoped that a similar experiment can be conducted using larger samples of participants in a more realistic setting. The experiment used wide differences between the guide lifetimes. Further experimentation to explore the sensitivity of the anchoring and adjustment heuristic by using much narrower differences needs to be undertaken. Further research is currently being undertaken which investigates potential mechanisms whereby an individual surveyor's propensity to rate element condition in a particular way can be gauged.

REFERENCES

Arnott D (1998) A Taxonomy of Decision Biases, *Technical Report 1/98*, Monash University, School of Information Management and Systems

Bazerman M (1998) *Judgement in Managerial Decision Making* (4^{th} Ed), New York, Wiley

BCIS (2001) *Life Expectancy of Building Components: Surveyors' Experiences of Buildings in Use – a practical guide*, London: Building Cost Information Service Ltd

Bellini J, Boton B, and Neath J (1996) Diagnostic determinants of rehabilitation counsellor eligibility decisions, *Journal of Rehabilitation Administration*, **20**(2), 93-106

Birnie J (1996) Bias and Financial Management Judgements, *Journal of Financial Management of Property and Construction*, **1**(1), 37-53

BSI (1992) *Guide to Durability of Buildings and Building Elements, Products and Components*, British Standard: BS 7543: 1992

Chapman K.P. (1999) Dissatisfaction with Stock Condition Surveys in Social Housing, *Structural Survey*, **17**(4), 211-215

Chapman K.P. and Beck M (1998) Recent Experiences of Housing Associations and other Registered Social Landlords in Commissioning Stock Condition Surveys, Proceedings COBRA Conference, Oxford, UK.

DETR (2000) *A New Financial Framework for Local Authority Housing,* Department of the Environment, Transport and the Regions, HMSO

Douglas J (1992) *Building Condition Assessment in the USA*, Research Paper No: 10, London: Royal Institution of Chartered Surveyors

Edwards W and Von Winterfeldt D (1986) On Cognitive Illusions and their Implications, *Southern California Law Review*, **59**(2)

Fortune C and Birnie J (2000) Money Illusions and the Judgements of Professional Quantity Surveyors, *Journal of Financial Management in Construction and Property*, **5**(1&2), 41 - 50

Gordon D and Gibbons J (1998) Placing Children on Child Protection Registers: Risk Indicators and Local Authority Differences, *British Journal of Social Work*, **28**(3), 423-436

HAPM (1992) *Component Life Manual*, E & FN Spon, London

Hogarth R (1987) *Judgement and Choice: The Psychology of Decision* (2nd Ed), Chichester, UK: Wiley

Hollis M and Bright K (1999) Surveying the Surveyors, *Structural Survey*, **17**(2), 123-133

Kempton J, Nicol S, Anumba C and Dickens J (2001) Surveyor Variability in Large-Scale Surveys, *Structural Survey,* **19**(4), 156-162

Kempton J, Nicol S, Anumba C and Dickens J (2000) Analysis of Surveyor Variability from Data Obtained from Surveys of Dwellings Represented on Video Film, *Proceedings of Association of Researchers in Construction Management (ARCOM)*, 6-8 September, Glasgow, UK, 635-644

Kempton J, Chapman K and Alani A (2002) Potential effects of the Confirmation Bias in Condition Surveys, *Structural Survey*, **20**(1) (in press)

NBA (1985) *Maintenance Cycles and Life Expectancies of Building Components and Materials: A guide to Data and Sources*, National Building Agency, London

Northcraft GB and Neale MA (1987) Experts, Amateurs and Real Estate: An Anchoring and Adjustment Perspective on Property Pricing Decisions, *Organisational Behaviour and Human Decision Processes,* **39**, 84-97

O'Dell A (1990) Development of the English House Condition Survey, *in* Quah LK (Ed) CIB W70, *Building Maintenance and Modernisation Worldwide*, Singapore: Longman

O'Dell A (1996) *Taking Stock – A Review of Housing Stock Condition Survey Methods in the UK*, Building Research Establishment Report PD163/996

RICS (1992) *Life Expectations of Building Components: Preliminary Results from a Survey of Building Surveyors Views*, London: RICS

RICS (1996*) How Much do Valuers Vary in their Valuations of Commercial Property?*, RICS Research Findings Number 2, London: RICS

Skitmore M, Stradling S, Tuohy A and Mkwezalamba H (1990) *The Accuracy of Construction Price Forecasts: A Study of Quantity Surveyors' Performance in Early Stage Estimating,* The University of Salford, ISBN 0901025127.

Thomas A (2001) The Asset Test, *Housing Today*, **265**, 14

Tversky A and Kahneman D (1971) Belief in the Law of Small Numbers, *Psychological Bulletin*, **76**(2), 105-110

Tversky A and Kahneman D (1973) Availability: A Heuristic for Judging Frequency and Probability', *Cognitive Psychology*, **5**, 207-232

Tversky A and Kahneman D (1974) 'Judgement under Uncertainty: Heuristics and Biases, *Science*, **185**,1124-1131

Zopounidis C (1999) Multicriteria Decision Aid in Financial Management, *European Journal of Operational Research*, **119**(2), 404-415