

Behavioural Biases on Residential House Purchase Decisions: A Multi-Criteria Decision-Making Approach

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Abstract

In this study, we examine if behavioural biases, such as framing effects, escalation of commitment, and overconfidence are present when residential property purchasers are choosing between alternative properties. To accomplish same, we use a Multi-Criteria Decision-Making (MCDM) approach to examine the behaviour of property purchasers in Dublin during the property boom of 2005.

The study was designed using a case study approach and the participants used a Multi-Criteria Decision-Making analysis tool to aid in their selection between alternative properties. The decision tool that was used is *Direct-Interactive*: i.e., the Decision-Maker gives scores and weights directly and is able to adjust them during the process. It also uses *Structured-Criteria*, i.e. it tracks elements of the decision to specific disaggregated criteria of the decision-maker.

This research finds that using a decision tool provides better decisions as was expected from the method, however, a subset of property buyers resisted applying the tool to make non-rational choices. This indicates how strong behavioural biases can be and how influencing their affect is, even when making large monetary decisions.

In conclusion, when a decision-making tool is introduced to enable property purchasers to improve their decision-making capability, a subset of property buyers may resist applying the tool to let their behavioural biases potentially override rational decision-making.

Keywords: behavioural biases; multi-criteria decision making (MCDM), residential real estate, framing bias, Empathy Gap.

Introduction

Ireland has traditionally had a very high home owner occupancy rate compared with peer countries. It is currently at 70% (census 2011), but in the 1990s, when it peaked, four out of five households had purchased their residence. House purchase decisions are high-stake decisions. The investment amount is large and usually involves 3-5 years of annual income.

For most people house purchase decisions are relatively infrequent. When making this decision, decision makers may be influenced by variety of sources (property professionals, family members, friends and colleagues, newspaper advertising, styling of property) and emotions play a large role in the decision making process (Levy 2008).

This research was conducted to observe how decision makers actually went through the decision process of purchasing a residential home. The study was conducted during 2005 when the Irish market was experiencing a property boom. Demand for second-hand residential houses was higher than supply and between 1996 and 2005 and annual house prices grew by an average of 15% during this period (Duffy, 2006). There was a shortage illusion operative in the market. When buying a house by private treaty or auction, there were many other bidders making higher bids, and closing a deal was difficult. A successful bidder had to go the *extra mile*, even if the price seemed too high and that the decision seemed irrational. Each week new record prices were announced for second-hand residential properties. If a decision-maker hesitated about making a purchase he would be left behind as the market moved on, and prices got higher.

This research develops the work of Brugha (2004b) which proposed a Multi-Criteria Decision Making MCDM methodology which works well for Decision-Makers who are making high-stake decisions such as property purchase. Brugha has designed a formal procedure for structuring criteria trees and shaping of constructs which is based on Nomology, the science and laws of the mind (Brugha, 2004a). He argues that a framework is needed to “get into the minds of the decision-maker” when they are actually making the decision. By using a criteria tree to break down the components of a decision and score them in a structured way, a decision-maker is less likely to react to emotions and become aware of the cognitive and motivational factors that can lead to behavioural biases

Multi-Criteria Decision Making (MCDM)

Decision analysis looks at how an individual decision-maker (or decision group) contemplates a choice of action in an uncertain environment. The theory of decision analysis is designed to help the individual make a choice among a set of pre-specified alternatives. Decision theory helps identify the alternative with the highest *expected value* (probability of obtaining a possible value). The decision making process relies on information about the alternatives. The quality of information in any decision situation can run the whole range from scientifically-derived hard data to subjective interpretations, from certainty about decision outcomes (deterministic information) to uncertain outcomes represented by probabilities.

MCDM considers a single or group of decision makers who have to choose among a number of alternatives, that are evaluated on the basis of two or more criteria or attributes. The alternatives can involve risk and uncertainties; the set of alternatives may be either finite or infinite. For example, a finite set would be the available house for sale in a given area at any one time. An infinite set arises in the design of a piece of electronic equipment involving continuous parameters subject to constraints that limit the feasible region. In general, the decision maker acts to maximise utility or the value function that depends on the criteria or attributes.

In the most basic form, MCDM assumes that a decision maker chooses among a set of alternatives whose object function values or attributes are known with certainty. Many of the procedure used with MCDM are interactive.

The objectives of MCDM are to 'support the decision-maker' and to 'improve the quality of the decision process' (Saaty (1980), Vincke (1999), Keeney and Raiffa (1976), Von Winterfeldt and Edwards (1986)). The actual decision boils down to selecting "a good choice" from a number of available choices. Each choice represents a decision alternative. In the *multi-criteria decision making* (MCDM) context, the selection is facilitated by evaluating each choice on the set of criteria. The criteria must be measurable - even if the measurement is performed only at the nominal scale (yes/no; present/absent) and their outcomes must be measured for every decision alternative. Criterion outcomes provide the basis for comparison of choices and consequently facilitate the selection of one, satisfactory choice. MCDM is a way of simplifying a complex problem by breaking into parts, making judgments about the parts and then reassembling the pieces.

