Decision Opportunity & Choice Architecture

On the risk of basement floods

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Abstract

In the paper I propose a decision opportunity for the problem of basement flooding caused by heavy precipitation: property owners can mitigate this risk before it materializes. Implementing the decision opportunity requires an active choice. Social science findings suggest comprehensive and pervasive information processing deficiencies together with contextual influences strongly affect decision behavior. Presenting the decision opportunity in a way that limits negative interference from these behavioral problems is therefore a key theme of the paper. I adopt the PrOACT approach to analyze and resolve these distinct problems. This involves exploring relevant objectives for property owners and for the presentation of the decision opportunity. I consider several technical as well as behavioral alternatives. Backwater valves represent the main group of the former and choice architectural tool sets the latter. Backwater valves block sewage backflow while choice architecture concerns how to present a choice given behavioral problems. By considering the consequences of these alternatives on the relevant objectives the process of eliminating dominated alternatives is pursued, followed by making tradeoffs which enable the identification of suggested choices. Subsequently, I propose that the mechanical backwater valve is preferable for implementing the decision opportunity. This alternative scored well on providing protection, being relatively cheap and involved few additional inconveniences relative to doing nothing about the risk. For presenting the decision opportunity the paper suggests the choice architectural tool set of customization and technology. This alternative scored well on promoting an active choice, promoting welfare increasing choices and providing guidance to property owners. However, its shortcoming is found in its limited capacity to reach all relevant property owners. The paper identifies a need for experimental evidence on the effects of these suggested measures. The starting point for such experimental explorations is further proposed to originate from the paper’s suggested choices.
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1 Introduction

The ability to make decisions is what gives us control over our future. However, it is not merely control that we seek, but influence to make things better. (Bond, Carlson & Keeney, 2008, p. 56).

This paper is my master’s thesis in Decision-, Risk- and Policy Analysis. In the paper I argue for the existence of a “decision opportunity” available to property owners exposed to the technical problem of basement floods and I explore behavioral problems that may hinder the reception of this decision opportunity and impede its subsequent implementation. I address these issues primarily from the context of Malmö, Sweden, although, the findings may have wider application.

A basement flood is a consequence of an urban flood. An urban flood is the inundation of the built environment that occurs as precipitation fall that is heavier than what the urban drainage system has been designed to handle (Hernebring & Mårtensson, 2013, p. 15-19). Such precipitation overwhelms the drainage system and cause raw sewage to back up through drainage lines and flow unhindered into basements, where it accumulates: creating a basement flood (Olshammer & Baresel, 2012; Grahn, 2010, p. 7).

The focus of this paper is with property owners who, as of yet, are unaffected by these floods and choose to do nothing to mitigate the risk. I propose that this decision behavior originates from ignorance, negligence or an active and deliberative choice. My focal point will be on making the ignorant aware and for the negligent to reconsider. I assume that doing nothing before a flooding event (ex-ante) is the revealed preference of a large majority of property owners, that is to say, the choice they actually make (Beshears et al, 2008). Of course the ignorant can be argued to have no preference. The assumption is based on the low adaptation rate of protective measures in Sweden (Olshammer & Baresel, 2012, p 50). However and interestingly the revealed preference of property owners seemingly changes after a flooding event (ex-post) when affected property owners instead actively choose to seek out protective measures: a risk management behavior commonly observed for property risks (Olshammer & Baresel, 2012, p. 46; Kunreuther & Pauly, 2004; Jolls, 2000). I make the argument that this shift in preferences by affected property owners may be indicative of a more general normative preference, that is to say, the choice property owners “ought to” make to advance their actual long-term interest. This introduces the possibility of intergroup learning: could unaffected property owners learn from the decision behavior of affected property owners? In essence, the affected group has gained new information and updated their preferences accordingly, presumably reflecting their own long-term interest. It is against this background that I argue for the existence of a “decision opportunity”: the possibility for unaffected property owners to mitigate the basement flooding risk before it materializes (Keeney, 1992). In the aggregate, installing protective measures is considered a rapid and cost-effective response to the risk of basement floods (Olshammer & Baresel, 2012, p. 43). The decision opportunity inherently “belongs” to the property owner to either act on or not. However, pointing out its existence requires both a message, a medium and a messenger.

Possible messengers include: water companies, public administrations, insurance companies, commercial actors, etc. However, my focus is not with the messenger. Instead my attention is on how the message can be presented. As the decision opportunity is a proposal that can be seized or rejected, it effectively represents a choice. Choices cannot be presented without a framing design. The intricacy of that framing design is the domain of “choice architecture” (Thaler & Sunstein, 2008). It is both what to present and how to present it that constitutes choice architecture, a prescriptive approach that has gained attention for its relatively low cost and potential for mitigating behavioral problems with high impact (Kunreuther, Meyer & Erwann,
In this context I examine which tools of choice architecture that may facilitate the transmission of the decision opportunity most favorably (Johnson et al., 2012). The tools are not mutually exclusive. What I seek is a suitable medium and a starting point of which set of tools the decision opportunity can be propagated.

I propose objectives for unaffected property owners that are used for evaluating protective measures. I also propose objectives for the choice architecture itself to achieve. I then look into alternatives of protective measures in parallel to choice architectural tools that can help overcome behavioral problems. For the former, backwater valves are a contraption that effectively can mitigate the risk of basement floods, essentially by blocking the entrance for sewer backflow. However, an active choice is obviously required from property owners to purchase and install this protective device in order for the protection to be had. What alternative is recommendable to this group of property owners? Furthermore, how is this alternative to be presented to them? Which set of architectural tools are most suitable for this purpose? Finally, I elaborate on the considered alternatives’ consequences and tradeoffs, both with regards to the objectives of property owners and choice architecture. The result of the paper is a suggested choice for the most suitable alternative for the technical as well as the behavioral problem. That is to say, for mitigating the risk of basement flooding and for presenting the decision opportunity, from the assumptions of this paper.

I present the paper according to the PrOACT approach (Problem, Objectives, Alternatives, Consequences & Tradeoffs) as proposed by Hammond, Keeney and Raiffa (2002) to analyze and resolve decision problems. With this structure I seek a coherent narrative that unobtrusively introduces key elements of decision analysis. My hope is that the structure is found entertaining and easier to digest relative to more conventional presentation styles. I apologize in advance to readers who find this hope unfounded.
2 Problem

Most people do not like problems, and since decisions are problems to most people, they typically do not create their own decision problems. Instead, decision problems are usually thrust upon them by others or by happenstance. [...] Once the decision problem is imposed from outside, the so-called solving begins. [...] (B)etter decision situations, which you create for yourself, should be thought of as decision opportunities rather than as decision problems. (Keeney, 1992, p. vii-viii).

Decisions can be thought of as either decision problems or as decision opportunities (Hammond, Keeney & Raiffa, 2002, p. 17-19; Keeney, 1992). In decision situations, decision problems are reactive and elicited or imposed on the decision maker by an external trigger. Decision opportunities are contrastingly anticipatory and can be initiated by the decision maker before a decision problem is imposed. What I propose in this paper is that a decision opportunity exists for the problem of basement flooding. Specifically, property owners may want to consider mitigating the risk of basement floods by installing protective measures, before happenstance effectively thrusts it upon them.

There are several essential components to consider when defining a decision problem or a decision opportunity. The process of defining the problem/opportunity is pivotal because the manner in which it is formulated will profoundly influence the development, direction and the alternatives that will be available for the ultimate decision (Hammond et al, 2002, p. 15-16). In my example I see the problem as having a technical component and a behavioral component. The technical component is the risk of basement flooding whose probability and magnitude can be determined within a given time horizon for a property (with a basement). The behavioral component is the decision behavior of the property owner, whom, when faced by this risk may choose to mitigate it or not. As we will see there are several cognitive intricacies in the mind that can interfere and hamper the reception of the message of the decision opportunity. Hammond et al (2002, p. 20-24) suggest to begin with the external trigger that creates the decision problem: the basement flood. In this chapter I will start by considering components of the technical problem before moving on to the behavioral problem. At the end of this chapter the scope of the problem is stated which will subsequently be addressed for the remainder of the paper.

2.1 Defining the technical problem

In Sweden the capacity of the urban drainage system is designed to correspond to precipitation with a recurrence interval of 1-in-10 years (Hernebring & Mårtensson, 2013, p. 18). This capacity is roughly equivalent to the infiltration capacity of the most commonly found geological conditions in Sweden. Consequently, an urban flood, inundation of land and property in the built environment, will occur when precipitation greater than 1-in-10 years falls as it exceeds the capacity of the drainage system and its surrounding areas. The yearly probability of an urban flood can thus be stated as < 0.1. One consequence of the urban flood that we will focus on is the propensity of the overwhelmed drainage system to cause raw sewage to back up through drainage lines and flow unhindered into basements, where it accumulates to create a basement flood (Olshammer & Baresel, 2012; Grahn, 2010). This is the technical risk that property owners (with a basement) are exposed to.

2.1.1 The external trigger

When precipitation falls that is greater than 1-in-10 which causes a basement flood, a previously unaffected property owner has now been thrust into a decision problem: what to do about this risk of having my property flooded?

However, as this risk is indeed knowable given sufficient information, it can also be anticipated and managed as a decision opportunity.
2.1.2 Basement floods: prevalence and losses

All properties exposed to greater than 1-in-10 year precipitation do not have equivalent risk, as there are several factors that determine the susceptibility of a basement to flood. Obviously, the property will first need to have a basement. Given that it indeed has, then the property’s elevation relative to the drainage system and its surrounding areas will matter (Grahn, 2010, p. 10). This is because surface runoff from higher laying areas will concentrate in lower laying area and exert greater stress there. If the property is unfortunate enough to be connected to a section of the drainage system that uses older combined sewage pipes, where domestic wastewater and storm water flow in the same pipe, the property is particularly vulnerable (Hernebring & Mårtensson, 2013, p. 16; Olshammer & Baresel, 2012 p. 7). This is because the combined pipes are more inclined to overload and cause basement floods relative to their successor the duplicate pipe where the two discharge streams are kept separate. Furthermore, the characteristics of the precipitation itself are of course deterministic where both intensity and duration will matter (Bengtsson, 2009, p. 3-4). The groundwater level will also have an impact as will the saturation level of vegetation etc. (Grahn, 2010, p.7; Hernebring & Mårtensson, 2013, p. 18, 45).

