

# Deciding to Disclose: Pregnancy and Alcohol Misuse

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## Acronyms

**FAS** Foetal Alcohol Syndrome

**CPT** Cumulative Prospect Theory

**PT** Prospect Theory

**NICE** National Institute for Health and Care Excellence

**IAPT** Improving Access to Psychological Therapies

**CMACE** Centre for Maternal and Child Enquiries

**AUDIT** Alcohol Use Disorders Identification Test

**T-ACE** Tolerance, Annoyance, Cut down, Eye-opener

**RCOG** Royal College of Obstetricians and Gynecologists

**AML** acute myeloid leukemia

**ADHD** Attention Defecit Hyperactivity Disorder

**PND** Postnatal Depression

**RCT** randomised control trial

**WHO** the World Health Organisation

**ESS** Evolutionarily Stable Strategy

**MCMC** Markov chain monte carlo methods

**DU** Discounted Utility

**AIC** Akaike information criterion

**ANOVA** analysis of variance

**ALSPAC** Avon Longitudinal Study of Parents and Children

**GEM** Gaussian Emulation Machine

**GEM-SA** Gaussian Emulation Machine for Sensitivity Analysis

**JIT** Just-in-time

**ABM** Agent Based Model

**CPT** Cumulative Prospect Theory

## Abstract

This dissertation presents a method for modelling disclosure behaviour by treating the interaction as paired signalling games played by decision theoretic agents. Two theories of decision making - Bayesian risk minimisation, and Cumulative Prospect Theory (CPT) - are investigated, and a simulation developed using Python.

The feasibility of the method is examined through a case study, which considers the disclosure of the drinking behaviour of pregnant women to their midwives.

The essence of the scenario is that there is considered to be a long term benefit to disclosure - common in the healthcare arena, but an opportunity cost associated with disclosure. In the case study, this is conceptualised as arising from the perceived undesirability of drinking while pregnant. More generally this could derive from any imbalance in the long term benefit and the opportunity cost, for example the subjective benefit of a cigarette in the near future, versus the discounted benefit of better health later.

Theories of decision are driven by the weighing of probabilities and subjective gains or losses. In this case, the probabilities are generated by individual agents based on their initial preconceptions and their experiences across the simulation, using Bayesian inference.

The Bayesian risk minimising model is able to reproduce qualitative trends around increased honesty over appointments, and a negative impact of harsh judgement of drinkers on disclosure. The CPT model is less successful, which may be a result of improper, or excessively homogenous parameters, in combination with unrealistic payoffs.

A global sensitivity analysis is also conducted using Gaussian Emulation Machines, and finally recommendations for further work are derived, along with a few key recommendations for practice - assume people are being honest, and be non-judgemental.

# 1 Introduction

## 2 Background

This chapter presents an overview of literature focusing on the impact of drinking behaviour in pregnancy, and factors affecting disclosure behaviour in the midwifery context. This is followed by a review of literature supporting the theoretical underpinning of the modelling approach, with particular reference to statistical decision theory.

### 2.1 Alcohol, and Disclosure in the Maternity Setting

#### 2.1.1 Impact of Alcohol

Distinct from stigma attached to alcohol consumption in pregnancy, is the question of the real impact on woman and baby both in the antenatal period, and beyond. While the canonical example of alcohol linked disorders is Foetal Alcohol Syndrome (FAS), and others on that spectrum, heavy drinking during pregnancy has been mooted as a factor in a variety of negative health outcomes.

The impact of moderate alcohol consumption in pregnancy is more contested. For example, Andersen et al. [5] examined moderate drinking in a large Danish cohort study, finding a significant increase in the risk of spontaneous abortion at low levels of consumption early in pregnancy. Savitz [78] questioned the extent to which this can be interpreted as a causal connection, noting that there is a known relationship between absence of morning sickness, and spontaneous abortion, and suggesting that this may explain much of the difference in risk. Kesmodel et al. [46] examined the relationship between alcohol consumption and still-birth, finding that increased consumption lead to an increase in risk to the baby, but in contrast to Andersen et al. [5] this was significant at term.

Considering longer term negative outcomes, a metastudy by Latino-Martel et al. [50] examined the potential for maternal alcohol consumption in pregnancy to feature as a risk factor for onset of childhood leukaemia, finding that any alcohol consumption was associated with an increased risk of childhood acute myeloid leukemia (AML), but note the rarity of the condition as a limitation.

Huizink and Mulder [39] reviewed literature looking at the impact of moderate consumption on neurodevelopmental and cognitive outcomes, concluding that maternal consumption can be a contributing factor to Attention Defecit Hyperactivity Disorder (ADHD), and impairments to learning and memory. They subsequently suggest that the underlying mechanism is not specific to alcohol consumption, but a more general phenomena arising from perturbations to foetal conditions [38], but caution that methodological issues in many of the studies reviewed may undermine this hypothesis.

Contrary to this, a meta-study by Gray and Henderson [30] found there was insufficient evidence to suggest any harm arising from moderate (under 1.5 UK units per day) alcohol consumption. This ties to the current guidance from the National Institute for Health and Care Excellence (NICE) [59], advising that women should avoid drinking at all in at least the first three months of pregnancy, and no more than 1-2 units once or twice a week if they do. In giving this advice, NICE acknowledge that the risks to the foetus from alcohol are a somewhat contentious subject, concluding that the evidence of harm is inconclusive, but that this is not sufficient to rule out the risk of negative outcomes. This tension is reflected by earlier guidance from the Royal College of Obstetricians and Gynecologists (RCOG) [73] suggesting no evidence of harm below 15 units per week, and subsequent criticism by Guerri et al. [32], who suggest that this might be interpreted as legitimising binge drinking, while noting several studies indicating adverse affects linked to even a single drink per day (e.g. Day et al. [16]). A subsequent RCOG statement [72] revised the recommendations to incorporate newer findings, advising that there is no known safe threshold for drinking in pregnancy, and highlighting binge drinking as of particular concern.

There has recently been an increased interest in the impact of binge drinking, as a distinct pattern of consumption, with a wide variety of negative outcomes reported by Maier and West [52], although a significant portion of their evidence base is drawn from animal studies which augers for caution in generalising findings to humans. Strandberg-larsen et al. [85] explored links between binge drinking, and stillbirth, reporting a statistically significant increase in risk associated with more than three antenatal binge episodes. Sun et al. [87] looked at seizure disorders in children whose mothers binged during pregnancy. They reported

significantly greater risk of both neonatal seizures (~3 fold) and epilepsy (1.81 fold) associated with binge drinking between 11 and 16 weeks, but emphasised the exploratory nature of the results, and need for replication. In terms of neurodevelopmental outcomes, Streissguth et al. [86] found a dose dependent association with scores on timed word, and arithmetic tests in fourteen year olds with a stronger association where bingeing occurred. A review by Henderson et al. [36] cautiously supports the contention that binge drinking has a neurodevelopmental impact, but found no consistent support for adverse outcomes in pregnancy (e.g. stillbirth, miscarriage, etc.) and note a paucity of studies in the area. Meyer-Leu et al. [56] considered the neonatal period, finding that both moderate and binge drinking were associated with an increased trend towards neonatal asphyxia. They also noted a large number of contradictory findings and raising methodological concerns about the studies reviewed by Henderson et al.. Barr et al. [7] contend that binge drinking may also contribute to psychiatric issues in the later life of offspring, although in this case their findings are confined to individuals with FAS, which may in itself be a confounding factor, rather than indicating a directly causative relationship between antenatal binge drinking and subsequent psychiatric disorder in offspring.