MCDM is used for many applications including making decision about includes water resources, energy, forestry, and planning. Numerous international Conferences have been sponsored by the International Society on Multiple-Criteria Decision Making: IIASA, the Society of Judgement and Decision Making; the Organisation for Subjective Probability, Utility and Decision Making; the European Working Group on Multiple Criteria Decision Aid; and the Chinese Special Interest Group on Multiple Criteria Decision making.

Behavioural Aspects

Thus far, behavioural research has had little impact on multiple criteria decision making, with the exception of von Neumann and Morgenstern (1944) and Savage (1954) discussed in Keeney and Raiffa (1976), Fishburn (1988) and Wakker (1989). Careful consideration must be given to the choice and display of information during the course of decision making (Dyer, Fishburn, Steurer, Wallenius, Zionts, 1992).

To date, research relating to the behavioural issues relating to the purchase of residential property has largely been confined to areas such as buyer search duration, location and tenure choice (Anglin, 1997; Baryla and Zumpano, 1995; Elder and Zumpano, 1991); and the anchoring role of the 'asking price' Black and Diaz (1996). Generally these studies do not focus on the dynamics relating to the decision-making process itself.

Research Approach

The study was designed using a case study approach and the participants also had the benefit of a multi-criteria decision analysis tool developed by Brugha (2001, 2004a, 2004b) to aid in their selection between alternative properties. The participants were asked to make a choice between various properties prior to using the decision tool and then after using the decision tool. It was expected that evidence of decision biases such as framing effect, escalation of commitment, and overconfidence would be present during the decision process. The purpose of the study was to determine if using the decision tool reduced or minimised these biases.

H1: Behavioural biases such as framing, overconfidence, escalation of commitment are also present in Private Treaty Sales.

The decision tool that was used is *Direct-Interactive*: i.e., the Decision-Maker gives scores and weights directly and is able to adjust them during the process. It also uses *Structured-Criteria*, i.e. it tracks elements of the decision to specific disaggregated criteria of the decision-maker. It is henceforth referred to as the Direct-Interactive Structured-Criteria (DISC) MCDM System.

In the case of this research, the market place was very competitive (Dublin, 2005), and the choice of second-hand homes was limited. This made choosing a home more difficult, because when a choice was finally made, it was likely that there would be competitive bidding and the house could be sold to another party. Thus, the search process would have to start again. It was estimated that each case study could take up to six months to complete with a considerable amount of properties to view and data to collect. It was therefore decided to examine just four cases.

Research Method

Brugha's approach to MCDM is based on Nomology which is based on the premise that intelligent beings choose to follow a common set of simple decision rules. It uses formal principles and axioms and the main principle is that "decision-making processes, in general, are invariant and more likely to be simple than complex." Brugha (1998a). Two independent dimensions are used: Committing and Convincing. These combine into two layers of a development process. In order for a decision-maker to be committed to making a decision, he must be convinced that he is making the right choice (i.e., he must choose between alternatives).

The ideas were originally founded in work by Hamilton (1877) which operates in levels somatic, psychic and pneumatic. Brugha (1998a) shows that these correspond to the three phases of a committing process. Somatic corresponds to the most basic level of commitment and addresses the question "can I get it or have it? Typically a cost question. This relates to the rational side of ourselves, if I cannot afford it, then there is no point considering the choice. Psychic corresponds to the feelings level of commitment and addresses the question "Do I like or want it?" typically a preference question. It is the emotional side of ourselves, we may not be able to afford our choice, or something less expensive may be available, but we choose it anyway. These combine into a typical cost/benefit question. Pneumatic corresponds to the values level. It could be a situational question, relating to location or services.

At the second and lower levels, the issue is about choosing between alternatives. Each convincing question is about a trade-off between technical, contextual and situational issues. For example, in the case of deciding which golf club to join, how does one decide how good are the Facilities and Amenities of the different clubs? One divides the issue into technical aspects to do with the clubhouse and course, contextual issues to do with the club's reputation, and situational issues to do with its location.

Method CASE STUDIES

Four different case studies were conducted during 2005 with property purchasers in South County Dublin. The development of the criteria tree is described in the following sections. All four cases studies used the same criteria tree.

Structuring Criteria Trees

The criteria tree which was developed for this research using the DISC MCDM methodology (Brugha 2001, 2004a, 2004b) is shown in Figure 1 and the procedure for its development is described below.

The problem considered here – buying a house, involves a combination of convincing oneself about various issues and committing oneself to making a decision. Convincing has three levels: technical or self, contextual (other people) and situational. Committing has three levels: need, preference and value.

In this case, the biggest qualitative distinction is at the top of the tree, with the issue of “Price” (Affordable?), vs. Preference for actual house (“House Itself”) vs. “Resale Value” (Good Investment?).

The Affordability Node (Price) has no sub branches. If this node is weighted high, then the decision-maker is very price sensitive.

The “House Itself” breaks into the following clusters:

1. House Description – Physical Structure: Size/Condition/Character; (*technical*).
2. Outdoor Description – Ease of Extension/Overlooked/Garden Aspect etc. (*contextual*).
3. Surroundings – Services/Neighbours/ Facilities in the area (*situational*).