About 39% of Malmö is covered by combined sewage pipes and this system serves some of the most densely populated areas of the city (VA SYD, 2009, p. 6, 14-17; Olshammer & Baresel, 2012 p. 37). An average of over 100 basement floods occur per year out of which the vast majority (97%) is caused by precipitation that is heavier than 1-in-10 years (VA SYD, 2009, p. 24-25; Bengtsson, 2009, p. 10). Year to year variations are, however, very large and a single event can have profound effects: On August 31st 2014, extreme precipitation fell over Malmö causing at least 3500 properties to flood (Wennersten, 2014). It is also possible to distinguish areas where repeated floods of properties do occur (Bengtsson, 2009, p. 10-14). Mårtensson and Gustafsson (2014) have developed a methodology for identifying such areas through model simulations where both the probability and the magnitude of the flood can be estimated, however this goes beyond the ambitions of this paper. For my purposes I will instead simply and for practical purposes equate the yearly probability of a basement flood with the probability of an urban flood, that is to say < 0.1. This crude assumption is likely to be most accurate for properties with a basement that lie lower than its surrounding areas, located where groundwater levels are high and being served by combined sewage pipes with adjacent vegetation saturated. Adjust for a lower probability if one or more of these factors do not correspond with any given property.

I extend a similarly crude assumption to the magnitude of the flood as I will equate it to the average cost of a basement flood and extrapolate it to all such occurrences. In terms of losses, we find that the direct out-of-pocket costs for property owners include insurance co-payments, restoration costs, loss of sentimental value and, particularly for repeated flooding: property value loss. As a benchmark indicator of these costs, we find that the insurance payouts from 8000 floods in 2010, topped 400 million SEK (Olshammer & Baresel, 2012, p. 5-6). Co-payments represented in excess of 100 million SEK. Taken together this suggests that the average basement flood costs about 50 000 SEK, out of which 80 % is absorbed by the insurance companies while 20 %, is charged as out-of-pocket co-payments to the property owner. Interestingly, this percentage is higher than what the relevant insurance policy may suggest: there the co-payment is fixed at 10 % of the sum of the insurance payout, or alternatively as in the case here, set to a minimum payment threshold of 10 000 SEK (Grahn, 2010, p. 9-10; Olshammer and Baresel, 2012, p. 6). Basement floods are thus more likely to qualify for the minimum payment threshold rather than the 10 % fixed sum. Furthermore, the size of the insurance payout given to compensate for damaged assets is determined by a standardized rate of depreciation for the item concerned and will consequently be lower than out-of-pocket restoration costs (Grahn, 2010, p. 11; Olshammer and
The argument is that no one should unduly benefit from receiving a payout. Hence, 10 000 SEK is likely an underestimate when restoration costs are factored in. Additionally, the sentimental value of assets, the emotional attachment bestowed onto items, may turn out to be non-reimbursable for things like photo albums, clothes, keepsakes etc. (Hernebring & Mårtensson, 2013, p. 51; Olshammer & Baresel, 2012, p. 43; Paludan et al, 2011, p. 52; Grahn, 2010, p. 15). Finally, repeated flooding may decrease property value by 10-25 % and lead to higher insurance premiums, although, the latter is at present not common practice in Sweden (Alestig, 2014; Festing et al, 2013, p. 2; Moberg, 2012). Consequently, these aggregated losses from various sources following a basement flood will add up to potentially much more than what the 10 000 SEK insurance co-payment suggests. Given the assumptions about the probability and this estimated magnitude of losses, the expected value of losses within a year is likely to exceed 1000 SEK. If we further assume that the property owner will remain the owner of the vulnerable property for a considerable time, say, 20-30 years, the expected value of losses will be in the range of 8800-9600 SEK. If we factor in the grim prospect of climate change and the expected increase in extreme precipitation, both the probability and the average magnitude of the losses from basement floods are likely to increase (IPCC, 2012).

It is easy to see why being thrust into a basement flood by happenstance is likely an unpleasant decision problem for the affected property owner (Grahn, 2010, p. 7, 25). It seems plausible that having gone through this ordeal was what prompted affected property owners to actively choose protective measures and take control of their vulnerability to this risk and so influence things for the better (Olshammer & Baresel, 2012, p. 46). The decision opportunity is for unaffected property owners to leapfrog the ordeal experienced by affected owners, learn from their judgments and proactively choose protective measures.

### 2.2 Defining the behavioral problem

Knowing about the risk of basement flooding is obviously a prerequisite for any potential action. What the preceding section went through should by no means be thought of as common or even easily assembled knowledge, in Malmö, Sweden. Instead there is a current lack of knowledge about the risk and the technical solutions available to mitigate it with (Olshammer & Baresel, 2012, p 50). In other words, finding out if your property, say, is located in an area of town served by combined sewage pipes is not necessarily easy. Neither is it facile to conduct a cost/benefit analysis of protective measures based on the vague (public) data available on basement floods (Ibid, 2012, p. 6). Following from the above I will assume that doing nothing before a flood by unaffected property owners is a revealed preference, that is to say, the choice they actually make or simply their “taste” (Beshears et al, 2008). This decision behavior I see as originating from either negligence (being aware but doing nothing) or as an active and deliberative choice (being aware and having decided to do nothing). Ignorant property owners (not being aware of the risk) may be argued to have no preference, yet. Affected property owners’ revealed preference is to do something (consider protective measures) presumably due to new information that prompted this update in preferences (Olshammer & Baresel, 2012, p. 44-45). I argue that the normative preference for property owners, the choice they ought to be making that is in their long-term interest, is the affected group’s choice rather than that of the unaffected group. On the aggregated level the affected group’s choice seem to be favored as both a rapid and cost-effective response to this problem (Ibid, 2012, p. 43). In other words, doing something is likely to be better than doing nothing, of course not in every single case, but considering the possibility of action should at least be. To that extent I will exclude from the section below the property owner who actively chose to do nothing as he/she did consider the possibility albeit choose to do nothing (maybe the property already had adequate protection or it was located on a hill etc.).
The more interesting property owners for our purposes are those doing nothing out of ignorance or negligence. The ignorant can be made informed about the risk and then choose to do something about it, become negligent or actively choose to do nothing. The reasons why these two origins of the doing nothing decision behavior are interesting is because they seemingly corresponds well with insights from cognitive psychology about when the disparity between revealed preferences and normative preferences are likely to be larger (Beshears et al, 2008). In this case, the revealed preference of unaffected property owners is to do nothing, which is exactly what will happen if nothing is actively chosen, that is to say, doing nothing choice is the default alternative regardless of its origin. Now, defaults have been found to matter greatly for outcomes and decision makers regularly accept the situation as is, even if this has considerable consequences (Dolan et al, 2012, p. 269; Beshears et al, 2008, p. 1788).

More closely connected to negligence: complexity has been found to delay choice making as the cost of problem-solving is seemingly (too) high, seemingly echoing the quote at the beginning of this chapter (Ibid, 2008, p. 1788-1789). Complexity tends to bias choice away from more complicated alternatives as well as adding “noise” to aggregated revealed preferences as complex alternatives are more likely to be misunderstood.

Applicable to both ignorance and negligence is the problem of limited personal experience (Ibid, 2008, p. 1789). Learning what is in one’s own best interest requires feedback. I have suggested that unaffected property owners may learn from affected property owners, although, this impact is likely to remain theoretical and have limited real world use insofar as it fails to offer a personal experience. Decision makers are far more likely to be responsive to their own experiences than those gained through indirect channels (Ibid, 2008, p. 1789). It is well known that third-party marketing can influence decision behavior (Ibid, 2008, p. 1789). However, in this case the problem is the opposite as there is a lack of awareness about the technical solutions and “not enough” exposure to such marketing for property owners (Olshammer & Baresel, 2012, p. 50). Finally, being faced by intertemporal choice making tend to increase the gap between revealed preferences and normative preferences (Ibid, 2008, p. 1790).

These issues are potential behavioral problems that may hinder the reception of the decision opportunity and impede its subsequent implementation. In the section below I will look more in-depth at various interferences to the decision opportunity necessary to consider as the paper progresses. We start with information processing in the brain and move on to a host of seemingly inconspicuous factors that influence choice.

2.2.1 System 1, System 2 and robust effects that influence choice

There is strong support in social science for the proposition that the human mind can be viewed as if containing two information processing “cognitive systems”: System 1 and System 2 (Kahneman, 2011). The proposition is an abstraction for complex cognitive processes and not for two strictly separated anatomical systems in the brain, although some regions of the brain have been associated with operations typical for either System 1 or System 2 (Mitchell et al, 2011; Camerer et al, 2005). The two systems have starkly different characteristics. Systems 1 is always on, effortless and largely out of your voluntary control (Kahneman, 2011, p. 19-70). System 2 requires your active, dedicated effort and is deliberative, reflective and associated with your sense of agency, concentration and your choices. System 1 is intuitive, driven by habits and highly emotional. This predisposition of System 1 causes it to constantly pass on ideas and feelings to System 2 who is forced to reject, endorse or rationalize these suggestions when articulating judgments and making decisions. This causes fatigue in System 2 who may be unwilling to engage at all: activities that impose high demands on System 2 are typically experienced as unpleasant (Ibid, 2011, p. 39-49). Worse is that System 1 is both highly suggestible and selective in the information it transmits to System 2 for judgment and decision making, who in turn has limited abilities and incomplete knowledge (Kahneman, 1973).
This cognitive set-up gives rise to heuristics and biases that everyone uses to form (unaided) judgments in decision making (Ibid, 2011, p. 89ff; Tversky & Kahneman, 1974). Heuristics and biases originate in System 1 and are all pervasive. Heuristics are equivalent to answering an easier, although correlated, question with the one you were actually asked. A bias suggests that the answer will be systematically skewed in a predictable direction. Usually, the decision behavior emerging from these cognitive processes is fairly reliable and satisfactory, but sometimes the result is misleading or mistakes in judgment. As in the case of revealed and normative preferences, deviation from that prescribed by expected utility theory is to be expected at times (Kunreuther, Meyer & Erwann, 2013; Beshears et al. 2008; Kunreuther & Pauly, 2004).