Overall, there is a distinct lack of consensus on what, and how extensive, the effects of drinking on the immediate and long term health outcomes are for the child.

### 2.1.2 Disclosure

The issue of disclosure is central to the model presented here, in particular self-report by women of information that might disadvantage them, or be expected to do so in the immediate term. In general, the consensus is that alcohol self-reports have acceptable validity in the research context [18], but do not correspond perfectly to alternative methods. Del Boca and Darkes [17] claim that the validity is generally accepted, and suggest that the current focus lies on what factors and processes underlie the discrepancies rather than questioning determining their existence. In this instance, the conjecture is that the information is in some way stigmatising; that, following Goffman [27], disclosure equates to revelation of the mark. This is not immediately contentious, for example Gomberg [28] identified stigma surrounding alcohol abusing women in particular, an issue also highlighted by Improving Access to Psychological Therapies (IAPT) guidance [41], as well as a number of other studies relating response effects to perceived negative consequences [49, 18, 10]. In the maternity context, Radcliffe [70] identifies stigma pertaining to substance misusing women amongst staff, and suggests that this may represent a barrier to appropriate treatment; similarly, NICE guidance on pregnancy and complex social factors [61] recognises concern about the attitude of staff as a source of anxiety in pregnant women who misuse substances.

Stigma, or fear of a judgemental response on the part of the practitioner should not however be taken uncritically to explain inaccurate reporting by patients. While recent NICE public health guidance advocates routine alcohol misuse screening as a part of all practice [60], there is no specific policy for routine antenatal care beyond providing information on possible impacts of alcohol consumption [59]. NICE guidance on pregnancy and complex social factors [61] does specifically address women who misuse alcohol, but presupposes knowledge of the problem through medical history, or via other services. Taken in concert with the potential for harm from even moderate alcohol use (section 2.1.1), this suggests that much of the onus is on the patient to volunteer information.

Where screening is used, Kaskutas and Graves [44] note that the most basic method, i.e. number of standard drinks consumed, can lead to inaccurate estimates of consumption arising from inability to relate the concept of a standard drink, to actual consumption. This is compounded by the impact of memory effects on recall over a number of days [84], and a lack of consistency in the standard drink measure [93]. Alternative screening tools, for example AUDIT, and T-ACE are available and have been shown to perform well in identifying problematic levels of drinking [67, 12, 74, 75], although the emphasis in these cases is on consumption at disordered levels.

Prior et al. [69] considered a different health arena (mental health problems and GPs), with similar characteristics in terms of concealment of medically relevant information. The central finding in this case is that non-disclosure is not a result of stigma, but of mismatched ontologies surrounding mental illness. Work by Alvik et al. [3], where the relationship between anonymity and reporting of alcohol consumption

by pregnant women was investigated, found no significant relationship, suggesting that a fear of social judgement may not be a dominant factor. This draws an interesting contrast with a study by Alvik et al. [4], which found that contemporaneous reports of consumption were significantly lower than those postpartum. Logistic regression results suggest that this trend is amplified by a number of factors, including level of alcohol consumption preceding conception, while anxiety about foetal wellbeing during pregnancy was associated with lower retrospective reports. Taken together with [3], these results could be seen as conflicting, but may suggest self-stigmatisation [99], or reflect a lack of distinction between anonymity, and confidentiality [53].

In summation then, there is a consensus that alcohol consumption is generally underreported in the pregnant population, with some support for the idea that concern about social judgement associated with stigmatisation may be a contributing factor. Of particular interest in the wider context of this work, is the relationship between underreporting and consumption, i.e. that heavier drinking is associated with a greater tendency to understate intake.

### 2.1.3 Practice Implications

Given that alcohol consumption is thought to be underreported some consideration must be given to the implications for midwifery practice, in terms of eliciting more accurate self-reporting. Phillips et al. [66] present a qualitative account of factors influencing the disclosure of substance misuse to midwives, identifying particularly the need to build up a rapport, potentially over a number of appointments. This was related to continuity of care, seen as necessary by both midwives and women for building up a trust relationship, itself a key component of facilitating disclosure. Stevens and McCourt [83] looked specifically at the process of transitioning to a caseloading model of care provision in one midwifery practice, reporting that both practitioners and women felt that this offered advantages in terms of long term relationship building. Relationship building was also highlighted by Kennedy et al. [45] in a narrative investigation of midwifery practice, where the subjects interpreted the midwife-woman dynamic as about mutuality. Kennedy et al. suggest that this arises from a recognition that interactions in this context are about information exchange, with the knowledge base of the woman as significant as that of the midwife, rather than simply a unidirectionally didactic relationship.

Hunter [40] also focuses on much of midwifery as about relationship building, suggesting that there is an insufficiently recognised emotional labour component to practice. Observation and interview of a number of midwives as they practiced suggested that many midwives effectively took a mother type role to their patients, with implications around the nature of information exchange that was able to take place. The emotional labour component was also reported by Stevens and McCourt, who suggest that this is more evident under a caseloading system, particularly with challenging patients with complex needs. Todd et al. [91] surveyed midwives working in a hospital environment, as well as those working in the community in a caseloading context, finding that community practice appeared to provide more job satisfaction, but was challenging to implement effectively because of limited resources. Community midwives suggested that larger team sizes, and smaller caseloads would contribute to a better realisation of the model. Farquhar et al. [21] approached the same question from the perspective of women, also finding that faulty implementation hampered the expected benefits. They found that those cared for under a team scheme, with much higher continuity of care, reported that they had a better relationship with their midwives, but were not more satisfied in general with their care. In contrast, Biró et al. [9] looked at a randomised control trial (RCT) of team midwifery care versus hospital care in Australia, finding a significantly higher level of satisfaction under the team model, the distinction in this case may lie in the different balance of team size to caseload size.

In terms of the impact of continuity of care on health, rather than experiential outcomes, research is relatively sparse. Marks et al. [54] examined the impact of continuity of care on Postnatal Depression (PND), which has similar features to alcohol in that it carries an associated stigma that can act as a barrier to help seeking [19]. Based on the results of a RCT, they conclude that continuity of care is not protective, in the sense of reducing rates or impacting onset, but was very successful in supporting engagement with treatment. Echoing this, a 2009 Cochrane Review by Hatem et al. [35] found no significant difference in incidence of PND, but reported benefits in terms of lower rates of episiotomies, anaesthesia, and shorter hospital stays, with higher satisfaction as found by Biró et al.. While research in this area does not specifically pertain

to disclosure, the general trend in results are suggestive when taken in concert with studies emphasising the importance of relationship building as key in fostering a disclosure friendly environment. Continuity of care is generally regarded as improving patient experience, and leading to better health outcomes in the wider medical arena [97], but is clearly not a cost free endeavour, with particular concern arising from the emotional cost [91], and increased rates of ‘burnout’ in practitioners [77].