Within the house there are three areas that are considered. The first is a technical issue which is size or area measured in square feet or metres. The next item to be considered is the condition/décor/ambiance. Is the house well presented and maintained? What services are available? This appeals to our emotional side, i.e., do we fall in love with the house at first sight? This node rates perception higher than reality. The final node is *age/character* of the house, which is situational.

In the following table, each of the lower level categories are described in more detail.

Table 1: House Description (Physical Characteristics)

Size	Technical	This is the size of the house in square metres/feet. It is also the size of individual rooms, and the height of rooms.
Condition/Décor/Ambiance	Contextual	This is the ambiance of the house and a commitment in terms of one's work to the house. The following questions about the condition of the house need to be asked? Is there structural damage, woodworm, dry rot etc? Does the house need to be rewired or is new plumbing required? Is a new kitchen or bathroom needed? Is an Alarm required? Will the new owners commit to undertake such tasks?

Character/Age	Situational	Does the property have period features? Or can they be added to look original, e.g., fireplaces, ceiling plaster work, roses, chair-rails, front door, sash windows. Or have new extensions/changes been added that may need to be removed. For example, PVC windows are becoming unpopular, and are also a fire hazard. Another example is a flat roof which may leak.
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Under outdoor description, there are three categories: Ease of Extension, Overlooked and Garden Type.

Table 2: Outdoor Description

Ease of Extension	Technical	Does house have side or rear access for building equipment? Is house attached to others, which may make extensions more difficult? Have neighbours extended their homes? Has planning permission been refused in the neighbourhood?
Overlooked	Contextual	Is the garden private? Can this be changed with landscaping? What is the view from each window, because this is something outside your control? What is expected view in Winter?
Garden Type	Situational	What is the size of the garden? Shape of the garden? Aspect of the garden? Does it have mature planting? Is it just newly landscaped? Do changes need to be made to front driveway, e.g., widen gate for car access, and remove grass to fit another car? Add hedging/fencing for privacy? Electronic Gates? If there is an unsightly oil tank? Is there side access for garden equipment? Is there a garden shed? Is there parking available?

The next node is “Surroundings”. Here one should begin with the more technical “Easy Transport,” - accessibility at rush hour; Public Transport- frequency/routing; and Bus/Bike Lanes. Next is the contextual node “Suitable Neighbours” which has more to do with people, and lastly is the situational

node “Facilities” which describes schools, restaurants, parks, beaches, shops, colleges and businesses in the area.

Table 3: Surroundings

Easy Transport	Technical	Transportation: Accessibility at rush hour. Public Transport – frequency and routing, Bus/Bike Lanes
Suitable Neighbours	Contextual	What are the neighbours like? Similar age group/profile to buyer? Young children?
Facilities	Situational	Proximity to your Workplace, Schools, Businesses, Shops, Restaurants, Bars, Parks, Beaches etc.

Going back to the top of the tree, the last branch at the Committing Level is the pneumatic branch which refers to the “Resale Value.” It poses the question “Is the house a good investment? It really poses a question about the future – Will this investment be good for me? This breaks into the following clusters:

1. Comparable Sales - Is the price good compared to other houses in the area? (*technical*).
2. Neighbourhood. – This focuses on the actual neighbourhood and attempts to establish the current trends on the street. If the population is ageing then future sales will be upcoming. It also questions if the current residents are upgrading their houses which may also influence house values (*contextual*).
3. Future Developments in Area –Future Local Authority Plans could easily be overlooked as they are the least obvious (*situational*).

Comparable Sales has no sub categories. This questions whether this house is fairly priced compared to other houses in the neighbourhood. It is monetary value and is clearly technical.

In the Neighbourhood category, the technical node “Safe” questions if the neighbourhood is a safe place to live. This does not appear in the four case studies as the neighbourhoods chosen in South County Dublin were considered very safe. The contextual node “Aging Population” is associated with people, it questions if the population is getting older, which would imply that other house will be put on the market in the near future influencing price increases. These houses may be bought by young couples or property developers, and sold a few years later for a much higher price, which increases the value of houses on the entire street. The situational node questions recent upgrades or planning permissions to other houses which may also raise future prices.

Table 4: Neighbourhood (Good Investment Potential?)

Safe Area	Technical	Is it a Safe Neighbourhood?
Aging Population	Contextual	Estimate of future housing turnover in area
Recent Upgrades to Other Houses	Situational	Trends in changes to neighbouring houses

And finally, with “Future Development in Area”, there are three branches as shown below.