Indeed, contextual influences from ubiquitous surrounding factors have been found to be strongly determinative to decision behavior (Dolan et al. 2012; Tversky & Kahneman, 1981). Dolan et al (2012) dedicate their article to cataloging the most robust effects found from these contextual influences. For example, the feelings and authority we associate with a messenger will matter greatly for how the message will be received (Ibid, 2012, p. 266). More generally, affective responses and associations strongly influence decision making (Ibid, 2012, p. 271). These responses are constantly triggered (primed) by inconspicuous factors from our surroundings that automatically bring such information to mind from memory (Ibid, 2012, p. 270-271). Such information come with emotions attached and decision makers tend to let their “likes” and “dislikes” determine beliefs and choices (known as “the affect heuristic”, see: Slovic et al, 2007). Decision makers take cues from how others react, by anchoring and comparing their own behavior to their perception of the relevant social norm (endorsement or rejection) (Dolan et al, 2012, p. 268-269). Interestingly, it is found that self-control problems can be mitigated by making ex-ante (public) commitments as failing to keep them come at a reputational cost (Dolan et al, 2012, p. 271-272).

Decision makers are “tribal”, overconfident and hold unrealistically optimistic beliefs (Dolan et al, 2012, p. 267, 272). Our brain has a built-in “optimism bias” that can be extended to the social group we associate ourselves with be (Sharot, 2012). Having made a decision we alter our beliefs in support of that decision (known as “cognitive dissonance”, see: Festinger, 1957). The brain also updates beliefs asymmetrically from new information, where positive news is more likely to be learnt from than negative news (Sharot et al, 2011). The UK Government have even developed a corrective manual for optimism when granting projects (HM Treasury, 2013). Attention is a limited resource that is easily drawn to whatever is salient and can shape what is ultimately chosen (Dolan et al, 2012, p. 269-270).

Finally, behavioral insights can offer enhanced understanding of the likely impact and response of decision makers to incentives (Ibid, 2012, p. 267-268). We care about more than just final outcomes: changes from the initial condition, the reference point, matters a great deal. Losses are felt more strongly than gains and loss aversion is to be expected. We tend to deal poorly with small probabilities and we have a pervasive inclination to code, categorize and evaluate prospects in discrete accounts: violating the perfectly fungible property inherent to money (known as “mental accounting”, see: Thaler, 1999; Thaler, 1994, p. 25-47). This is by no means an exhaustive list of behavioral problems and for the interested reader I recommend pursuing the subject further from the references at the end of the paper.

2.3 Scope of the problem

Not all property owners face the same risk of basement flooding. Out of necessity, with regards to time and means I have limited the scope of this paper to the problem of property owners unaffected by a basement flood who do nothing to mitigate the risk due to ignorance or negligence. The probability of occurrence in a given year has crudely been assessed to around 0.1 and the estimated magnitude of losses as above 10
000 SEK. The decision opportunity is the choice to mitigate the risk before it materializes. In chapter 4, we will look at technical alternatives that can reduce the risk.

However, behavioral problems may hinder the smooth reception of this message and/or its implementation. The decision opportunity hinges on System 1 recognition and System 2 execution. Presenting the decision opportunity in a manner that increases the likelihood of its implementation then becomes crucial. In a sense to “nudge” the property owner into considering protective measures (Thaler & Sunstein, 2008). This is where choice architecture enters the paper and as we shall see it has both paternalistic and libertarian features (Sunstein & Thaler, 2003). Choice architecture uses our behavioral problems constructively and has developed several tools to target specific behavioral problems (Johnson et al, 2012). Going forward the issues to be addressed through choice architecture is what to present to the decision maker and how to present it.

In the next chapter we will look at possible objectives that the property owner may accommodate when considering protecting his/her basement. In parallel and for the decision opportunity, we shall seek objectives for choice architecture.
3 Objectives

By itself, an understanding of human error cannot justify paternalism. We need to have a sense of what paternalism is for – of what it would actually achieve in people's lives. The obvious answer is that if choice architects are armed with an understanding of where people go wrong, they are in a good position to help people go right. The central idea is that some forms of paternalism can enable people to have better lives (by their own lights). If there is a moral argument on behalf of paternalism, this is where it resides. (Sunstein, 2014, p. 87).

Values are fundamental to decisions insofar as being what you really care about (Keeney, 1992, p. 3). You perceive an alternative in varying degrees of good or bad largely dependent upon how well it corresponds with what you value. The implication is that (your) values are the decision criteria you ought to formalize and apply as you go about evaluating and comparing alternatives (Hammond et al, 2002, p. 29-30; Keeney, 1992, p. 6-7). A property owner may, for example, value a safe and secure home. He/she may also value stability over time in these domains, that is to say, bad surprises such as a basement flood implies no positive value.

The concept of objectives are analogous to that of values. An objective is simply a statement of something you wish to achieve in a given situation (Keeney, 1992, p. 34-35). Faced by the risk of basement flooding an objective may be to stem or mitigate that risk, which of course coherently follows from the values about a safe and secure home over time. Importantly, objectives like values are essentially personal, although they may be extended and shared by groups or organizations. As I have suggested in the preceding chapter, values and objectives expressed as revealed preferences by the group of affected property owners may be translatable to the group of unaffected property owners in the context of basement floods.

Regardless of their exact origin objectives are indeed pivotal for sound decision making (Hammond et al, 2002, p. 31-39). Insofar as it is objectives that outline the underlying reasons behind a decision and give an indication about its importance. Objectives guide what information to seek. Listing and incorporating all relevant objectives in the decision process produces a more balanced decision. Obviously, the skill of being able to articulate in what way each objective is relevant for the decision situation is imperative.

I do not claim the ability to express objectives representative for all property owners or for all conceivable constellations of choice architecture; I will have to remain in the abstract in both cases. I will start the chapter by looking at theoretical structures of objectives, followed by exploring human deficiencies in this domain before moving on to the helping hand and reasoning of choice architecture. I will end the chapter by hypothesizing objectives for property owners considering protective measures and for the choice architecture of the decision opportunity.

3.1 Means and ends

Inevitably, whatever you want to achieve in any given situation will be context-dependent (Keeney, 1992, p. 34-35). Breaking down your objectives in a sequential fashion as either means or ends, can be helpful. Means objectives make it possible to achieve something of greater interest to you: your ends objective. Your ends objective is simply what you wanted to achieve in that particular situation. The purpose of means objectives is to help you identify and generate alternatives with which you can achieve that more fundamental ends objective of yours. Consequently, alternatives are evaluated and compared on the basis of their consequences for the ends objectives alone (Ibid, 1992, p. 85).

In more complex matters objectives hierarchies and means-ends networks can be constructed to map out relationships between objectives (Ibid, 1992, p. 69ff). Objectives hierarchies involves making value judgments on objectives desirability, while means-ends networks require factual knowledge (Ibid, 1992, p. 81-82).
3.2 Objectives and human error

Identifying and articulating objectives require active, dedicated effort in a deliberative, reflective mental process. In other words it is an operation that is characteristic of System 2. Recall: activities imposing high demands on System 2 are typically experienced as unpleasant (Kahneman, 2011, p. 39-49). System 2 has limited abilities and incomplete factual knowledge. Human error, that is to say, mistakes become likely. Specifically, this translates into a poor ability to generate self-relevant objectives in any given decision situation (Bond et al, 2008). Decision makers typically fail to identify up to half of the objectives that they themselves will, if asked, state as being crucial to the decision (Ibid, 2008, p. 62). Worse, the overlooked objectives are close to on par in perceived significance with the ones they themselves identify (Ibid, 2008, p. 64). This deficiency is proposed as due to decision makers not thinking broadly enough about objectives and not thoroughly enough about how objectives are relevant for the decision situation (Bond et al, 2010, p. 251-252). Providing decision makers with a master list of objectives have been found to improve more comprehensive inclusion of objectives (Ibid, 2010).

People are busy, their minds preoccupied with diverse matters and time as well as attention is always limited. In such an environment unfamiliar, complex and unusual problems like basement flooding may be overlooked until happenstance imposes it. Facilitating deliberation about the risk and its mitigation should be made simpler.

3.2.1 Libertarian Paternalism and choice architecture

It is not an oxymoron, Sunstein and Thaler (2003) assures us, although “Libertarian Paternalism” sure sounds like one. Their argument is for it to be both possible and indeed desirable to influence certain kinds of behavior while respecting freedom of choice. The politics of libertarian paternalism wants to assist decision makers in finding suitable means for promoting their own ends (Sunstein, 2014, p. 19). This is a paternalistic proposition as it does so by intentionally influencing choices for the “better”, often with regards to welfare, both from a societal and individual perspective. At the same time no coercion or compliance is required, the decision maker is to remain free to choose according to his/her own volition, hence the libertarian moniker. This prescriptive approach to decision making will first attempt to “nudge” decision makers in the desired direction, before additional interventions are to be considered (Thaler & Sunstein, 2008; Sunstein, 2014). The cognitive mechanism that these nudges tap into are the same as those behavioral problems I explored in Chapter 2 (see: 2.2 and 2.2.1).

Choice architecture is nudges applied to presenting anyone with a choice and concerns what to present and how to present it (Johnson et al, 2012; Thaler & Sunstein, 2008, p. 89-109). A choice cannot be presented without a design and any design will have go through the quirks inherent to our System 1, System 2 cognitive setup. Consequently, the design will trigger inconspicuous contextual influences and so influence choice (Sunstein, 2014, p. 21). The point of choice architecture is to acknowledge this fact and use it consciously rather than unintentionally. This obviously raises concerns about the paternalistic nature of choice architecture, what are the motives, or as we have addressed them: its objectives?

Paternalism can be perceived as being “soft” or “hard” depending on the “cost” it imposes on the decision maker (Sunstein, 2014, p. 55-61). Regardless if these costs are seen as in a continuum or as discrete categories, the general idea is for a progression to exist from, say, a warning to something harder like a fine or even a jail sentence. Furthermore, libertarian paternalism is choice preserving. The mechanism of nudges are meant to influence the decision maker toward choices that will (likely) promote his/her own ends. Consider, for example, the default (or the recommended) configuration versus the customizable configuration that are prompted as choices when installing a computer program. This is an example of a choice architectural
nudge. If you know nothing or have no inclination to select among a myriad options in the customizable configuration, you can choose the default, be just fine and move on to more important things. No coercion needed. Now, consider instead that the default was that you had to select all configuration yourself before you could move on to more important things. The former is an example of soft paternalism while the latter of hard paternalism. Importantly, none of these examples forced you to install the program: you chose to do so out of your own volition. The choice architectural nudge just made that process simpler. In this way choice architecture represents a type of means-ends network, complete with the needed factual knowledge (default configuration) that makes it possible to guide the decision maker toward a choice that will help him/her achieve their own ends. We can easily extend the example to include the decision maker’s means objective: installing the program to enable, say, word processing in order to achieve his/her ends objective for the situation: writing a master thesis.