## 2.2 Games, Signals, and Decisions

### 2.2.1 Signalling Games

Game theory generally deals with strategic decision making in the unusual circumstance of complete information, that is, every player has at least complete knowledge of all possible outcomes, who their opponents are, and so forth. Arguably more generally applicable is the incomplete information scenario, where players lack information about the rules of play in some fashion. Harsanyi [33] proposed a method for effectively transforming such games into games of complete information by treating the possible variations on the rules as subgames. To determine which subgame is to be played, an additional player - nature - is introduced to make the first move, where nature conducts a lottery according to some probability distribution. If it is assumed that the underlying probability distribution is known to all players, the game is then one of complete information.

Perhaps the best known example of Bayesian games, are the signalling games codified by Kreps and Cho [47], after initially being framed by Spence [82] in the context of employment markets. The general form of such a game is that one player holds information known only to them, on the basis of which they send a signal to the other player(s), which the other player(s) then act upon. Much of the interest in signalling games turns on what conditions are necessary for honest signalling to be a Nash equilibrium, or in the context of evolutionary game theory, an Evolutionarily Stable Strategy (ESS) .

One approach to this requires that signalling is a costly exercise, as proposed by Grafen [29] in examining biological signals (for example, the eye-catching but unwieldy peacock tail). Grafen demonstrated that an earlier suggestion by Zahavi [103], who proposed that such signals were in effect a handicap demonstrating fitness, would lead to an ESS because of the costly nature of the signalling. This solution is also noted by Spence [82], who showed that a separating equilibrium exists<sup>1</sup> contingent on signals being more costly for some types.

Costly signalling has been applied to explain a variety of apparently contradictory behaviours, for example Godfray [26] in the context of offspring soliciting food from parents, where the key question is why a behaviour with potentially very high costs (namely, being eaten) would be preferred to a less risky method. In a social context, costly signalling has been proposed as an explanation for religion in human societies. Sosis [81] developed a model of religious ritual as an exercise in costly signalling, showing that higher costs to engagement in rituals for skeptics maintains the stability of religious groups and the presumed benefits that membership confers. Henrich [37] extended this idea, and developed an evolutionary model combining cultural transmission with costly signalling in a population, finding that for even modest costs the system moved towards universal belief. Wildman and Sosis [101] subsequently extended the model, to address the fact that both stable equilibria are binary states, finding that the incorporation of group differentiation allowed subgroups to persist.

Signalling games have also been extended to provide models of other observed human behaviour, for example Austen-Smith and Fryer Jr. [6] attempted to explain the observed poor academic attainment of some social groups by positing a multiple audience signalling game. They found that the introduction of a secondary signalling game with a peer audience, alongside the prototypical Spence model introduced a pooling equilibrium. Subsequent empirical work by Fryer Jr. and Torelli [24] has provided some support for this idea. Along similar lines, Feltovich et al. [23] examine an observed failure by high quality types to signal as would be anticipated, introducing the concept of countersignaling in scenarios where there is noisy leakage of type information. They found that where there is added noisy type information available, separating equilibria exist where high quality senders signal either as low quality, or not at all.

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<sup>1</sup>In fact, an infinite number of them.



### 2.2.2 Bayesian Decision Theory and Expected Utility

Decision theory is the theory of rational decision making [65], this contrasts with game theory which is concerned with strategic decision making. In the broadest sense, the field can be divided into two types of theories: normative, and descriptive. Normative theories are those which attempt to give the rational answer to a decision problem, descriptive or behavioural theories focus instead on characterising the process of human decision making. In this instance, the particular concern is with theories of decision making under uncertainty.

Underpinning almost all theories of decision making, and much of economic theory in general is the concept of expected utility, originally proposed by Bernoulli [8]. This casts decisions as choices between lotteries or gambles, with differing payoffs and probabilities.

Under this model, the expected utility of any gamble is a function of the probability of the outcomes, their utility to the gambler, and the gambler’s risk aversion. Essentially this is an extension of the expected value criterion, which assumes that the expected value is based only on the probability and objective value of outcomes. By contrast, the utility framing is a subjective measure, allowing differing preferences between gamblers. Von Neumann and Morgenstern [98] later formalised the theory, defining rational decision as acting to maximise expected utility, where an individual’s preferences are shown to fulfil four axioms, namely completeness, transitivity, independence, and continuity. Completeness requires that for any two lotteries A and B, the decision maker prefers one to the other, or is indifferent. Transitivity requires that if A is preferred to B, and B is preferred to C, then A is also preferred to C. Continuity states that given a scenario as in the transitivity axiom, there is some combination of lotteries A and C where the decision maker is indifferent between that combined lottery and B. Finally, independence maintains that if one were to prefer gamble A to B, that preference holds if both are combined with lottery C.

While vastly influential, the expected utility theory has been substantially criticised, generally for failing to predict real behaviour. Allais [2] attacked the independence axiom in particular, suggesting that in some scenarios people’s choices would be inconsistent where expected utility implies otherwise. A number of studies (e.g. [62, 13]) have since supported the intuition to some extent.

More recently, support for some aspects of the expected utility theory, particularly the concept of utility as a common currency for comparison, has come from neurology, for example following work by Platt and Glimcher [68], Padoa-Schioppa and Assad [63, 64] report neuronal firing corresponding to economic value in decision making tasks undertaken by monkeys, while Christopoulos et al. [15] found similarly indicative results for risk aversion. The suggestion implicit in the model proposed here, that this also applies to social judgements, is less investigated, although both Watson and Platt [100], and Willis et al. [102] found that lesions in the brain area<sup>2</sup> identified by Padoa-Schioppa and Assad lead to abnormal social judgements in humans and primates.

Bayesian decision theory, as expounded by Robbins [71] applies Bayesian inference to the process of decision making under some degree of uncertainty, on the basis that the decision is a repeated one. The central idea is relatively straightforward, and assumes that the loss or gain of some action to resolve a decision is contingent on an unknown parameter. To solve the problem, the decision maker chooses whichever action will minimise the risk, where the risk of an action is  $\sum_i \lambda(a_j|w_i)P(w_i|x)$ , i.e. the loss incurred for taking action  $a_j$  given that the true state of the world is  $w_i$ , multiplied by the belief that this is the true state of world given evidence  $x$ , summed across all possible worlds. Essentially this is identical with expected value, with Bayesian style probabilities. This allows an additional process of inference to progressively update the distribution from which  $P(w_i|x)$  derives, as new evidence is obtained after each decision.

This approach has been used in a wide variety of scenarios, for example McNamara and Houston [55] have applied statistical decision theory as a framework for understanding animal learning<sup>3</sup>, while Harsanyi [34] has derived an ethical framework from the principles. Less controversially, in contexts where optimality is desirable as an outcome, Dorazio and Johnson [20] have used Bayesian decision methods in combination with Markov chain monte carlo methods (MCMC) to solve complex waterfowl habitat management problems, and

<sup>2</sup>The orbitofrontal cortex.

<sup>3</sup>Although they note that this is in the sense of how animals ‘should’ learn, rather than how they do learn

Kristensen [48] has developed robots which utilise Bayesian decision analysis to plan sensor operations.