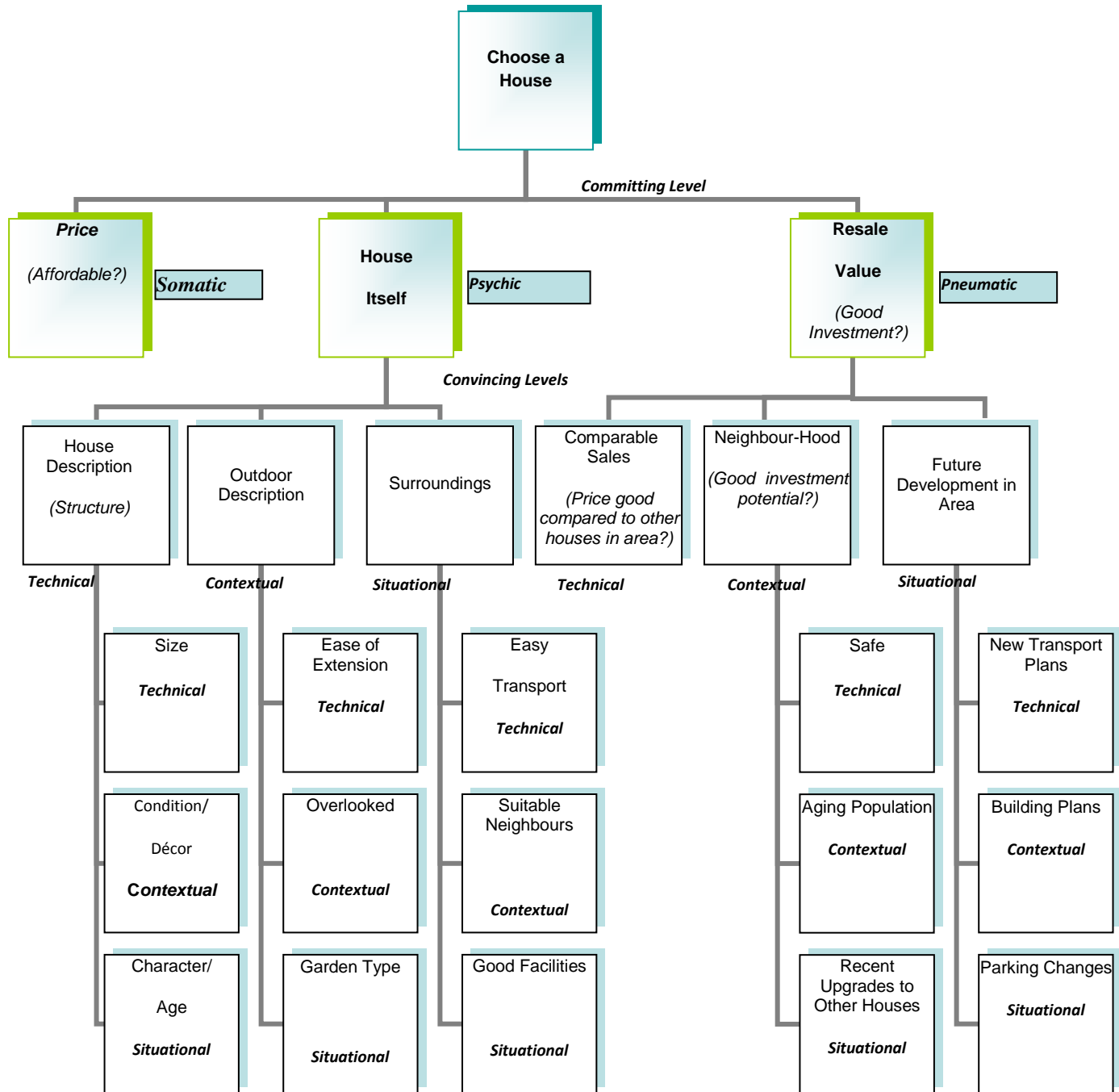
Table 5: Local Authority Plans

New Transport Plans?	Technical	Will there be new trains/bus routes introduced? e.g., LUAS
Building Plans?	Contextual	Inquire about building plans at local planning office
Parking Changes?	Situational	Are there parking restrictions, paid parking, or will this be introduced?

Building plans for new apartments also add value to an area upon completion. In general new apartments are built to a high specification, with expensive fittings and fixtures, which command a high price. The price per square foot for an apartment is generally more expensive than neighbouring houses, which in turn increases the value of these houses. However, this may be only of interest if you are planning to sell your house, as living in a densely populated area may not be desirable.

Introduction of paid parking to an area is also an added advantage. Residents can buy annual parking stickers from the local authority for a relatively small sum (e.g., 25 Euro/year). Paid parking means commuters cannot use these parking places for all day parking, which generally frees up spaces in an area.

Figure 1: The Criteria Tree



Case Study Procedure using DISC MCDM

1. Choose participants who were actively in the process of purchasing a property;
2. There is a real choice between properties that people want to make that has not been made already;
3. Ask each participant to provide weights on categories on the criteria tree, using utility scoring;
4. Ask the participants to read the weighting out loud, to ensure they understood the task;
5. Ask the participants to score their properties on the criteria tree after they had viewed the properties; Check that they provide the scores correctly;
6. Analyse results and ask participant to compare original choice with choice provided by criteria tree. Ask follow up questions for clarity if necessary; and
7. Interview participant after a purchase decision has been made, to examine if criteria tree influenced their choice.

Scoring the Criteria tree

This section describes how the participants provided weights for the tree, and what the different weights mean.