A final dimension exists to paternalism: means paternalism versus ends paternalism (Sunstein, 2014, p. 61-72). An example of soft ends paternalism: Unaffected property owners are automatically enrolled in an insurance plan that orders and bills them for a particular protective measure against basement floods, unless they opt out of it. An example of hard ends paternalism: A law requiring protective measures against basement floods. A breakdown of the paternalistic dimensions are illustrated in table 1 below.

Table 1. Overview of different types of paternalism.

<table>
<thead>
<tr>
<th>Means paternalism</th>
<th>Ends paternalism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft paternalism</td>
<td>Choice architectural nudges</td>
</tr>
<tr>
<td></td>
<td>Automatic enrollment in plan with protective measures (with opt-out provision)</td>
</tr>
<tr>
<td>Hard paternalism</td>
<td>Defaulting with forced choice</td>
</tr>
<tr>
<td></td>
<td>Law requiring protective measures</td>
</tr>
</tbody>
</table>

This breakdown is an adaptation of table 2.1 on page 71 in Sunstein (2014).

Choice architecture, as used in this paper, is found in the upper-left quadrant. In section 3.4 I look into the objectives I propose for this choice architecture. Next I will propose objectives that property owner may accommodate when considering protecting his/her basement.

### 3.3 Objectives: Property owners

I have already suggested that a property owner may value a safe and secure home. That is an ends objective. Furthermore, he/she may also value stability over time in these domains. Another ends objective. Minimizing volatility is then a means objective. The purpose of this means objective is to generate alternatives for how to uphold the stability of a safe and secure home. By looking at the sources of such peril this may take us down to the basement where we discover a vulnerability to floods. Mitigating that risk is then a mean that will promote the ends objectives. We have now constructed a simple means-ends network and even implied an objectives hierarchy (safe and secure on top with stability over time below). However, these objectives are too high in the objectives hierarchy for our purposes. I will therefore propose the following three ends objectives that unaffected (but aware of the risk) property owner accommodate which are directly applicable to the situation of basement flooding:

1. Avoiding a flooded basement.
2. Keeping costs to a minimum.
3. Limiting inconveniences.

Basically, I assume that unaffected property owners simply want to prevent a flood, with little inconvenience and at a decent price. As we shall see in the following chapter, doing something about basement floods come with inconveniences. I will consider the following inconveniences: (i) Basement’s storage arrangements changes, (ii) Efforts required with heavy precipitation, (iii) Temporary disabled wastewater evacuation (iv) Reoccurring maintenance or inspection needs and (v) Space requirements. Compared to the default of doing nothing we find that four of these instances imply *additional* inconveniences (doing nothing causes temporary disabled wastewater evacuation during the flood). Having as few of these inconveniences as possible is obviously attractive.

### 3.4 Objectives: Choice architecture

Who is the messenger of the decision opportunity? I have earlier proposed several possible messengers: water companies, public administrations, insurance companies, commercial actors, etc. All of these messengers will have particular and unique sets of objectives that best promote their own ends. I have chosen not to “pick” one of them and pursue the exercise of adapting a distinct choice architecture accordingly. This is because my interest is elsewhere and broader: How can the decision opportunity be most favorably presented through the use of choice architecture?

In trying to answer why this is so, let us start with welfare. I assume that heeding the decision opportunity and subsequently implementing it, is generally a welfare promoting choice for unaffected property owners. Promoting welfare increasing choices is therefore an ends objective. On a more general level the decision opportunity is also a choice that unaffected property owners are asked to take an active position on. Eliciting an active choice is another ends objective and a clear departure from the idleness of doing nothing. As many property owners as possible should receive the message and most importantly the choice architecture needs to providing guidance that make the selection of suitable alternatives less of a strain on System 2. Both of these are also ends objectives which brings the total of ends objectives for the choice architecture to four:

1. Promoting active decision making.
2. Promoting welfare increasing choices.
3. Reaching all property owners.
4. Providing guidance.

Now, we have objectives for both the property owner and for the choice architecture. In the next chapter we will look at alternatives with which these objectives are to be achieved.
4 Alternatives

Choice architecture is inevitable, and hence certain influences on choices are also inevitable, whether or not they are intentional or the product of any kind of conscious design. (Sunstein, 2014, p. 21).

In decision situations alternatives are inescapable (Hammond et al, 2002, p. 45-54). Alternatives are means to achieve an end. If backwater valves can mitigate the risk of basement floods they are a means to promote that end. However, the range of alternatives considered also set the limit for what is possible to achieve and to choose from in the decision situation. In other words, the chosen alternative and its consequence can be no better than the best of the alternatives considered. If only a limited set of backwater valve types are considered then obviously the potential benefits of backwater valves not considered will fall outside of the decision situation. This is why thinking broadly when seeking alternatives is rewarding and also why decision maker’s deficiencies in this domain are troublesome (Bond et al, 2008). Facilitating these processes are therefore a suitable target for choice architecture.

In this chapter we begin by exploring technical alternatives, so-called backwater valves that mitigate the risk of basement floods. We will look at several different types of valves with varying degrees of sophistication and cost. These represent the available alternatives that property owners can choose from and implement, effectively seizing the decision opportunity if doing so. We will also explore the tools that are at the disposal of choice architecture. These are the tools with which the decision opportunity can be presented.

4.1 To mitigate the risk of basement flooding

There are many alternatives available with which property owners can mitigate the risk of basement flooding. A dramatic measure would be to sell the property and relocate to higher grounds with no basement. Similarly, removing openings and reconstructing the property to eliminate this risk would be both dramatic and expensive. Other alternatives include: erecting barriers such as window wells, flood walls around doors, flood gates at driveway entrances or simply placing sandbags to cover vents and other openings during heavy precipitation. (NYC, 2014, p. 2). Other preventive measures include: improving lot drainage by reducing the amount of impermeable surfaces adjacent to the property, disconnecting the downspout and letting the storm water drain in a rain barrel or above ground in an area that slopes away from the property instead of feeding into an overloaded drainage system (Ibid; VA SYD, 2009, p. 28). These are all sensible alternatives that reduce the general risk of flooding but as my focus is narrower other alternatives are necessary. This is because the technical problem in this paper is caused by sewage backflow which originates in the drainage line that normally discharge wastewater from the property, as we saw in chapter 2 (see 2.1). The specific category of technical alternatives that addresses this problem are backwater valves (also known as check valves). We will go through six different types of backwater valves below. However, before we move on to those there is one noteworthy alternative left that I will mention:

1. Alternative 1: Elevate items from the floor (NYC, 2014, p. 3).

It is a beautifully simple and cost-effective anticipatory protective measure. Of course, this measure is highly limited as it does nothing to actually avoid a flooded basement and only concern movable objects. Nevertheless, its potential to decrease sentimental value losses should not be overlooked. I will include this alternative throughout the paper.
4.1.1 Backwater valves

Backwater valves are devices that put an obstruction in the way of back flowing sewage to prevent it from entering the basement. Backwater valves come in various sizes to fit varying needs and can be installed either inside or directly adjacent to the concerned property (Olshammer & Baresel, 2012, p. 21). In a report compiled for Insurance Sweden, an industry organization for Swedish insurance companies, Olshammer and Baresel (2012) have detailed six varieties of backwater valves that are suitable for our purposes. I will present these six types with increasing levels of sophistication below:

1) **The manual backwater valve** (Ibid, 2012, p. 22-23). This valve has an installation cost of less than 1000 SEK per valve. It requires somebody to manually switch it on in anticipation of a potential flood. It also needs to be switched off after the event to re-enable discharge of wastewater from the concerned pipe of the property.

2) **The mechanical backwater valve** (Ibid, 2012, p. 23-24). The installation cost of this valve is about 5000 SEK per valve. It automatically closes in response to increasing air-pressure when the water level rises. The valve can also be closed manually if desired. It requires yearly inspection to ensure smooth functionality. Evacuation of wastewater from the concerned pipe of the property is disabled during use.

3) **The electronic backwater valve** (Ibid, 2012, p. 24-25). The cost of this valve is 10 000 SEK, not including installation costs or yearly inspections by qualified personnel. This valve has an electronic sensor and a motor that closes the valve when needed. Evacuation of wastewater from the concerned pipe of the property is disabled during use.

4) **The backwater valve with elevating pumping device** (Ibid, 2012, p. 25-27). This valve has an elevating pumping device that lifts the wastewater from the concerned pipe of the property above ground level, thus enabling continuous evacuation during use. This solution cost around 15 000 SEK, not including installation costs, operational costs and yearly inspections by qualified personnel. This alternative is particularly recommended by Olshammer and Baresel (2012, p. 26) as it provides excellent protection but is unsuitable for narrow spaces.

5) **The electronic backwater valve with pumping device** (Ibid, 2012, p. 27-28). Coming in at cost of about 15 000 SEK, not including installation costs, operational costs and yearly inspections by qualified personnel. The pumping device of this valve allows for continuous evacuation of wastewater from the concerned pipe of the property. This solution is like the preceding alternative particularly recommended by Olshammer and Baresel (2012, p. 26) as it provides excellent protection and is suitable for narrow spaces.

6) **The backwater valve adjacent to the property** (Ibid, 2012, p. 28-29). This valve is designed to be installed directly adjacent to the property and includes an associated cesspool. The installation cost is around 50 000 SEK, not including maintenance and inspection costs. The valve allows for continuous evacuation of wastewater from the concerned pipe of the property.

In the next chapter we will look at the consequences of these alternative on the objectives of the property owners. I will now turn the choice architectural tools.

### 4.2 Tools for choice architects

Anyone presenting someone with choices is a choice architect. The way a choice is presented matters greatly and precisely because there is no neutral way to do this that
choice architecture is inevitable (Johnson et al, 2012, p. 488). Choice architecture can be helpful and simple or harmful, complex and exploitative (Sunstein, 2014, p. 15). As implied by the objectives in the previous chapter the choice architecture for the decision opportunity aims toward the former rather than the latter. Johnson et al (2012) propose two distinct categories of tools for choice architects: tools that help structure the choice task (what to present) and tools that help describe the choice options (how to present) to the decision maker. In the sections below tool 1-6 are structuring tools, tool 7-9 are describing tools while tool 10-11 are additional tools that deal with known implementation issues.