As with standard expected utility, the Bayesian approach can be criticised, in this case on the grounds of plausibility. The question of plausibility arises from the suggestion that Bayesian inference is in some way a model of human inductive reasoning, as argued by some branches of cognitive science. For example, Tenenbaum et al. argue for the Bayesian approach as a top-down model of inductive reasoning in humans [88, 31], a general approach criticised by Bowers and Davis [11] as unfalsifiable, overcomplicated, and relying on an unrealistic conceptualisation of the brain as optimal. Miller [57] also applied similar criticism to claims by Gallistel [25] that Bayesian inference better characterises learning as opposed to associative conditioning type models, suggesting that this relies on an assumption of optimality which is unfounded.

### 2.2.3 Descriptive Decision Theory

Arguably the most significant criticism of theories of decision making, is their failure to correspond to empirically observed decision making <sup>4</sup>. This was probably first raised by Simon [79], who proposed that the apparent divergence derived from a tendency to satisfice, rather than optimise. This suggestion rests on the not unreasonable assumption that people do not have unlimited cognitive capacity (i.e. bounded rationality [80]), and hence use heuristic means to make decisions, namely by choosing the first ‘good enough’ option. Simon suggests that this process nevertheless leads to the optimal solution in most cases.

Subsequent work on descriptive theories largely follows the same framework in assuming that in reality, human decision making is a heuristic process. Tversky and Kahneman [95] developed three heuristics to explain observed systematic errors in reasoning - representativeness, availability, and anchoring. Representativeness suggests that when asked to judge how related one object or event is to another, they do this based on the extent to which they resemble one another - crucially they will ignore additional, better information when available. Availability claims that when tasked with estimating probabilities, people will rely on the ease with which they can call examples to mind (note that this might be considered an example of satisficing). Finally, anchoring proposes that when estimating, people start with some initial value and progressively update from there, i.e. they will tend to overweight prior evidence at the expense of new information.

Subsequently, Kahneman and Tversky [43], Tversky and Kahneman [96] also identified framing effects, which imply that the decisions people make are impacted by the fashion in which the problem is presented. The essential outcome from these findings is that people are risk seeking when faced with outcomes framed as losses, but risk averse towards gains, and regard any loss as greater than an equivalent gain. The impact of framing in itself has been shown to be significant, for example Toll et al. [92] found improved abstinence rates in smoking cessation where quitting was framed as a gain, and NICE recommend considering the framing of treatment outcomes when presenting options to patients [58].

Prospect Theory (PT) [42] attempts to provide a decision rule accounting for the heuristic nature of decision making and incorporate framing effects, which successfully explains many perceived failures of rationality. A revised version, CPT [94] addressing a violation of first order stochastic dominance possible under the original formulation, extends the theory to allow decisions with more than two options, but sacrifices the editing phase. Camerer [14] reviews a number of successes in explaining apparent anomalies with CPT, and argues that should replace expected utility in general usage. Thaler [90] regards the theory as promising, but points out that it is in many ways incomplete, citing the lack of explanation as to how people construct frames as an example of this.

A significant weakness of CPT as a general theory of decision making is that it fails to account for behaviour under intertemporal choice, or rather does not attempt to address it. Generally, intertemporal choice is assumed to be underpinned by the Discounted Utility (DU) model of Samuelson [76], which proposes that the value of a thing right now is greater than the value of it at some point in the future (jam today has more utility than jam tomorrow), following an exponential relationship. A more nuanced view of this has been proposed by Ainslie [1], suggesting that the relationship is hyperbolic rather than exponential. Both models however fail to explain several inconsistencies, for example Thaler [89] found that discounting

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<sup>4</sup>This critique is not unique to decision theory, and has also been levelled at game theory (e.g. Fehr and Fischbacher [22] on the irrational altruism of humans playing the prisoners’ dilemma).

rates were different between gains and losses. Loewenstein and Prelec [51] report a number of additional inconsistencies that are not adequately resolved by DU models, and propose an alternative along the lines of CPT to resolve them while retaining the capabilities of Kahneman and Tversky's model in immediate term choices.

## 3 Model

### 3.1 Disclosure Game

### 3.2 Agent Models

## 4 Method

### 4.1 Qualitative Trends

### 4.2 Sensitivity Analysis

## 5 Results

### 5.1

## 6 Discussion and Conclusions

## References

- [1] G Ainslie. Derivation of "Rational" Economic Behavior from Hyperbolic Discount Curves. *The American Economic Review*, 81(2):334–340, 1991. URL <http://www.jstor.org/stable/10.2307/2006881>.
- [2] M Allais. Le Comportement de l'Homme Rationnel devant le Risque : Critique des Postulats et Axiomes de l'Ecole Americaine. *Econometrica*, 21(4):503–546, 1953.
- [3] Astrid Alvik, Tor Haldorsen, and Rolf Lindemann. Consistency of Reported Alcohol Use by Pregnant Women: Anonymous Versus Confidential Questionnaires With Item Nonresponse Differences. *Alcoholism: Clinical & Experimental Research*, 29(8):1444–1449, August 2005. ISSN 0145-6008. doi: 10.1097/01.alc.0000175014.31463.9a.
- [4] Astrid Alvik, Tor Haldorsen, Berit Groholt, and Rolf Lindemann. Alcohol consumption before and during pregnancy comparing concurrent and retrospective reports. *Alcoholism: Clinical & Experimental Research*, 30(3):510–5, March 2006. ISSN 0145-6008. doi: 10.1111/j.1530-0277.2006.00055.x.
- [5] Anne-Marie Nybo Andersen, Per Kragh Andersen, Jørn Olsen, Morten Grønbaek, and Katrine Strandberg-Larsen. Moderate alcohol intake during pregnancy and risk of fetal death. *International Journal of Epidemiology*, 41(2):405–13, April 2012. ISSN 1464-3685. doi: 10.1093/ije/dyr189. URL <http://www.ncbi.nlm.nih.gov/pubmed/22253313>.
- [6] D Austen-Smith and R G Fryer Jr. An economic analysis of "acting white". *Quarterly Journal of Economics*, (May):551–583, 2005. URL <http://qje.oxfordjournals.org/content/120/2/551.short>.
- [7] Helen M Barr, Fred L Bookstein, Kieran D O'Malley, Paul D Connor, Janet E Huggins, and Ann P Streissguth. Binge drinking during pregnancy as a predictor of psychiatric disorders on the Structured Clinical Interview for DSM-IV in young adult offspring. *The American Journal of Psychiatry*, 163(6):1061–5, June 2006. ISSN 0002-953X. doi: 10.1176/appi.ajp.163.6.1061. URL <http://www.ncbi.nlm.nih.gov/pubmed/16741207>.
- [8] D Bernoulli. Exposition of a New Theory on the Measurement of Risk. *Econometrica*, 22(1):23–36, 1954. URL <http://www.jstor.org/stable/10.2307/1909829>.