At the initial meeting between the researcher and the participant, each category of the criteria tree was discussed and explained. The participants were asked if they could like to change the structure of the tree or add new categories. In all cases there were no changes recommended. The participants were also provided with the description tables on each category which are provided in the previous section.

The next step in the process is for participants to assign weights for each branch of the criteria tree. They start at the smallest branches of the tree and work their way up (bottom-up approach).

The benefit of working from the bottom up is that, through working with the alternatives and the criteria, the decision-maker learns more about what they mean and so scores them accurately. It also makes more sense to have participants to work firstly with criteria which are qualitatively close and finish up with those which are very different from each other.

In most cases, each branch of the tree has three sub-branches. The sum of the weights add up to “1”, therefore if a participant choose 0.5 for one branch of the tree the other two branches must share a

portion of 0.5 A pre-programmed excel file was used for this process which calculated all the scores automatically. A separate file was recorded for each property.

The next step is to rate each of the criteria for the chosen houses out of 10. For example, if a property had a very nice interior, the participant could provide a score of 7 or 8 for that property. When scoring the next property, the participant could score the property higher or lower depending on how it compared to the initial property. At the end of scoring all houses, the participant could adjust scores for each house so that the scores were consistent relative to each other. Price was the only score that was rated low if the price was high.

The role of the researcher is to provide initial task instructions, and occasionally may ask the participant to further explain their scoring of the tree. For example, if the participant says “that was easy” the researcher might say “tell me more about that.” The neutral prompt encourages the participant to explain his/her actions. The research makes non-judgemental comments only, the participant is forced to make their own choices to complete their own scoring.

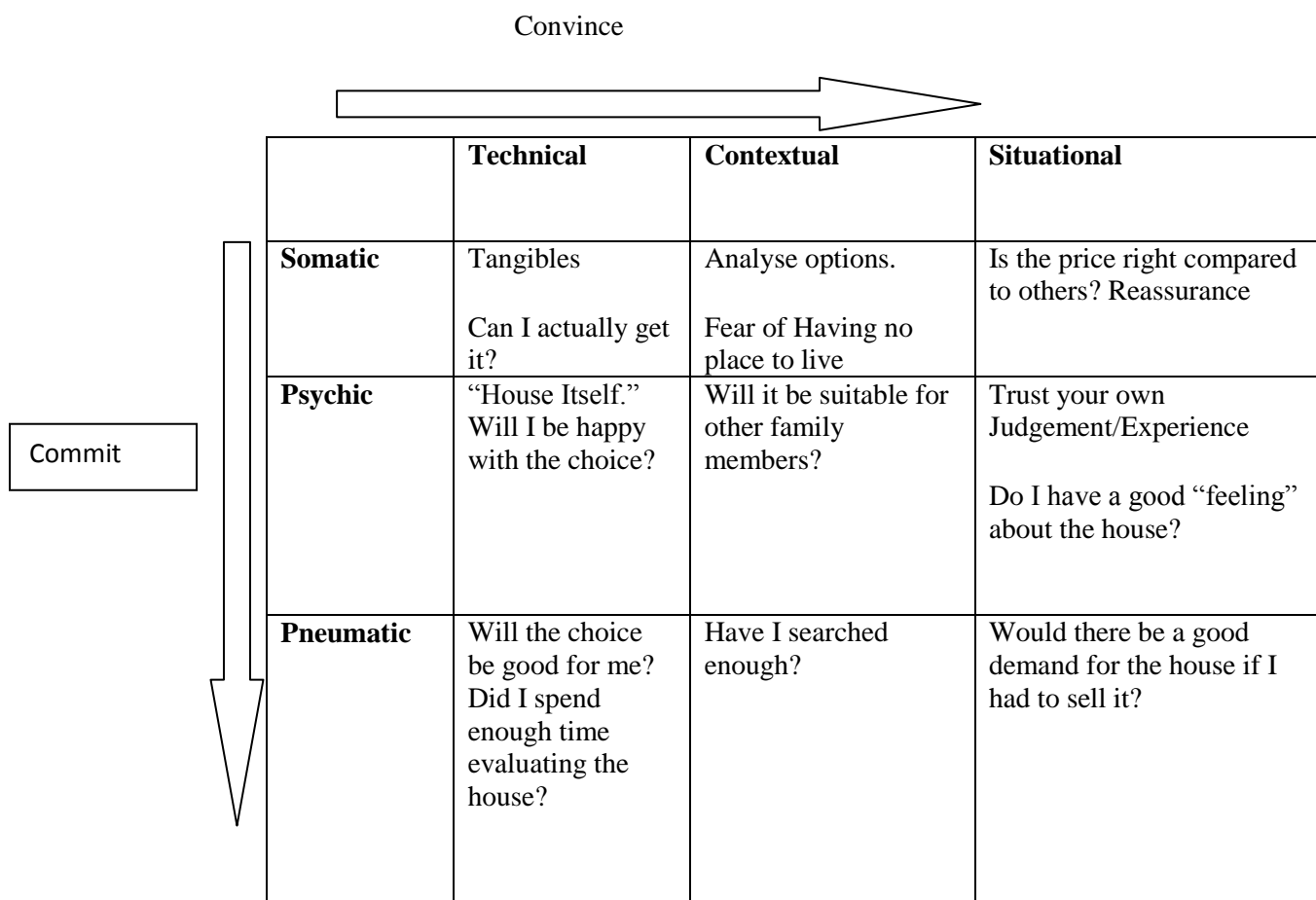


Figure 2: The Committing Process

CASE STUDIES

Four different case studies were conducted during 2005 with property purchasers. By using a criteria tree to break down the components of a decision and score them in a structured way, a decision-maker is less likely to react to their emotions. By using a criteria tree, the decision-maker will become aware of the cognitive and motivational factors that lead to biases in perception.