### 4.2.1 Tool 1: A requisite number of alternatives

Complexity, as in too many choices can provoke feelings of alternative overload or alternative paralysis in decision makers and tend to delay, bias and/or add noise to choice (Johnson et al, 2012, p. 488-490; Beshears et al, 2008, p. 1788). Presenting a smaller number of alternatives will mitigate this effect. The challenge for the choice architect is to strike a balance between the likelihood of decision makers finding a preference match and that of presenting fewer alternatives. The preferences match is the alternative that corresponds to the decision maker’s objectives. It is this reduction of alternatives for the technical problem that will be the result of this paper, while the result of the behavioral problem is with which tools (how) to present it.

### 4.2.2 Tool 2: Technology as decision aids

Technology is a prevalent feature of everyday life for most people, property owners included (Johnson et al, 2012, p. 490-491). Technology can act as decision aids that facilitate and simplify the process of finding, sorting, evaluating and choosing a suitable alternative. Through a sympathetic user interface technology can enable comparisons of alternatives based on the relevant objectives for the decision and help to identify or even suggest novel alternatives that otherwise might have remained unknown. Technology allows for personalization and hence can accommodate heterogeneity, such as the ability to filter out unattractive alternatives.

### 4.2.3 Tool 3: Setting up a default

Changing what happens if nothing is actively chosen is a particularly powerful choice architectural tool that abates the effects of decision inertia or passivity (Ibid, 2012, p. 491-492; Beshears et al, 2008, p. 1788). Changing the default can be done in several ways: setting one (new) default for all property owners (say, a law requiring backwater valves), assigning a default at random (as an experiment: automatic enrollment in an insurance plan that will order and bill selected property owners unless they opt-out) or forced choice (withholding insurance coverage until a position is taken by the property owner on the decision opportunity).

All of these defaults are harder forms of paternalism than what I intend for the choice architecture of the decision opportunity (see table 1 in 3.2.1.). Nevertheless, defaults are important to choice architecture despite their obvious ethical risk. By randomizing defaults the possibility to test and gather empirical evidence on the effects arises, this is already applied to public policy in the UK (Haynes et al, 2012).

### 4.2.4 Tool 4: “Good enough” rather than optimal

Similarly to the deferral of choice that occurs in face of complexity, endlessly searching after or awaiting for the optimal alternative to emerge can also delay choice (Johnson et al, 2012, p. 492). For example, backwater valves come with different benefits at various price points. The choice architecture could assist the property owners to settle for “good enough” alternatives rather than opting a more commercial
design that may instead want to highlight the most beneficial valves from the standpoint of the messenger.

4.2.5 Tool 5: Limited time window
To counteract the effects of procrastination from decision situations with long time horizons, it has been found useful to set up offers that are limited in time (Johnson et al, 2012, p. 492-493; Beshears et al, 2008, p. 1789). An easily imaginable example could be to offer a discount on backwater valves with an expiration date to unaffected property owners.

4.2.6 Tool 6: Staging the decision
There is a difference between making a single decision (yes, I want a backwater valve) and a series of decisions on configuration options (should it have an elevating pumping device or one placed outside etc.) and this has implications for how choices are made, justified and the information considered (Johnson et al, 2012, p. 493). Decision makers are more likely to choose default configurations if many configuration options are required. Screening for suitable alternatives is usually simplified by focusing on a narrower subset of features which are then compared across alternatives. Consequently, “staging” the alternatives so certain features, the property owner’s objectives, become the focal points and base for this process. Essentially enabling the sorting and filtering of alternatives based on these objectives.

4.2.7 Tool 7: Splitting and merging
If you increase the section allotted to fruits and vegetables in a shopping cart will it end up influencing the amount bought? It turns out, it might (Wansink et al, 2014). Building on the mechanism identified in Tool 6, when faced by a fixed set of configuration options for an alternative decision makers tend to have a strong bias to allocate attention and resources evenly over the finite set (Johnson et al, 2012, p. 494-495). Be it assigning probabilities to events or investment opportunities, even allotment is seemingly the default. Therefore it matters not only what alternatives to present to the decision maker but also how these alternatives are broken down in the presentation. If certain features of the alternative is presented as divided into sub-categories while other features are merged into a single category, the former will have more salient feature and influence in the decision situation than the latter. For backwater valves it can be preferable to make features corresponding to the property owner’s objectives more salient, while merging technical data into one category since it likely targets professionals rather than our subjects.

4.2.8 Tool 8: Adding labels
Decision makers tend to use information selectively to predict their projected satisfaction with various alternatives and when making their choice (Johnson et al, 2012, p. 495). Too much information and too many features can cause overload and paralysis produce poorer choices based on even on a single aspect (Iyengar & Lepper, 2000; Peters et al. 2007). Peters et al (2007) find that decision makers are better at comprehending information if the threshold of cognitive effort is lowered, that is to say, when the choice is simplified. Adding evaluative labels with qualitative descriptions (words, symbols or ratings etc.) as supplements to numeric information increases information processing speed as they trigger affective responses that are quickly assessed. Put differently, attract System 1 who will pass it on to System 2.

4.2.9 Tool 9: Translating properties
Complexity from non-linear or counter-intuitive properties are a common source of confusion leading to poorer choices (Johnson et al, 2012, p. 495-496; Beshears et al,
Understanding the probability of a basement flood within 20-30 years is about 88-96% for example. Translating the risk over a longer time horizon may be a more intuitive way to consider the problem and this also simplifies evaluation against the time the property is expected to be in their possession.

### 4.2.10 Tool 10: Customization

Individual differences will inevitably influence the outcome from choice architecture (Johnson et al, 2012, 496-497). It is therefore crucial to have some understanding of how the property owner is likely to process and draw meaning from the choice architectural design of the decision opportunity. In this paper we only have an abstract understanding of the objectives that were defined for the group of unaffected property owners (see 3.3) which should certainly not be thought of as individually representative. Customizing the set of alternatives and what features to present could increase the likelihood of preference matches. A user interface that prepopulates a (default) list with relevant suggestions and responds to user input by adjusting its recommendations (say, according to the address of the property) is easily imaginable.

### 4.2.11 Tool 11: Experiencing the outcome

People are generally poor at accurately predicting the desirability of the experience they will enjoy from the consequences of their choice (Johnson et al, 2012, 497-498). Over- and underestimations are both common as is a failure to sufficiently adjust for adaptation to enduring changes. Attempting to adjust for these inaccurate predictions can be tried with choice architecture. For example, doing nothing to mitigate the risk of basement floods may be an inexpensive choice, until the flood actually occurs. Taking control to ensure a safe and secure home by installing a backwater valve may be a more pleasant experience over time.

### 4.3 Alternatives considered

In this chapter we have explored technical alternatives that can mitigate the risk of basement flooding and several choice architectural tools. Although I presented the choice architectural tools separately, I will group them to tool sets since there is considerable overlap between tools. Below I provide a summary of all alternatives:

I. **Technical alternatives:**
   1. Elevate items from the floor.
   2. Install a manual backwater valve.
   3. Install a mechanical backwater valve.
   4. Install an electronic backwater valve.
   5. Install a backwater valve loop with elevating pumping device.
   6. Install an electronic backwater valve with pumping device.
   7. Install a backwater valve adjacent to the property.

II. **Choice architectural tool alternatives:**
   1. Changing what happens if nothing is done: Tool 3.
   2. Dealing with overload issues: Tool 1, Tool 4 & Tool 5.

We now have our problems, objectives and alternatives. In the next chapter I will have a look at the consequences these alternatives signify for the objectives.
5 Consequences

For each domain, one may wonder whether choice architecture can leverage economic solutions. Prior to the advent of choice architecture, traditional models in economics have suggested three policy levers: altering prices, providing information, and placing restrictions on purchasing and other behavior. […] The good news is that the same factors that lead us to make a mindless suboptimal or unhealthy choice can often be reversed to help us make a mindless better choice. (Johnson et al, 2012, p. 499-500).

It is the alternative with potential to solve your decision problem and to satisfy your objectives that will be the preferred choice (Hammond et al, 2002, p, 63). Getting there, however, will require that the consequences are known for each alternative. Inaccuracy, incompleteness and imprecision are all difficulties on the way (Ibid, 2002, p. 64-65). The goal should be to describe the consequences adequately. By considering the implications of the consequences you gain enhanced understanding of the decision problem and of your objectives. A particularly useful method in this context is to construct a consequences table, listing both alternatives and objectives to facilitate comparisons (Ibid, 2002, p. 67-69). Making the most out of the available information and addressing uncertainty head on are both additional recommendations (Ibid, 2002, p. 72-74).

In this chapter I start with looking at the consequences of each alternative for its associated objectives. I will assemble consequence tables for both property owners and choice architecture to allow for easier comparison of the alternatives. As for uncertainty, we are dealing with value uncertainty as well as considerable structural uncertainty in this paper (IPCC, 2007, p. 120-121). That is to say, I cannot claim complete, accurate and precise determination of, say, the probability value of a basement flood as already alluded to in chapter 2 (see 2.1 and 2.1.2). This is because I lack the necessary data. There is also prevalent structural uncertainty, that is to say, incomplete understanding of most notably the behavioral processes that generate the particular results I am after. This is due to limits in our scientific understanding. Therefore, I will state my level of confidence in the correctness of my assessments for the consequences of choice architectural tool sets as in the table below.

Table 2. Level of confidence in my assessments.

<table>
<thead>
<tr>
<th>Confidence Terminology</th>
<th>Positive connotation</th>
<th>Negative connotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very high confidence</td>
<td>Yes (5)</td>
<td>No (-5)</td>
</tr>
<tr>
<td>High confidence</td>
<td>Yes (4)</td>
<td>No (-4)</td>
</tr>
<tr>
<td>Medium confidence</td>
<td>Yes (3)</td>
<td>No (-3)</td>
</tr>
<tr>
<td>Low confidence</td>
<td>Yes (2)</td>
<td>No (-2)</td>
</tr>
<tr>
<td>Very low confidence</td>
<td>Yes (1)</td>
<td>No (-1)</td>
</tr>
</tbody>
</table>

The confidence terminology is taken from Box 1.1 on page 120 in IPCC (2007).

Consequences relevant to property owners’ objectives are described in a more straightforward way, because of a greater possibility to express these as, for example, costs and so on. I will make a simple assessments of “yes” or “no” to indicate if the alternative satisfies the objective or not. For choice architecture I then add my level of confidence in the assessment where “Yes (5)” is opposite to “No (-5)”. I have added color-coding to enhance readability. Green signifies the best possible consequence for an objective from the considered alternatives while red marks the worst consequence.
5.1 Consequences: technical alternatives

The question we will try to answer is: how well do the technical alternatives satisfy the objectives of unaffected property owners? Let me reiterate the objectives: avoiding a flooded basement, keeping costs to a minimum and limiting inconveniences. The first two objectives are presumably self-explanatory while the third objective can benefit from further precision.