- [9] Mary Anne Biró, Ulla Waldenström, Stephanie Brown, and Jan H Pannifex. Satisfaction with team midwifery care for low- and high-risk women: a randomized controlled trial. *Birth*, 30(1):1–10, March 2003. ISSN 0730-7659. URL <http://www.ncbi.nlm.nih.gov/pubmed/12581034>.
- [10] Ed Blair, Seymour Sudman, NM Bradburn, and Carol Stocking. How to Ask Questions About Drinking and Sex: Response Effects in Measuring Consumer Behaviour. *Journal of Marketing Research*, 14(3): 316–321, 1977. URL <http://www.jstor.org/stable/10.2307/3150769>.
- [11] Jeffrey S Bowers and Colin J Davis. Bayesian just-so stories in psychology and neuroscience. *Psychological Bulletin*, 138(3):389–414, May 2012. ISSN 1939-1455. doi: 10.1037/a0026450. URL <http://www.ncbi.nlm.nih.gov/pubmed/22545686>.
- [12] K A Bradley, J Boyd-Wickizer, S H Powell, and M L Burman. Alcohol screening questionnaires in women: a critical review. *JAMA: the Journal of the American Medical Association*, 280(2):166–71, July 1998. ISSN 0098-7484. URL <http://www.ncbi.nlm.nih.gov/pubmed/9669791>.
- [13] M S Burke, J R Carter, R D Gominiak, and D F Ohl. An Experimental Note on the Allais Paradox and Monetary Incentives. *Empirical Economics*, 21(4):617–632, 1996. URL <http://link.springer.com/article/10.1007/BF01180705>.
- [14] C F Camerer. Prospect theory in the wild: Evidence from the field. 2004. URL [http://books.google.com/books?hl=en&lr=&id=sA4jJOjwCW4C&oi=fnd&pg=PA148&dq=Prospect+Theory+in+the+Wild:+Evidence+From+the+Field&ots=tTEZYdFitq&sig=uJi1Tlzl9grxRp703EJLcSXQNG0http://books.google.com/books?hl=en&lr=&id=sA4jJOjwCW4C&oi=fnd&pg=PA148&dq=Prospect+Theory+in+the+Wild:+Evidence+From+the+Field&ots=tTE1XdJfyv&sig=Njm\\_rhqiDNaE4\\_Z\\_3NF3k5GjW1E](http://books.google.com/books?hl=en&lr=&id=sA4jJOjwCW4C&oi=fnd&pg=PA148&dq=Prospect+Theory+in+the+Wild:+Evidence+From+the+Field&ots=tTEZYdFitq&sig=uJi1Tlzl9grxRp703EJLcSXQNG0http://books.google.com/books?hl=en&lr=&id=sA4jJOjwCW4C&oi=fnd&pg=PA148&dq=Prospect+Theory+in+the+Wild:+Evidence+From+the+Field&ots=tTE1XdJfyv&sig=Njm_rhqiDNaE4_Z_3NF3k5GjW1E).
- [15] George I Christopoulos, Philippe N Tobler, Peter Bossaerts, Raymond J Dolan, and Wolfram Schultz. Neural correlates of value, risk, and risk aversion contributing to decision making under risk. *The Journal of Neuroscience*, 29(40):12574–83, October 2009. ISSN 1529-2401. doi: 10.1523/JNEUROSCI.2614-09.2009. URL <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2794196&tool=pmcentrez&rendertype=abstract>.
- [16] N L Day, G Richardson, N Robles, U Sambamoorthi, P Taylor, M Scher, D Stoffer, D Jasperse, and M Cornelius. Effect of prenatal alcohol exposure on growth and morphology of offspring at 8 months of age. *Pediatrics*, 85(5):748–52, May 1990. ISSN 0031-4005. URL <http://www.ncbi.nlm.nih.gov/pubmed/2330235>.
- [17] Frances K Del Boca and Jack Darkes. The validity of self-reports of alcohol consumption: state of the science and challenges for research. *Addiction*, 98 Suppl 2:1–12, December 2003. ISSN 0965-2140. URL <http://www.ncbi.nlm.nih.gov/pubmed/14984237>.
- [18] Frances K Del Boca and Jane A Noll. Truth or consequences: the validity of self-report data in health services research on addictions. *Addiction*, 95(11):347–360, November 2000. ISSN 13600443. doi: 10.1080/09652140020004278. URL <http://doi.wiley.com/10.1080/09652140020004278>.
- [19] Cindy-Lee Dennis and Leinic Chung-Lee. Postpartum depression help-seeking barriers and maternal treatment preferences: a qualitative systematic review. *Birth*, 33(4):323–31, December 2006. ISSN 0730-7659. doi: 10.1111/j.1523-536X.2006.00130.x. URL <http://www.ncbi.nlm.nih.gov/pubmed/17150072>.
- [20] R M Dorazio and F A Johnson. Bayesian inference and decision theory-a framework for decision making in natural resource management. *Ecological Applications*, 13(2):556–563, 2003. URL [http://www.esajournals.org/doi/abs/10.1890/1051-0761\(2003\)013\[0556:BIADTA\]2.0.CO;2](http://www.esajournals.org/doi/abs/10.1890/1051-0761(2003)013[0556:BIADTA]2.0.CO;2).
- [21] M Farquhar, C Camilleri-Ferrante, and C Todd. Continuity of care in maternity services: women’s views of one team midwifery scheme. *Midwifery*, 16(1):35–47, March 2000. ISSN 0266-6138. doi: 10.1054/midw.1999.0189. URL <http://www.ncbi.nlm.nih.gov/pubmed/11139860>.

- [22] Ernst Fehr and Urs Fischbacher. The nature of human altruism. *Nature*, 425(6960):785–91, October 2003. ISSN 1476-4687. doi: 10.1038/nature02043.
- [23] Nick Feltovich, Rick Harbaugh, and T To. Too cool for school? Signalling and countersignalling. *RAND Journal of Economics*, 33(4):630–649, 2002. URL <http://www.jstor.org/stable/10.2307/3087478>.
- [24] R G Fryer Jr. and P Torelli. An empirical analysis of ‘acting white’. *Journal of Public Economics*, 94(5): 380–396, 2010. URL <http://www.sciencedirect.com/science/article/pii/S0047272709001406>.
- [25] C R Gallistel. Extinction from a rationalist perspective. *Behavioural Processes*, 90(1):66–80, May 2012. ISSN 1872-8308. doi: 10.1016/j.beproc.2012.02.008. URL <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3350810&tool=pmcentrez&rendertype=abstract>.
- [26] H C J Godfray. Signalling of Need by Offspring to their Parents. *Nature*, 352:328–330, 1991. URL <http://www.nature.com/nature/journal/v352/n6333/abs/352328a0.html>.
- [27] Erving Goffman. *Stigma: Notes on the Management of Spoiled Identity*. Penguin Books, London, 1990.
- [28] E S Gomberg. Alcoholic women in treatment: the question of stigma and age. *Alcohol and Alcoholism*, 23(6):507–14, January 1988. ISSN 0735-0414. URL <http://www.ncbi.nlm.nih.gov/pubmed/3245868>.
- [29] A Grafen. Biological Signals as Handicaps. *Journal of Theoretical Biology*, 144:517–546, 1990. URL <http://www.sciencedirect.com/science/article/pii/S0022519305800888>.
- [30] R Gray and J Henderson. Review of the fetal effects of prenatal alcohol exposure. Technical Report May, 2006.
- [31] T L Griffiths, N Chater, Charles Kemp, Joshua B Tenenbaum, and Amy Perfors. Probabilistic Model of Cognition: Exploring Representations and Inductive Biases. *Trends in Cognitive Sciences*, 14(8): 357–364, 2010. URL <http://www.sciencedirect.com/science/article/pii/S1364661310001129>.
- [32] C Guerri, E Riley, and K Strömblad. Commentary on the recommendations of the Royal College of Obstetricians and Gynaecologists concerning alcohol consumption in pregnancy. *Alcohol and Alcoholism*, 34(4):497–501, 1999. ISSN 0735-0414.
- [33] John C Harsanyi. Games with Incomplete Information Played by “Bayesian” Players, I-III. *Management Science*, 14(3):159–182, 1967.
- [34] John C Harsanyi. Bayesian Decision Theory and Utilitarian Ethics. *The American Economic Review*, 68(2):223–228, 1978. URL <http://www.jstor.org/stable/10.2307/1816692>.
- [35] M Hatem, J Sandall, D Devane, H Soltani, and S Gates. Midwife-led versus other models of care for childbearing women (Review). *Cochrane Database of Systematic Reviews*, (3), 2009. URL <http://www.who.int/entity/rhl/reviews/CD004667.pdf>.
- [36] Jane Henderson, Ulrik Kesmodel, and Ron Gray. Systematic review of the fetal effects of prenatal binge-drinking. *Journal of Epidemiology and Community Health*, 61(12):1069–73, December 2007. ISSN 0143-005X. doi: 10.1136/jech.2006.054213. URL <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2465662&tool=pmcentrez&rendertype=abstract>.
- [37] Joseph Henrich. The evolution of costly displays, cooperation and religion. *Evolution and Human Behavior*, 30(4):244–260, July 2009. ISSN 10905138. doi: 10.1016/j.evolhumbehav.2009.03.005. URL <http://linkinghub.elsevier.com/retrieve/pii/S1090513809000245>.