Case 1: Rose and John

The decision in question involves two Decision-Makers (DMs); a husband and wife team who planned to purchase a property in the South County Dublin area. They have one child (one year old) and their major concern is good local schools. They planned to buy a semi-detached house in Dublin in a family neighbourhood. Their price range was €550,000 to €700,000. However, their aim was to buy a home in the middle of this price range so that they will have funds available for an extension and decoration. They believed this approach will provide better value, and lower stamp duty. They had selected four properties, which were in the market in the September 2005 timeframe.

The DMs provided weights for the tree first, and subsequently a score is provided for each property. Each DM provided their weights and scores separately. The results are provided below:

Their first choice before scoring the four houses with the criteria tree was the most attractive house (Option 1) but also the most expensive house. When scoring the houses with the criteria tree, Option 1 had the highest score with Rose, but Option 3 (the least attractive house) had the highest score with John).

Even though both DM's first choice was Option 1 before using the criteria tree, they agreed that Option 3 had much potential and was for sale for €135,000 less. It was in a location three miles away from Option 1 but had good transport routes.

This case study illustrated that both Rose and John were influenced greatly by the initial visual appearance of the house. They were both subject to a framing effect, Rose more so than John. The criteria tree made their bias evident, and indicated the Option 1 was the best value for money.

Conclusions – Case 1

Both DMs were surprised that the results were different from the choices they made prior to applying Brugh's methodology. Upon reassessing the output from Brugh's model, they realised their original decision was less rigorous and emotionally driven than it should have been. They agreed that they had been influenced by a framing effect. The DMs also commented that prior to using the criteria tree they tended to choose a house based on four categories: price, location, interior and garden. But they didn't weight their choices, and the weights are really what contribute to the difference in outcomes, as illustrated with Option 1 vs. Option 3. They agreed that Brugh's methodology produced a better decision for them, both financially and practically (i.e., the garden was bigger than the other alternatives, which allowed for their large extension.)

In summary, the first advantage of using structured-criteria is that it puts the criteria into a formal structure that facilitates the weighting of choices (Brugh 2004a). A second advantage is that the procedure can be replicated independently of the DAs. A third advantage is that it explicitly uses clusters that have been generated in the minds of the DMs. This means that the clusters are more conducive to being weighted against each other, and likewise the attributes are more easily scored. A

fourth advantage is that, any new criterion brought in by a new alternative can be fitted into the existing structure.

Case 2: Susan

In September 2005, Susan lived in a 2 bedroom apartment in South County Dublin, and was in full-time employment. She had one child who had recently started primary school, and she decided that she wanted to upgrade to a family home. Her price range was €700,000 to €750,000. She decided to focus her search in South Dublin. The two areas she considered were: Dundrum and Cabinteely. At this point Brugha's criteria tree was introduced.

On the top node of the tree she decided that the price of house was the most important factor and she rated it highly. She also wanted a house that was in "Walk-in" condition, so this also got a high score.

There were three houses for sale on the same street. Two of the houses had a sale price of €750,000, and one in had a sale price of €695,000. The less expensive house was dark, the garden was overgrown and it needed some minor renovations.

Susan decided to change the weights on the criteria tree to reflect that price was no longer the most important criteria since all three houses were within her budget. At this point she decided that "House Itself" was the most important criteria and rescored it with her highest score and downgrading the score of "Price". Thus, "House Itself" became the most important category. She noted "What you think is important in theory changes when you actually start viewing houses." (This clearly indicates framing affect).

Basically she convinced herself that even though Option 3 was the cheapest house, and had the second highest score on the tree, it was not her preference. She preferred Option 1 even though it was very similar and cost €55,000 more. She also fell into the trap of rescoring the tree to justify her choice of the more expensive house.

Summary – Case 2

In the case of DM Susan, a number of contradictory factors seemed to appear in the Decision Making process. These are of interest because she altered the weights of the "committing" criteria tree during the course of her decision making. Her decision process initially appeared to be technical. She put a high weighting on the money factor, "Can I afford it?" Then when she found three houses which met both the technical and situational criteria, the technical factor became very low in weight, and the psychic factor was elevated. (The situational factor was no longer relevant since the three houses were on the same street). Within the criteria, the rankings were reversed when the weightings were changed.

Comparing the prices, "Option 3" was the best value at €695,000. As these houses are only 15 years old, only surface decoration was needed. The estimated cost of these repairs was €20,000. In comparison, "Option 1" cost €750,000. If Susan had purchased "option 3" at €695,000, and spent €20,000 on refurbishment, she would have saved close to €40,000. This is a considerable savings to someone who originally had weighted price so highly.