Doing something about basement floods comes with inconveniences. From the alternatives described in 4.1 and 4.1.1., it is possible to derive the following inconveniences: (i) Basement’s storage arrangements changes, (ii) An effort is required during heavy precipitation, (iii) Temporary disabled wastewater evacuation, (iv) Reoccurring maintenance or inspection needs and (v) Space requirements. If we compare these inconveniences to the default of doing nothing we find that in four instances they imply additional inconveniences, while a temporary disabled wastewater evacuation remains the same as for the default. It is therefore desirable for alternatives to have as few of these inconveniences as possible. I use shorter free-form descriptions in the consequences table to describe consequences for this objective (Hammond et al, 2002, p. 66). Let us now turn to the alternatives.

5.1.1 Alternative 1: Elevate items from the floor

Elevating items from the floor is a simple and low-cost anticipatory protective measure that minimizes the risk of flood damage for movable objects (NYC, 2014, p. 3). Elevating items will cost virtually nothing but the physical effort and possibly new shelves. However, contrary to backwater valves this alternative will not avoid a basement flood. Moreover, having to reorganize and move items onto shelves or elsewhere, perhaps even out of the basement, is surely an inconvenience relative to doing nothing. As it is an anticipatory measure, no effort is needed during heavy precipitation. Nor does it require additional space, maintenance or inspection. Finally, wastewater evacuation will be impossible during a flood.

5.1.2 Alternative 2: Install a manual backwater valve

This manual alternative can avoid a basement flood (Olshammer & Baresel, 2012, p. 23-24). However, protection is directly dependent on both foresight and availability, as someone is indeed required to manually go down and close the vent when needed. Furthermore, the valve needs to be opened again after the precipitation has subsided in order for evacuation to be possible through the concerned drainage pipe. Forgetting to do so may cause an accidental self-inflicted basement flood. Nevertheless, at around 1000 SEK the manual backwater valve is the cheapest of these solutions. As for inconveniences we have already touched on the effort required as well as the disabled wastewater evacuation. Additionally, the valve will need some maintenance and inspection but the basement can be used as storage no differently than from doing nothing and no additional space is required.

5.1.3 Alternative 3: Install a mechanical backwater valve

The mechanical backwater valve gets rid of the need for manual interventions. The valve is activated by the increase in air-pressure that occurs when the water level rises and reopens as the pressure falls (Ibid, 2012, p. 23-24). The mechanical backwater valve will avoid a flooded basement for a cost of ≤ 5000 SEK. No effort is needed during heavy precipitation nor is there a need to change the storage arrangements of the basement. The valve requires virtually no additional space but will need maintenance and inspection. Evacuating wastewater is impossible while the valve is in use.
5.1.4 Alternative 4: Install an electronic backwater valve

The electronic backwater valve adds a sensor and a control unit that closes and opens the valve (Ibid, 2012, p. 24-25). This valve will avoid a basement flood for a cost of around 10 000 SEK. The valve includes an external battery (for blackouts), conducts regular self-diagnostics and signal malfunctions. Evacuation of wastewater is not possible during use and the valve indicates when this is the case. Installing the valve requires specialist knowledge but once this is done the valve is largely maintenance-free during its technical lifespan. Consequently, no effort is needed during heavy precipitation and there is no need to change the basement’s storage arrangements. The valve requires modest space in the basement.

5.1.5 Alternative 5: Install a backwater valve loop with elevating pumping device

In addition to being a backwater valve, this alternative offers to lift the property’s output of wastewater above ground level (Ibid, 2012, p. 25-27). This creates a difference of elevation between the property’s drainage pipe and the city’s drainage system which effectively eliminates the risk of basement floods. This alternative allows wastewater to be continuously discharged from the property during use. The valve cost about 15 000 SEK, not including installation or operational costs. However, as this solution has no external battery the pump will fail during blackouts but the backwater valve function will still work due to the elevation difference between the property’s drainage pipe and the city’s drainage system. This solution is unsuitable for narrower spaces as it does require additional space. No effort is needed during heavy precipitation and no changes of the basement storage arrangements are required. Maintenance and inspections are required.

5.1.6 Alternative 6: Install an electronic backwater valve with pumping device

Adding a pumping device to the electronic backwater valve allows wastewater from the property to be continuously fed into the city’s drainage system even when the valve is in use (Ibid, 2012, p. 27-28). At a cost of ≥ 15 000 SEK, this alternative has modest space requirements. Additional costs for regularly maintenance and operation are then added. In the case of blackouts the pump will not work but the backwater valve will as it has an external battery. No effort is needed during heavy precipitation and no changes of the basement storage arrangements are required.

5.1.7 Alternative 7: Install a backwater valve adjacent to the property

Installing a backwater valve adjacent to the property will obviously require no space inside (Ibid, 2012, p. 28-29). At a cost of ≥ 50 000 SEK including the necessary cesspool, it is the most expensive alternative. However, it may be an alternative to the above alternative in tight spaces or for older houses where the drainage pipe sometime is located underneath the basement floor. The valve requires inspection and maintenance. This solution allows wastewater to be continuously fed from the property even as the valve is in use. No effort is needed during heavy precipitation and no changes in storage arrangements of the basement is necessary.

5.1.8 Consequences table for technical alternatives

We now have all the consequences for the objectives from all technical alternatives. It is therefore possible to construct a consequences table from these (Hammond et al, 2002, p. 67). The alternatives are listed along the top of the table and the objectives down its left side. In the boxes of the matrix I have summarized the consequence that each alternative has on each objective. For the objective “limiting inconveniences” I
have only indicated changes relative to doing nothing. This table thus gives an excellent overview of all consequences.

Table 3. Consequences table for technical alternatives.

<table>
<thead>
<tr>
<th>Objectives &amp; Alternatives</th>
<th>Alt. 1</th>
<th>Alt. 2</th>
<th>Alt. 3</th>
<th>Alt. 4</th>
<th>Alt. 5</th>
<th>Alt. 6</th>
<th>Alt. 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoiding a flooded basement</td>
<td>No</td>
<td>Yes, if person present</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Keeping costs to a minimum</td>
<td>0 SEK</td>
<td>1000 SEK</td>
<td>5000 SEK</td>
<td>10 000 SEK</td>
<td>15 000 SEK</td>
<td>15 000 SEK</td>
<td>50 000 SEK</td>
</tr>
<tr>
<td>Limiting inconveniences</td>
<td>Usage change</td>
<td>Effort required, Maint. and inspect.</td>
<td>Maint. and inspect</td>
<td>Space needs, Maint. and inspect</td>
<td>Space needs, Maint. and inspect, Evac. possible</td>
<td>Space needs, Maint. and inspect, Evac. possible</td>
<td>Space needs, Maint. and inspect, Evac. possible</td>
</tr>
</tbody>
</table>

This table compiles the consequence each alternative has on each objective. Abbreviations: Usage change: change in basement’s storage arrangements. Effort required: effort is required during heavy precipitation. Maint. and inspect.: reoccurring maintenance or inspection needs. Space needs: Space requirements. Evac. possible: wastewater evacuation is possible.

In the next chapter we will return to this table and eliminate inferior alternatives in order to arrive at a suggested choice for unaffected property owners.

5.2 Consequences: alternatives for choice architecture

The question we will try to answer is: how well do the choice architectural tool sets satisfy the objectives for the choice architecture? Let me reiterate the objectives: promoting active decision making, promoting welfare increasing choices, reaching all property owners and providing guidance. Furthermore, it is appropriate to be reminded of the incomplete understanding, the structural uncertainty, of the behavioral processes that generate the particular results I am after. This is because there are limits to our scientific knowledge in this domain. For this reason I explicitly state my level of confidence in the correctness of my assessments for the choice architectural tool sets.

5.2.1 Set 1: Changing what happens if nothing is done (Tool 3)

Changing the default will profoundly reduce the cognitive efforts required to experience the outcome of whatever the choice architect has chosen as the default for the decision maker (Johnson et al, 2012, p. 491-492). In many important contexts you are either hurt or helped by doing nothing in particular (Sunstein, 2013, p. 48-49). This is often the result of earlier decisions and work done by many people. Think about clean drinking water, a democratic society or public pension savings. These and countless others are foundations that enable us to thrive even though we basically “do nothing” actively to uphold them. However, these functions have distinctly different characteristics and benefits than backwater valves. For this problem a forced default (withholding insurance until a risk reducing measure is actively chosen), a random default (the previous suggestion for a selected group) or one default for all property owners (law requiring a backwater valve) are all possible. The distributional impact on the relevant population need to matter for defaults (Ibid, 2013, p. 163-169). That is to say some may be helped while others may be hurt by a default. A default does provide guidance of sorts because it suggest a pre-selected configuration that will require an
act of deliberative commitment by the decision maker to deviate away from. Defaults make use of passive choice and do not promote active choice making, unless of course it is a forced choice default. This particular type of default is very unlikely for the technical problem. You are not required, for example, to choose if you want a fire extinguisher or not in order to benefit from insurance.

Despite their merits in many domains, defaults in this context are examples of either hard or ends paternalism. As such they are incompatible with the ambitions of this paper. In summary: No, this alternative does not promote an active choice with very high confidence. Consequently, no it does not with very high confidence promote welfare increasing choices. Yes, a default can with very high confidence be made to reach all property owners. Yes, a default provides guidance for a choice, again with very high confidence.

5.2.2 Set 2: Dealing with overload issues (Tool 1, Tool 4 & Tool 5)

This tool set addresses issues from complexity and more generally delayed choice making (Johnson et al, 2012, p. 488-490, 492-493). The tool set suggests it as appropriate to reduce the number of alternatives to present to the property owner and for example offer a limited in time discount coupon on a “good enough” backwater valve. All measures are meant to speed up the decision making process and counteract procrastination. However, reducing the number of alternatives may also reduce the likelihood for a preference match. Introducing, presumably third-party marketing with time limited discounts to all property owners, may indeed speed up choice making but also increase the risk for poor choice making as the particular discounted product may be chosen rather than according to the case specific needs (Beshears et al, 2008, p. 1789). In other words choices that fail to promote an increase in welfare may be stimulated. A mail-out of coupons for a specific product/products would provide no guidance on what choices to make. Ultimately, it would of course depend on who the messenger is.