- [38] Anja C Huizink. Moderate use of alcohol, tobacco and cannabis during pregnancy: new approaches and update on research findings. *Reproductive Toxicology*, 28(2):143–51, September 2009. ISSN 1873-1708. doi: 10.1016/j.reprotox.2009.04.010. URL <http://www.ncbi.nlm.nih.gov/pubmed/19394419>.
- [39] Anja C Huizink and Eduard J H Mulder. Maternal smoking, drinking or cannabis use during pregnancy and neurobehavioral and cognitive functioning in human offspring. *Neuroscience and Biobehavioral Reviews*, 30(1):24–41, January 2006. ISSN 0149-7634. doi: 10.1016/j.neubiorev.2005.04.005. URL <http://www.ncbi.nlm.nih.gov/pubmed/16095697>.
- [40] Billie Hunter. The importance of reciprocity in relationships between community-based midwives and mothers. *Midwifery*, 22(4):308–22, December 2006. ISSN 0266-6138. doi: 10.1016/j.midw.2005.11.002. URL <http://www.ncbi.nlm.nih.gov/pubmed/16616398>.
- [41] Improving Access to Psychological Therapies, DrugScope, and National Treatment Agency for Substance Misuse. IAPT positive practice guide for working with people who use drugs and alcohol, 2012.
- [42] D Kahneman and A Tversky. Prospect Theory: An Analysis of Decision Under Risk. *Econometrica*, 47(March):263–291, 1979. URL <http://www.jstor.org/stable/10.2307/1914185>.
- [43] Daniel Kahneman and Amos Tversky. Choices, values, and frames. *American Psychologist*, 39(4):341–350, 1984. URL <http://psycnet.apa.org/journals/amp/39/4/341/>.
- [44] L A Kaskutas and K Graves. An alternative to standard drinks as a measure of alcohol consumption. *Journal of Substance Abuse*, 12(1-2):67–78, January 2000. ISSN 0899-3289. URL <http://www.ncbi.nlm.nih.gov/pubmed/11288475>.
- [45] H P Kennedy, M T Shannon, U Chuahorm, and M K Kravetz. The landscape of caring for women: A narrative study of midwifery practice. *Journal of Midwifery & Women's Health*, 49(1):14–23, 2004. doi: 10.1016/j.jmwh.2003.09.015. URL <http://onlinelibrary.wiley.com/doi/10.1111/j.1542-2011.2004.tb04403.x/full>.
- [46] Ulrik Kesmodel, Kirsten Wisborg, Sjúrethur Fróethi Olsen, Tine Brink Henriksen, and Niels Jø rgen Secher. Moderate alcohol intake during pregnancy and the risk of stillbirth and death in the first year of life. *American Journal of Epidemiology*, 155(4):305–12, February 2002. ISSN 0002-9262. URL <http://www.ncbi.nlm.nih.gov/pubmed/11836194>.
- [47] D M Kreps and I Cho. Signalling Games and Stable Equilibria. *The Quarterly Journal of Economics*, 102(2):179–221, 1987. URL <http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Signalling+Games+and+Stable+Equilibria#0>.
- [48] Steen Kristensen. Sensor planning with Bayesian decision theory. *Robotics and Autonomous Systems*, 19(3-4):273–286, March 1997. ISSN 09218890. doi: 10.1016/S0921-8890(96)00056-5. URL <http://linkinghub.elsevier.com/retrieve/pii/S0921889096000565>.
- [49] J Langenbucher and J Merrill. The Validity of Self-Reported Cost Events by Substance Abusers: Limits, Liabilities, and Future Directions. *Evaluation Review*, 25(2):184–210, April 2001. ISSN 0193-841X. doi: 10.1177/0193841X0102500204. URL <http://erx.sagepub.com/cgi/doi/10.1177/0193841X0102500204>.
- [50] Paule Latino-Martel, Doris S M Chan, Nathalie Druesne-Pecollo, Emilie Barrandon, Serge Hercberg, and Teresa Norat. Maternal alcohol consumption during pregnancy and risk of childhood leukemia: systematic review and meta-analysis. *Cancer Epidemiology, Biomarkers & Prevention*, 19(5):1238–60, May 2010. ISSN 1538-7755. doi: 10.1158/1055-9965.EPI-09-1110. URL <http://www.ncbi.nlm.nih.gov/pubmed/20447918>.