During the decision-making process, when Susan made the offer on "Option 1", she was reacting to her psychic emotions and her fear of having "no place to live." She "had a good feeling" about the house. She made the offer extremely quickly, and did not consider offering less than the asking price even though there were three houses on the same street for sale, one which was priced much lower. She could not extrapolate beyond her current emotional state (empathy gap); she did not want to be

inconvenienced more than necessary by having to do minor renovations to a house and paid a big price (€40,000) for this decision choice.

Case 3: Patrick

Patrick is an accountant and in early 2005 he decided to sell his apartment and use the funds to purchase a house. He made offers on a few houses however he was not the highest bidder and was unsuccessful. He spent six months searching for a property, and had accumulated sunk costs of paying; i.e., he had paid legal fees and property surveys prior to auctions of a few houses, but he was unsuccessful at the auction. He also spent a considerable amount of time viewing houses each weekend. This case study refers to nine houses that he considered purchasing but he viewed many more. When he eventually viewed Option 10 in the area of his choice, he made an immediate offer, and agreed to sign a contract paying over 10% of the property price within the same week. This scenario shows that his commitment was escalated to buy a house as quickly as possible.

In summary, Patrick stated that the criteria tree helped him stay focused on his goals. He remained *price* conscious throughout the process, and focused on the end result, - the potential of the property, not how the house initially looked. He found the tool to be extremely useful throughout the process, and it reassured him that he was making decisions in accordance with his initial goals. He avoided falling into the trap of overpaying at an auction. Option 10 was the most unattractive choice both inside and outside, however, because the psychic factors *House Itself* had a low weight he remained focused on his goal. Even though he attended three auctions, he avoided buying there because he was focused on price.

Case 4: Linda

Linda who was a single woman in her mid thirties and worked in Blackrock, Co. Dublin as a paralegal secretary. She had recently sold her apartment in Co. Wicklow. She had a budget of €490,000.

Her plan was to buy an apartment in Blackrock, as she was tired of commuting. She looked at many apartments in the Blackrock area, but decided that she wants a newly constructed apartment in a new or almost new apartment complex. Linda's major concern was keeping within her budget of €490,000. She also liked the idea of an apartment scheme with a security gate. She viewed five apartments in Blackrock, Co. Dublin. Four out of the five apartments are in the same scheme, and one is situated in another scheme (Option 1) which is an attractive apartment complex with sea views.

Decision Biases

This case study illustrated that Linda was also influenced by a framing affect. Her utility scores had a high weighting on the Psychic affects (*House Itself*). She liked the décor the most at Option 1- Castledawson. But because she had given the somatic factors (Price) the highest weight, her decision outcome was focused on what was more important for her pocket. By using the criteria tree, her framing bias was overcome. Her weights remained unchanged before and after her decision. She also stated that by going through all the nodes and branches of the tree that situational affects like "noisy road" and "access due to heavy traffic" would not have been considered otherwise. When asked how appropriate the criteria tree was for choosing an apartment she stated that "Some of the branches were not appropriate for an apartment, e.g., garden type, but I considered to it be deck type. I believe process worked very well for me, and saved me money."

This is another example of Brugh's tree highlighting the behavioural bias of framing, and thereby the Decision-Maker became aware of the bias and made a better decision.

Results

All of the respondents had a very positive response from using DISC MCDM criteria tree. They agreed that the process was straightforward, and were pleased to have this tool for current and future decisions about property purchase.

One advantage of using structured-criteria is that it is a formal procedure (Brugha 2004a). An extension of this is that the procedure can be replicated independently of the DAs. A third advantage is that it explicitly uses clusters that have been generated in the minds of the DMs. This means that the clusters are more conducive to being weighted against each other, and likewise the attributes are more easily scored. A fourth advantage is that, any new criterion brought in by a new alternative can be fitted into the existing structure.

In Case 1, Rose and John, and Case 4 Linda, the DMs were surprised that the results were different from the choices they made prior to applying Brugha's methodology. Upon reassessing the output from Brugha's model, they realised their original decision was less rigorous and more emotionally driven than it should have been. They agreed that they had been influenced by a framing affect. Rose and John also avoided the Winner's Curse by not getting involved with multiple bidders on a house which was their original first choice. In Case 2 Susan, she stated that the criteria tree had helped her choose the right area and street, however, she ignored the cost factor as soon as the three houses she was considering were within her budget. In other words, she chose to ignore the house that was best value (indicated by the tree). Her cognitive biases were so strong that she ignored common sense. She was overconfident with her decision, she did not ask an expert surveyor for an opinion. By bidding too quickly on an overvalued house she was essentially subject to the Winner's Curse as the threat of other bidders encouraged her to make a fast choice.

In Case 3 (Patrick), he stated that the criteria tree helped him stay focused on his goals. He remained *price* conscious throughout the process, and focused on the end result, - the potential of the property, not how it appeared. He found the tool to be extremely useful throughout the process, and it reassured him that he was making decisions in accordance with his initial goals. He decided not to overpay at auctions. However, as his house search continued, he had accumulated six months of sunk costs in terms of time and money. The bias of escalation of commitment was evident in his final purchase because he made an offer for the property immediately, after a very quick viewing.