In summary: Yes, this tool set does promote active choice making with low confidence. No, this alternative does not with very low confidence promote welfare increasing choices. Yes, it is possible with a mailing of discount coupons to reach all property owners with high confidence. Finally, no, a mail-out would not with high confidence provide guidance for a suitable choice.

5.2.3 Set 3: Simplifying evaluation (Tool 7, Tool 8, Tool 9 & Tool 11)

This tool set proposes to simplify the evaluation of the available alternatives for the property owner (Johnson et al, 2012, p. 494-498). This can be done by splitting out and adding labels with qualitative descriptions to features that correspond with the property owner’s objectives. Technical data could instead be merged into one category and not placed as saliently. This tool set also suggest including a translation of the risk for basement flooding over a longer time period and to emphasize the possibility of ensuring a safe and secure home throughout this period with a protective measure.

Collectively, this alternative is meant to stimulate active choice making and my assessment is that, yes, it will with medium confidence. Simplified evaluation is meant to facilitate choice making and in this case to stimulate welfare increasing choices. Labelling can increase and simplify information processing by triggering quick affective responses. Translating the experiences of the choice over time can further boost evaluation accuracy as it becomes simpler to evaluate against the time the property is expected to be in possession. Consequently, yes, this tool set with very high confidence can promote welfare increasing choices. Obviously, this alternative needs a medium to be presented to all property owners with and both set 2 or set 4 are potential candidates for this. Therefore, I consider this tool set as not available for assessment on this objective. Finally, yes, this alternative provides guidance with very high confidence.
5.2.4 Set 4: Customization and technology (Tool 2, Tool 6 & Tool 10)

This tool set aims to customize and stage the decision in web based user interface that is more personalized for the unaffected property owner (Ibid, 2012, p. 490-491, 493, 496-497). This alternative makes constructive use of decision makers’ tendency to screen alternatives by focusing on a narrower subset of features and compare it across alternatives. Consequently, “staging” the presentation of alternatives with the features that correspond to the property owners’ objectives as such focal points is a good foundation. Through a sympathetic user interface technology the property owner could then be able to sort and select or filter away alternatives based on the features. Customization could increase the likelihood of preference matches. Customization can accommodate personalization and hence is suitable for the heterogeneity of property owners. The user interface could start off with a prepopulated (default) list with relevant suggestions but should responds to user input by adjusting the recommendations accordingly. Remember that the risk is differentiated for property owners and the property’s address can be highly relevant. Furthermore, a web based platform collects data, which there is a lack of for this problem that can be used to identify or even suggest novel alternatives that otherwise might have remained unknown. For example, in your street a mechanical backwater valve is recommended as being adequate. Generating and assembling a master list of selectable additional features for the alternative could provide further guidance and perhaps increase the likelihood of preference matches. This is because master lists tend to facilitate broader and deeper consideration of relevant objectives that the feature correspond to (Bond et al, 2010).

In summary: yes, this alternative does promote active choice making with high confidence. Yes, this alternative can promote welfare increasing choices with very high confidence. However, it is far from sure that all property owners can be reached, hence: no, with very low confidence. Yes, this tool set provides guidance with very high confidence.

5.2.5 Consequences table for choice architectural tool sets.

All consequences from the choice architectural tool sets are presented in the table below. The alternatives are listed at the top and the objectives down the left side. In the boxes of the matrix are my assessments of the consequence that each alternative has on each objective. The numeric value corresponds to those found in table 2.

Table 4. Consequences table for choice architectural tool sets.

<table>
<thead>
<tr>
<th>Objectives &amp; Alternatives</th>
<th>Set 1</th>
<th>Set 2</th>
<th>Set 3</th>
<th>Set 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promoting active decision making</td>
<td>No (-5)</td>
<td>Yes (2)</td>
<td>Yes (3)</td>
<td>Yes (4)</td>
</tr>
<tr>
<td>Promoting welfare increasing choices</td>
<td>No (-5)</td>
<td>No (1)</td>
<td>Yes (5)</td>
<td>Yes (5)</td>
</tr>
<tr>
<td>Reaching all property owners</td>
<td>Yes (5)</td>
<td>Yes (4)</td>
<td>N/A</td>
<td>No (-1)</td>
</tr>
<tr>
<td>Providing guidance</td>
<td>Yes (5)</td>
<td>No (-4)</td>
<td>Yes (5)</td>
<td>Yes (5)</td>
</tr>
</tbody>
</table>

This table compiles the consequence each alternative has on each objective.

In the next chapter we will return to this and the previous table and eliminate inferior alternatives to arrive at suggested choices for both unaffected property owners and choice architecture.
6 Tradeoffs

Important decisions usually have conflicting objectives – you can’t have your cake and eat it, too – and therefore you have to make tradeoffs. You need to give up something on one objective to achieve more in terms of another. (Hammond et al, 2002, p. 79).

Decisions with multiple objectives can’t be resolved by focusing on any one objective (Hammond et al, 2002, 80-84). Consequences on all objectives need to be considered. By eliminating obviously inferior or so called dominated alternatives, the choice will get simpler. That is to say, if two alternatives are equally desirable on all but one objective, where one is better than the other, the inferior alternative is dominated and should be eliminated from further consideration. Alternatives can also be practically dominated, meaning that despite being better on one objective and being worse on the other objectives, the degree of advantage on that objective may not outweigh the alternative's shortcomings on the other objectives. Hence it too can be eliminated. The point is to keep reducing the number of alternatives from further consideration and narrow in on the preferred choice. Consequences tables are especially attractive because they facilitate this process. Ranking alternatives based on their performance for each objective will simplify the process further.

When alternatives no longer can be excluded due to dominance, tradeoffs need to be made (Ibid, 2002, 84). First, if alternatives rank as equally attractive on one objective, that objective should be ignored and attention be brought to where this is not the case. Hammond et al (2002, p. 86-87) offers the even swap method with which to eliminate objectives. This is done by essentially trading an increase in value for one objective on one alternative for a decrease of an equivalent amount for the same alternative but on another objective, hence making a tradeoff. Once again the rationale is to keep simplifying the decision. This method allows for the elimination of objectives which makes it possible to once more eliminate alternatives on the basis of dominance and hone in on the preferred choice.

In this chapter we are seeking a preferred choice for both property owners and choice architecture. I will begin the process by reworking the consequences tables from the previous chapter into rankings and eliminate alternatives by dominance. The even swap method is then applied where needed before arriving at my suggested choices that conclude the chapter.

6.1 Technical alternatives: Dominance

In the table below I have reworked the previous consequences table and substituted the descriptions with objective specific rankings of the alternatives.

Table 5. Consequences table with rankings for technical alternatives.

<table>
<thead>
<tr>
<th>Objectives &amp; Alternatives</th>
<th>Alt. 1</th>
<th>Alt. 2</th>
<th>Alt. 3</th>
<th>Alt. 4</th>
<th>Alt. 5</th>
<th>Alt. 6</th>
<th>Alt. 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoiding a flooded basement</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Keeping costs to a minimum</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Limiting inconveniences</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Green signifies the best possible consequence for an objective from the considered alternatives while red marks the worst consequence.
It is easy to spot that Alternative 7 is properly dominated by Alternatives 4, 5 and 6. It performs worse on one objective and is equivalent on two. Alternative 3 clearly dominates Alternatives 4, 5 and 6 as it is equivalent on one objective and better than all of them on two objectives. Consequently, alternatives 4, 5, 6 and 7 are all eliminated from further consideration. This leaves us with Alternatives 1, 2 and 3.

To see if any of the remaining alternatives can be practically dominated we need to return to the original consequences table (table 3 on page 21). Here we find that Alternative 1 does not avoid a flooded basement, Alternative 2 might do that provided someone is present to initiate it when needed while Alternative 3 automatically avoids a flooded basement. The advantage of automatic avoidance is reflected by its higher cost: Alternative 3 comes in at 5000 SEK, Alternative 2 at 1000 SEK while Alternative 1 is virtually free of charge. Alternative 3 will automatically keep your basement dry. Alternative 1 does spare you the destruction of movable items while Alternative 2 if not activated when needed is equal to doing nothing. This leads us to inconveniences where we find that Alternative 2 requires this particularly vital effort during heavy precipitation as well as maintenance and inspection needs, while Alternative 1 only requires usage changes of the basement (elevating items) and Alternative 3 solely requires maintenance and inspection needs. Consider practical dominance, I argue Alternative 2 is to be considered against Alternative 1. Can the small advantage Alternative 2 has for avoiding a flooded basement justify its higher cost and greater inconveniences relative to Alternative 1? I argue that it does not, specifically due to its utter dependence on foresight and the presence of someone to effectively initiate the protection. Consequently, Alternative 2 is practically dominated by Alternative 1 and hence eliminated from further consideration. This leaves us with only Alternative 1 and Alternative 3 and neither of these dominate the other, so tradeoffs become necessary.

6.2 Technical alternatives: Tradeoffs

The first thing we should notice about Alternative 1 and Alternative 3 is that they perform equally well on one objective. This means that this objective can be ignored from further consideration and we should instead focus on where the alternatives differ. The redrawn table is found below.

Table 6. Tradeoffs for technical alternatives.

<table>
<thead>
<tr>
<th>Objectives &amp; Alternatives</th>
<th>Alt. 1</th>
<th>Alt. 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoiding a flooded basement</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Keeping costs to a minimum</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

The alternatives perform better on different objectives making tradeoffs necessary.

It seems to come down to the question if the 5000 SEK price tag of Alternative 3 is acceptable for avoiding a flooded basement or not. After all it is cheaper to simply elevate any objects from the floor and accept the risk to unmovable objects, as Alternative 1 proposes. We can try to solve this issue with the even swap method. If we were to change the “no” of Alternative 1 to a “yes” for the objective of avoiding a flooded basement we could eliminate that objective and only be concerned with keeping costs to a minimum. If we do that change how much is it worth?

Specifically, is that change worth more or less than 5000 SEK, the breaking point between the two alternatives? The answer depends on the time horizon. The relevant question to pose unaffected property owners is how long the property is expected to be
in their possession. If we consider the expected value losses of doing nothing (see chapter 2, 2.1.2) we find that in as little as 7 years these costs will have accrued to about 5200 SEK and so exceeded the cost of Alternative 3. Consequently, if the property is in the proprietorship of the unaffected property owner for 7 years or more, Alternative 3 will be the better choice otherwise Alternative 1 will be better. However assuming at least a 7 year time horizon, to compensate for the change from “no” to “yes” for Alternative 1 on avoiding a flooded basement, a higher value than 5000 SEK is needed. Therefore, under this assumption Alternative 1 is eliminated as it is dominated by Alternative 3. The choice of what technical alternative for the problem of basement flooding to suggest to unaffected property owners is now clear: the mechanical backwater valve. Although, it will not be suitable to all in this heterogeneous group of property owners.