- [51] George Loewenstein and D Prelec. Anomalies in intertemporal choice: Evidence and an interpretation. *The Quarterly Journal of Economics*, 107(2):573–597, 1992. URL <http://qje.oxfordjournals.org/content/107/2/573.short>.
- [52] S E Maier and J R West. Drinking Patterns and Alcohol-Related Birth Defects. *Alcohol Research & Health*, 25(3):168–174, 2001.
- [53] Janet H Malvin and Joel M Moskowitz. Anonymous Versus Identifiable Self-Reports of Adolescent Drug Attitudes, Intentions, and Use. *Public Opinion Quarterly*, 47(4):557, 1983. ISSN 0033362X. doi: 10.1086/268812. URL <http://poq.oxfordjournals.org/cgi/doi/10.1086/268812>.
- [54] M N Marks, K Siddle, and C Warwick. Can we prevent postnatal depression? A randomized controlled trial to assess the effect of continuity of midwifery care on rates of postnatal depression in high-risk women. *The Journal of Maternal-fetal & Neonatal Medicine*, 13(2):119–27, February 2003. ISSN 1476-7058. doi: 10.1080/jmf.13.2.119.127. URL <http://www.ncbi.nlm.nih.gov/pubmed/12735413>.
- [55] J McNamara and A Houston. The application of statistical decision theory to animal behaviour. *Journal of Theoretical Biology*, 85(4):673–90, August 1980. ISSN 0022-5193. URL <http://www.ncbi.nlm.nih.gov/pubmed/7442286>.
- [56] Yvonne Meyer-Leu, Sakari Lemola, Jean-Bernard Daeppen, Olivier Deriaz, and Stefan Gerber. Association of moderate alcohol use and binge drinking during pregnancy with neonatal health. *Alcoholism: Clinical & Experimental Research*, 35(9):1669–77, September 2011. ISSN 1530-0277. doi: 10.1111/j.1530-0277.2011.01513.x. URL <http://www.ncbi.nlm.nih.gov/pubmed/21554334>.
- [57] Ralph R Miller. An assessment of Gallistel’s (2012) rationalistic account of extinction phenomena. *Behavioural Processes*, 90(1):81–3; discussion 87–8, May 2012. ISSN 1872-8308. doi: 10.1016/j.beproc.2012.02.005. URL <http://www.ncbi.nlm.nih.gov/pubmed/22421221>.
- [58] National Institute for Health and Care Excellence. *Antenatal and Postnatal Mental Health. CG45*. NICE, London, 2007. ISBN 9781854334541.
- [59] National Institute for Health and Care Excellence. *Antenatal care. CG62*. NICE, London, 2010. ISBN 9781904752462.
- [60] National Institute for Health and Care Excellence. *Alcohol-use disorders: preventing harmful drinking. PH24*. NICE, London, 2010.
- [61] National Institute for Health and Clinical Excellence. *Pregnancy and complex social factors. CG110*. NICE, Manchester, 2010.
- [62] A Oliver. A quantitative and qualitative test of the Allais paradox using health outcomes. *Journal of Economic Psychology*, 24(1):35–48, 2003. URL <http://www.sciencedirect.com/science/article/pii/S0167487002001538>.
- [63] Camillo Padoa-Schioppa and John A Assad. Neurons in the orbitofrontal cortex encode economic value. *Nature*, 441(7090):223–6, May 2006. ISSN 1476-4687. doi: 10.1038/nature04676. URL <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2630027&tool=pmcentrez&rendertype=abstract>.
- [64] Camillo Padoa-Schioppa and John A Assad. The representation of economic value in the orbitofrontal cortex is invariant for changes of menu. *Nature neuroscience*, 11(1):95–102, January 2008. ISSN 1097-6256. doi: 10.1038/nn2020. URL <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2646102&tool=pmcentrez&rendertype=abstract>.
- [65] M Peterson. *An introduction to decision theory*. Cambridge University Press, Cambridge, UK, 2009.



- [66] Diane Phillips, K Thomas, H Cox, L A Ricciardelli, J Ogle, V Love, and A Steele. Factors that Influence Women’s Disclosures of Substance Use During Pregnancy: A Qualitative Study of Ten Midwives and Ten Pregnant Women. *The Journal of Drug Issues*, 37(2):357–376, 2007.
- [67] Marco Piccinelli and Elisabetta Tessari. Efficacy of the alcohol use disorders identification test as a screening tool for hazardous alcohol intake and related disorders in primary care: a validity study. *British Medical Journal*, 314(February):420–424, 1997. URL <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2125904/>.
- [68] M L Platt and Paul W Glimcher. Neural correlates of decision variables in parietal cortex. *Nature*, 400(6741):233–8, July 1999. ISSN 0028-0836. doi: 10.1038/22268. URL <http://www.ncbi.nlm.nih.gov/pubmed/10421364>.
- [69] Lindsay Prior, Fiona Wood, Glyn Lewis, and Roisin Pill. Stigma revisited, disclosure of emotional problems in primary care consultations in Wales. *Social Science & Medicine*, 56(10):2191–200, May 2003. ISSN 0277-9536. URL <http://www.ncbi.nlm.nih.gov/pubmed/12697207>.
- [70] P Radcliffe. Substance-misusing women: Stigma in the maternity setting. *British Journal of Midwifery*, 19(8):497–506, 2011. URL <http://www.intermid.co.uk/cgi-bin/go.pl/library/abstract.html?uid=85563>.
- [71] Herbert Robbins. The Empirical Bayes Approach to Statistical Decision Problems. *The Annals of Mathematical Statistics*, 35(1):1–20, March 1964. ISSN 0003-4851. doi: 10.1214/aoms/1177703729. URL [http://link.springer.com/chapter/10.1007/978-1-4612-5110-1\\_4http://projecteuclid.org/euclid.aoms/1177703729](http://link.springer.com/chapter/10.1007/978-1-4612-5110-1_4http://projecteuclid.org/euclid.aoms/1177703729).
- [72] Royal College of Obstetricians and Gynaecologists. Alcohol Consumption and the Outcomes of Pregnancy. In *RCOG Statement No. 5*, number 5, pages 1–10. RCOG, London, 2006.
- [73] Royal College of Obstetricians and Gynecologists. Alcohol Consumption in Pregnancy. In *RCOG Guideline No. 9*. RCOG, London, 1996.
- [74] M Russell. New assessment tools for risk drinking during pregnancy. *Alcohol Health and Research World*, 18(1):55–67, 1994. URL [ftp://senfiles.healthystartfv.org/SortLiteratureReview1990-1999.Data/ProQuest\\_15022621994Russell-4113017088/ProQuest\\_15022621994Russell.pdf](ftp://senfiles.healthystartfv.org/SortLiteratureReview1990-1999.Data/ProQuest_15022621994Russell-4113017088/ProQuest_15022621994Russell.pdf).
- [75] Marcia Russell and S S Martier. Detecting risk drinking during pregnancy: a comparison of four screening questionnaires. *American Journal of Public Health*, 86(10):1435–1439, 1996. URL <http://ajph.aphapublications.org/doi/abs/10.2105/AJPH.86.10.1435?view=long&pmid=8876514>.
- [76] Paul A Samuelson. Note on Measurement of Utility. *The Review of Economic Studies*, 4(2):155–161, 1937.
- [77] J Sandall. Midwives’ burnout and continuity of care. *British Journal of Midwifery*, 5(2):106–111, 1997. URL [http://www.intermid.co.uk/cgi-bin/go.pl/library/article.cgi?uid=8720;article=BJM\\_5\\_2\\_106\\_111;format=html](http://www.intermid.co.uk/cgi-bin/go.pl/library/article.cgi?uid=8720;article=BJM_5_2_106_111;format=html).
- [78] David A Savitz. Re: Moderate alcohol intake during pregnancy and risk of fetal death. *International Journal of Epidemiology*, 41(6):1847; author reply 1848, December 2012. ISSN 1464-3685. doi: 10.1093/ije/dys152. URL <http://www.ncbi.nlm.nih.gov/pubmed/23064503>.
- [79] H A Simon. Rational choice and the structure of the environment. *Psychological Review*, 63(2):129–138, 1956. URL <http://psycnet.apa.org/journals/rev/63/2/129/>.
- [80] H A Simon. Bounded Rationality in Social Science: Today and Tomorrow. *Mind & Society*, 1(1): 25–39, 2000. URL <http://link.springer.com/article/10.1007/BF02512227>.