In all four cases, behavioural biases were evident to varying degrees, and in three out of the four cases, the research shows that the decisions-makers made better decisions. In Case 2, the framing effect was so prominent, that the decision-maker chose to adjust her weights to ignore the affect of "price". In summary, by using the DISC MCDM (Brugha 2001, 2004a, 2004b), decision biases become evident to decision-makers, and it is ultimately their choice whether to ignore the decision biases or not.

The case study also showed that women were most influenced by "how the property looked" or "the feeling" it created. These influences were stronger than the monetary issue of "Is it good value?" This is agreement with Levy (2008), where men seemed to be concerned with the financial and status aspects of homeownership, whereas women displayed a stronger interest in familial issues (cf. Madigan et al., 1990). Levy (2008) also states that families could undertake structured house searches, but make their final decision based on a general feeling, which in many cases they found hard to articulate or explain. The results from the case studies show that women are more emotional

when buying houses than men, which causes them to lose perspective of the price (as illustrated in the cases).

Our aim of this study was to prove the following hypotheses:

H1: Behavioural biases such as framing, overconfidence, escalation of commitment are also present in Private Treaty Sales.

Decision theory argues that decision-making tools improve our decision making, and lead to a better decision quality. The adaptation of Brugh's (2004a) DISC MCDM for residential property purchase shows that decision quality improves for the decision-maker in most cases. In all four cases behavioural biases were evident to varying degrees. Behavioural biases become evident, but are not eliminated completely.

References

- Anglin, Paul M., "Determinants of Buyer Search in a Housing Market", *Real Estate Economics*, 1997, Vol. 25(4):567-589
- Baryla, Jr., Edward A., and Leonard V. Zumpano, "Buyer Search Duration in the Residential Real Estate," *Journal of real Estate research*, 1995, Vol. 10(1), p1-14
- Brugha, C. (2001). *Decision-Maker Centred MCDM: Some Empirical Tests and Their Implications. Multiple Criteria Decision Making in the New Millennium in Lecture Notes in Economics and Mathematical Systems*. Springer. 507: 69-78.
- Brugha, C. (2004a). "Structure of Multiple Criteria Decision-Making." *Journal of the Operational Research Society* 55: 1156-1168.
- Brugha, C. (2004b). "Phased Multi-Criteria Preference Finding." *European Journal of Operational Research* 158(2): 308-316.
- Diaz III, H., A. (2001). "Behavioural Research into Real Estate Valuation Process: Progress Toward a Descriptive Model." *Research Issues in Real Estate* 8: 3-30.
- Diaz III, J., Hansz, A. (1997). "How valuers use the value opinions of others." *Journal of Property Valuation & Investment* 15(3): 256-260.
- Diaz III, Z., R., Black, R.T. (1999). "Does contingent reward reduce negotiation anchoring?" *Journal of Property Investment & Finance* 17(4): 374-379.
- Duffy, D. (2006). *ESRI House Price Index, Special Edition, The last 10 Years*. Permanent TSB. Dublin.
- Elder, Harold W., Zumpano, Leonard V. and Edward A. Baryla, "Buyer Search Intensity and the Role of the Residential Real Estate Broker," *Journal of Real Estate Finance and Economics*, 1999, Vol.18(3), p.351-368.
- Fishburn, P., C. "Utility Theory for Decision Making," Wiley, New York, 1970
- James S. Dyer et al (1992). "Multiple Criteria Decision Making, Multiattribute Utility Theory: The Next Ten Years," *Management Science* May 1992 vol. 38 no. 5 645-654
- Hamilton, W. (1877). *Lectures on metaphysics*. In: *Lectures on Metaphysics and Logic*. Edinburgh and London, William Blackwood and Sons.
- Kahneman, D., Slovic, P., Tversky, A. (1982). *Judgement under Uncertainty: Heuristics and Biases*. Cambridge, Cambridge University Press.
- Keeney, R., Raiffa, H. (1976). *Decisions with Multiple Objectives: Preferences and Value Tradeoffs*. New York, Wiley.
- Levy, Deborah; Murphy Laurence, Lee Christina, "Influences and Emotions: Exploring Family Decision-making Processes when Buying a House," *Housing Studies*, March 2008
- Saaty, T. L. (1980). *The Analytic Hierarchy Process*, McGraw.

Saaty, T. L. (1990). "How To Make A Decision: the Analytic Hierarchy Process." *European Journal of Operations Research* 74: 426-447.

Savage, L. J. (1954). *The Foundations of Statistics*. New York, Wiley.

Vincke, P. (1999). "Robust solutions and methods in decision aid." *Journal of Multi-Criteria Decision Analysis* 8: 181-187.

von Winterfeldt, D., Edwards, W (1986). *Decision Analysis and Behavioural Research*. New York, Cambridge University Press.

Wakker, P. P., "Additive Representations of Preferences," Kluwer, Dordrecht, Holland 1989