### 6.3 Choice architectural tool sets: Dominance

In the table below I have reworked the consequences table for choice architectural tool sets and substituted the descriptions with objective specific rankings.

**Table 7. Consequences table with rankings for choice architectural tool sets.**

<table>
<thead>
<tr>
<th>Objectives &amp; Alternatives</th>
<th>Set 1</th>
<th>Set 2</th>
<th>Set 3</th>
<th>Set 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promoting active decision making</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Promoting welfare increasing choices</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Reaching all property owners</td>
<td>1</td>
<td>2</td>
<td>N/A</td>
<td>3</td>
</tr>
<tr>
<td>Providing guidance</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Green signifies the best possible consequence for an objective from the considered alternatives while red marks the worst consequence.

There are no dominated alternatives in this table. Set 1 ties as the best performer on two objectives but is the worst on two others. Set 2 is our middle of the road alternative. Set 3 performs great on two objectives, come in second on one objective and finds itself out of the running for another objective. Set 4 is the overall strongest performer, tying as best for three objectives while being worst on one objective.

However, I will argue that Set 1 (Changing what happens if nothing is done) is to be considered practically dominated or perhaps “disqualified” as it represents a harder form of paternalism than what I strive for with the decision opportunity (see: 4.2.3 and 5.2.1). This results in the table below.

**Table 8. Reworked consequences table.**

<table>
<thead>
<tr>
<th>Objectives &amp; Alternatives</th>
<th>Set 2</th>
<th>Set 3</th>
<th>Set 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promoting active decision making</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Promoting welfare increasing choices</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Reaching all property owners</td>
<td>1</td>
<td>N/A</td>
<td>2</td>
</tr>
<tr>
<td>Providing guidance</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Remaining alternatives after having eliminated Set 1.
Set 2 is worse on all but one objective: reaching all property owners. Set 4 is best on one objective and ties for best on two while performs worse on one: reaching all property owners. Set 3 ties for best on two objectives, comes in as second on one and is unavailable for comparison on one: reaching all property owners. Here will depend on which set it is combined with. Going to the consequences table and our original behavioral problem (table 4 on page 23) we find that providing guidance that helps promote an active, welfare increasing choice is essentially what we are trying to do with the choice architecture for the decision opportunity. Of course, reaching all relevant property owners is important but it is hardly the main event, it could even be considered a means objective. On this basis I argue that Set 2 is practically dominated by Set 4. When it comes to Set 3 and Set 4, we find that we cannot directly compare them on the objective of reaching all property owners because the performance of Set 3 depends on which set it is combined with. In this case only Set 4 remains for this combination and consequently its performance would be equal to Set 4. The only remaining difference between the two alternatives is on promoting an active choice, where Set 4 dominates and eliminates Set 3. Therefore, it is Set 4 that carries the biggest promise for choice architectural contributions to the decision opportunity. Obviously, Set 3 could (and should) be combined/integrated with Set 4 for additional benefits. Nevertheless, it is Set 4 that provides us with a starting point and medium for the transmission of the decision opportunity.

6.4 Suggested choices

At last we have arrived at which choices to recommend for the technical and behavioral problem that together may help unaffected property owners to seize and implement the decision opportunity. It is the mechanical backwater valve that I suggest for the technical problem and the choice architectural tool set of customization and technology for presenting the decision opportunity with.

As proposed in 5.2.4 for this tool set the user interface could start off with a prepopulated (default) list with relevant suggestions but should responds to user input by adjusting its recommendations accordingly. It now seems appropriate that such a list would start off with suggesting a mechanical backwater valve.
7 Discussion

One of the most important questions to be addressed is learning. I am talking about real learning here, not optimal learning. How do people really learn about the world around them? […] I hope you will pitch in and help. There is more than enough work to go around. (Thaler, 1994, p. xxii).

It is far from certain that my suggestions for a mechanical backwater valve and the use of customization and technology as the bases for choice architecture to present the decision opportunity with are the best possible solutions to these respective problems. They are products of my best assessment as explored in this paper through the lens of the PrOACT approach (Hammond et al, 2002). The approach is meant for analyzing and resolving decision problems. Without being able to test if what I suggest have any noticeable effect, learn from those findings and adapt future suggestions accordingly, there is profound uncertainty about me having resolved the paper’s problems (Haynes, 2012, p. 15; Beshears et al, 2008, p. 1790-1793). There are limits to our knowledge about how people learn about the world around them and this certainly also applies to how unaffected property owners process information about the decision opportunity. That the decision opportunity hinges on System 1 recognition and System 2 execution gives us clues but no clear answers (Kahneman, 2011).

Can the negligent be nudged to rethink their position? Will informing the ignorant in the suggested way have an impact at all? A web-based user interface will only reach those who actually visit it. This seemingly begs the question of how willing unaffected property owners are to engage in the decision opportunity to begin with. Considering the predominance of doing nothing only limited cognitive engagement should be expected. This is made worse by the fact that the decision opportunity implies costs now for theoretical benefits later which poses intertemporal problems (Dolan et al, 2012, p. 268; Beshears et al, 2008, 1789-1790). The “good enough” alternative may then be our runner up: elevating items from the floor (NYC, 2014, p. 3; Ibid, 2012, p. 492-493). It is certainly plausible that all my suggestions would manage to do, if implemented, is to create a stylish webpage for an obscure problem that no one will ever visit. Perhaps a mail-out of time limited discount coupons for mechanical backwater valves would then be the better choice. What is more encouraging is that the choice architectural tool sets are not mutually exclusive and can be added as needed. The problem again is indeed to establish what is needed.

Looking beyond this circular argument and more generally at cognitive deficiencies in information processing it is too easy to find additional question marks. One in particular comes readily to mind and originates from our unrealistic optimism (Sharot, 2012). Our asymmetrical updating and adjustment to information tend to favor positive news over negative news (Sharot et al, 2011). Framing the decision opportunity as just an opportunity may be a way to at least partly circumvent this and is of course in itself an excellent example of choice architecture. These preconditions may otherwise have crushing implication for merely making an ignorant property owner aware of their risk (see Box 7 in: Haynes, 2012, p. 17). It will of course not happen to him/her. Such gloomy outlooks may speak in favor of our “disqualified” alternative of switching what happens if property owners do nothing (Dolan et al, 2012, p. 269; Johnson et al, 2012, 491-492). Provided that more complete, accurate and precise data can be gathered on the problem of basement floods maybe this could be a way of the future for Malmö, given that distributional impacts suggest it to be a welfare increasing measure (Mårtensson & Gustafsson, 2014). This gets us back to the messenger of the decision opportunity.

Creating, updating and maintaining the kind of system suggested here seemingly requires a commitment to the cause. Possible messengers I have mentioned include: water companies, public administrations, insurance companies and commercial actors. Perhaps this kind of system would do well as a public-private partnership initiative? Whatever constellation, as Dolan et al (2012, p. 266) points out the authority and
emotions that unaffected property owners associated with the messenger will matter. Making room for heterogeneity is crucial. Some of the other backwater valves than the suggested one could be preference matches for an unaffected property owner with different objectives than the ones included here.

A context found to influence choice, but that I left virtually unexplored, has to do with social norms (Ibid, 2012, p. 268-269). As decision makers take cues for their decisions from the relevant social norm, if no such norm is known for the problem of basement flooding there is nowhere unaffected property owners can take their cues from. Artificially creating such a norm through informational campaigns is of course possible. Here, affected property owners should be a good starting point. If it can be made more widely known that this group tended to change their preference away from doing nothing toward protective measures such as backwater valves, the inception of a norm may already exist.

Finally, I haven’t explored the more visceral, affective responses and associations that influence decision making (Ibid, 2012, p. 271). These are constantly triggered by our surroundings as we go about our lives. Maybe adding gruesome images of raw sewage flooding a basement at the top of the suggested webpage with an urging to heed the decision opportunity is recommendable? All in all, we are left wanting experimental evidence for the effects of these measures on this problem. I hope I have been able to at least reveal a potential starting point.
8 Conclusion

Choice architecture is the social environment against which we make our decision. [...] For all of us, a key question is whether the relevant choice architecture is helpful and simple or harmful, complex, and exploitative. (Sunstein, 2013, p. 9-10).

In this paper I argued for the existence of a decision opportunity. Property owners unaffected by a basement flood have the possibility to mitigate this risk before it materializes. What I have been aiming to do is concretizing this decision opportunity to these property owners, partly by identifying a suitable technical alternative and partly by finding an appropriate frame for how to present it. I adopted the PrOACT approach to analyze and resolve these problems. This involved exploring different alternatives for each distinct problem. I considered several technical alternatives. Based on the consequences that those alternatives would have on objectives I had proposed as relevant to property owners, one alternative could subsequently be selected: the mechanical backwater valve. That alternative was my suggested choice for unaffected property owners to implement the decision opportunity with. This alternative scored well on providing protection, being relatively cheap and involved few additional inconveniences relative to the default of doing nothing about this risk.

My main focus was however on the pertinent question of how to present the decision opportunity. Findings from social science suggest that decision makers have comprehensive and pervasive information processing deficiencies and that contextual influences from ubiquitous surrounding factors are strongly determinative to decision behavior. Presenting the decision opportunity in a way that limits the interference from these behavioral problems was therefore a key theme of the paper. As choices cannot be presented without a framing design choice architecture is inevitable, that is, the way a choice is presented. Consequently, certain influences on choice are also inevitable. To make the choice architecture surrounding the decision opportunity helpful and simple, I explored several choice architectural tool sets which may mitigate the above behavioral problems. Based on the consequences that these tool sets would have on objectives I had proposed as relevant for the choice architecture, one alternative could be selected: customization and technology. That tool set was my suggested choice for how to present the decision opportunity to unaffected property owners. This alternative scored well on promoting an active choice, promoting welfare increasing choices and providing guidance to property owners. However, this alternative may not reach all relevant property owners as it is necessarily would be limited to those who actually visited it. Consequently, the paper identifies a need for experimental evidence on the effects of these suggested measures for the technical as well as the behavioral problem. The paper’s result is a recommended starting point for such experimental explorations in this domain.
References