- [81] Richard Sosis. Why aren't we all hutterites? *Human Nature*, 14(2):91–127, June 2003. ISSN 1045-6767. doi: 10.1007/s12110-003-1000-6. URL <http://link.springer.com/10.1007/s12110-003-1000-6>.
- [82] M Spence. Job Market Signaling. *The Quarterly Journal of Economics*, 87(3):355–374, 1973. URL <http://qje.oxfordjournals.org/content/87/3/355.short>.
- [83] T Stevens and C McCourt. One-to-one Midwifery Practice Part 2: the Transition Period. *British Journal of Midwifery*, 10(1):45–50, 2002. URL <http://www.intermid.co.uk/cgi-bin/go.pl/library/abstract.html?uid=10051>.
- [84] Tim Stockwell, Susan Donath, Mark Cooper-Stanbury, Tanya Chikritzhs, Paul Catalano, and Cid Mateo. Under-reporting of alcohol consumption in household surveys: a comparison of quantity-frequency, graduated-frequency and recent recall. *Addiction*, 99(8):1024–33, August 2004. ISSN 0965-2140. doi: 10.1111/j.1360-0443.2004.00815.x. URL <http://www.ncbi.nlm.nih.gov/pubmed/15265099>.
- [85] Katrine Strandberg-larsen, Naja Rod Nielsen, Per Kragh Andersen, and Anne-marie Nybo Andersen. Binge Drinking in Pregnancy and Risk of Fetal Death. *Obstetrics & Gynecology*, 111(3):602–609, 2008.
- [86] Ann P Streissguth, H M Barr, H C Olson, Paul D Sampson, F L Bookstein, and D M Burgess. Drinking during pregnancy decreases word attack and arithmetic scores on standardized tests: adolescent data from a population-based prospective study. *Alcoholism: Clinical & Experimental Research*, 18(2): 248–54, April 1994. ISSN 0145-6008. URL <http://www.ncbi.nlm.nih.gov/pubmed/8048722>.
- [87] Yuelian Sun, Katrine Strandberg-Larsen, Mogens Vestergaard, Jakob Christensen, Anne-Marie Nybo Andersen, Morten Grønbaek, and Jørn Olsen. Binge drinking during pregnancy and risk of seizures in childhood: a study based on the Danish National Birth Cohort. *American Journal of Epidemiology*, 169(3):313–22, February 2009. ISSN 1476-6256. doi: 10.1093/aje/kwn334. URL <http://www.ncbi.nlm.nih.gov/pubmed/19064645>.
- [88] Joshua B Tenenbaum, Thomas L Griffiths, and Charles Kemp. Theory-based Bayesian models of inductive learning and reasoning. *Trends in cognitive sciences*, 10(7):309–18, July 2006. ISSN 1364-6613. doi: 10.1016/j.tics.2006.05.009. URL <http://www.ncbi.nlm.nih.gov/pubmed/16797219>.
- [89] R Thaler. Some Empirical Evidence on Dynamic Inconsistency. *Economics Letters*, 8:201–207, 1981. URL <http://www.sciencedirect.com/science/article/pii/0165176581900677>.
- [90] R Thaler. From homo economicus to homo sapiens. *The Journal of Economic Perspectives*, 14(1): 133–141, 2000. URL <http://www.jstor.org/stable/10.2307/2647056>.
- [91] C J Todd, M C Farquhar, and C Camilleri-Ferrante. Team midwifery: the views and job satisfaction of midwives. *Midwifery*, 14(4):214–24, December 1998. ISSN 0266-6138. URL <http://www.ncbi.nlm.nih.gov/pubmed/10076316>.
- [92] B A Toll, S S O'Malley, and N A Katulak. Comparing Gain- and Loss-Framed Messages for Smoking Cessation With Sustained-Release Bupropion: A Randomized Controlled Trial. *Psychology of Addictive Behaviour*, 21(4):534–544, 2007. doi: 10.1037/0893-164X.21.4.534.Comparing. URL <http://psycnet.apa.org/journals/adb/21/4/534/>.
- [93] C Turner. How much alcohol is in a 'standard drink'? An analysis of 125 studies. *British Journal of Addiction*, 85(9):1171–5, September 1990. ISSN 0952-0481. URL <http://www.ncbi.nlm.nih.gov/pubmed/2224197>.
- [94] A Tversky and Daniel Kahneman. Advances in prospect theory: Cumulative representation of uncertainty. *Journal of Risk and Uncertainty*, 5(4):297–323, October 1992. ISSN 0895-5646. doi: 10.1007/BF00122574. URL <http://link.springer.com/10.1007/BF00122574>.

- [95] Amos Tversky and Daniel Kahneman. Judgment under Uncertainty: Heuristics and Biases. *Science*, 185(4157):1124–31, September 1974. ISSN 0036-8075. doi: 10.1126/science.185.4157.1124. URL <http://www.ncbi.nlm.nih.gov/pubmed/17835457>.
- [96] Amos Tversky and Daniel Kahneman. Rational Choice and the Framing of Decisions Rational Choice and the Framing of Decisions \*. *The Journal of Business*, 59(4):251–278, 1986.
- [97] Carl Van Walraven, Natalie Oake, Alison Jennings, and Alan J Forster. The association between continuity of care and outcomes: a systematic and critical review. *Journal of Evaluation in Clinical Practice*, 16(5):947–56, October 2010. ISSN 1365-2753. doi: 10.1111/j.1365-2753.2009.01235.x. URL <http://www.ncbi.nlm.nih.gov/pubmed/20553366>.
- [98] J Von Neumann and O Morgenstern. *The theory of games and economic behavior*. Princeton University Press, Princeton, 3rd edition, 1953. URL <http://www.citeulike.org/group/1984/article/1062512>.
- [99] Amy C Watson, Patrick Corrigan, Jonathon E Larson, and Molly Sells. Self-stigma in people with mental illness. *Schizophrenia Bulletin*, 33(6):1312–1318, November 2007. ISSN 0586-7614. doi: 10.1093/schbul/sbl076. URL <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2779887&tool=pmcentrez&rendertype=abstract>.
- [100] Karli K Watson and Michael L Platt. Social signals in primate orbitofrontal cortex. *Current biology : CB*, 22(23):2268–73, December 2012. ISSN 1879-0445. doi: 10.1016/j.cub.2012.10.016. URL <http://www.ncbi.nlm.nih.gov/pubmed/23122847>.
- [101] W J Wildman and R Sosis. Stability of Groups with Costly Beliefs and Practices. *Journal of Artificial Societies and ...*, 14(3), 2011. URL <http://jasss.soc.surrey.ac.uk/14/3/6.html>.
- [102] Megan L Willis, Romina Palermo, Darren Burke, Ky McGrillen, and Laurie Miller. Orbitofrontal cortex lesions result in abnormal social judgements to emotional faces. *Neuropsychologia*, 48(7):2182–7, June 2010. ISSN 1873-3514. doi: 10.1016/j.neuropsychologia.2010.04.010. URL <http://www.ncbi.nlm.nih.gov/pubmed/20399220>.
- [103] A Zahavi. Mate selection-a selection for a handicap. *Journal of Theoretical Biology*, 53(1):205–14, September 1975. ISSN 0022-5193. URL <http://www.ncbi.nlm.nih.gov/pubmed/1195756>.