



# Applying Findings from Financial Literacy to Encourage Responsible Gambling

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# Executive Summary

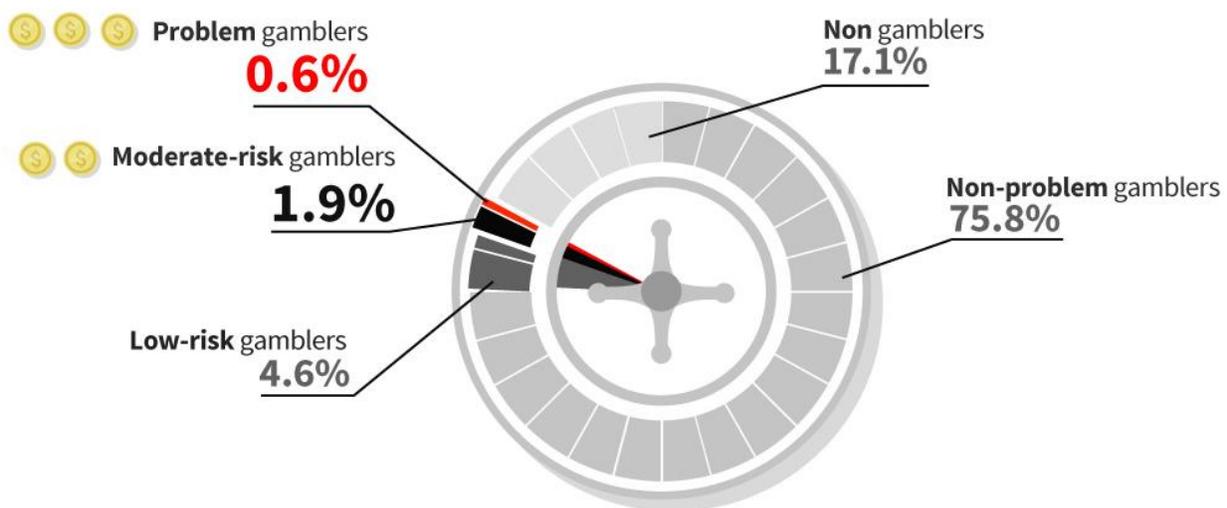
Gambling is a \$13B a year industry in Canada (Responsible Gambling Council, 2014). Though most Canadians gamble with little consequence, about 3% of the adult population engage in moderate-risk and problem gambling (Wood & Williams, 2009). Lottery groups and other gambling associations are aware of the potential harms and are looking to promote responsible gambling behaviours. In this report, we review evidence-based findings from financial literacy, a primary area that explores individual spending behaviour and evaluation of risk, to understand how various tools and methods developed in this domain can improve responsible gambling initiatives. From our research, we identify five key behaviours underlying responsible gambling: (1) setting limits, (2) tracking behaviour, (3) impulse control, (4) risk perception, and (5) alternative seeking. Using findings from financial literacy research and behavioural insights, we propose three sets of evidence-based recommendations aimed at encouraging responsible gambling behaviours.

# 1. Introduction

Four out of five Canadians participate in some form of gambling in a given year, fueling the \$13B gambling industry in Canada (Responsible Gambling Council [RGC], 2014). In 2011, the average adult Canadian lost \$550 to gambling, placing Canada fourth for the highest loss per capita in the Western world (McMahon, 2013).

While gambling is an enjoyable activity for most Canadians, it can lead to severe consequences for a small subset of the population, including harm in personal life, work life, household finances, and physical and mental health (RGC, 2014). According to the Canadian Problem Gambling Index, these moderate-risk and problem gamblers make up between 1.6% and 6.1% of the adult population, depending on the province (RGC, 2014). Figure 1 shows the composition of gamblers in Ontario, the province with the highest gaming revenue in Canada.

Figure 1. Composition of gamblers in Ontario (2010–11)



Adapted from *Canadian Gambling Digest 2013–2014*, p.16. Copyright 2015 by the Canadian Partnership for Responsible Gambling.

Although it is difficult to estimate the revenues that come from the problem gambling section, a study suggests that 4.8% of problem gamblers in Ontario in 2003 accounted for approximately 36% of Ontario gambling revenue (Williams & Wood, 2007). Lottery groups and other gambling associations are aware of this issue and are trying to promote responsible gambling. As part of this effort, they are developing various resources, tools, and platforms to help individuals better understand the risks associated with gambling in the context of their individual financial circumstances.

The focus of this report is on encouraging responsible gambling behaviour, rather than treating problem gamblers. First, responsible gamblers are the majority, comprising over

95% of the gamblers in Canada (RGC, 2014). Second, gamblers are easier to influence before they reach the problem stage. Research suggests that problem gamblers may be more impulsive, are poorer decision makers, and likely have more to lose by gambling excessively (Lostutter, Lewis, Cronce, Neighbors, & Larimer, 2014). Third, intervening is much more costly at the problem stage. Currently, programs to treat addiction and mental health for the relatively small percentage of problem gamblers receive three times more allocation of gambling revenue compared to responsible gambling initiatives (RGC, 2014).

In this report, we aim to do two things:

- 1) We look at responsible gambling from a behavioural lens. What are the cognitive and psychological influences that lead people to gamble? In particular, what specific behaviours are associated with responsible gambling, aside from the general description of “playing beyond means”? Understanding the frictions will help inform the design of tools and interventions to encourage responsible gambling.
- 2) We review findings from financial literacy to understand how various tools and methods developed in this domain can improve responsible gambling initiatives. Gambling and financial decision making share similarities: (1) both have an intertemporal nature. People tend to give into the immediate pleasure of betting or spending without properly considering the long-term and aggregate consequences of their actions; (2) contextual influences – how choices are framed and what features are highlighted – disproportionately influence these behaviours; and (3) consumers have low levels of expertise in making accurate risk assessments for both gambling and financial decisions. We believe best practices used to influence financial behaviours will also be useful in encouraging responsible gambling behaviours.

The remainder of the report is organized as follows. First, we discuss our research methodology and rationale. Then, we put a behavioural lens on gambling, looking especially at the psychological and cognitive influences that lead consumers to gamble excessively. Next, we review evidence-based findings from the domain of financial literacy and behavioural economics that can be used to help individuals gamble responsibly.

Given insights from our research, we propose three sets of recommendations aimed at encouraging responsible gambling behaviours, buttressed with concrete examples of how they will work in practice. Finally, we conclude with a discussion on future research in the prevention of problem gambling.

## 2. Methodology

We began by reviewing literature on the behavioural antecedents of gambling. We also conducted in-depth interviews with experts and gamblers to get their perspectives on the frictions that individuals face in managing their spending, making risk assessments, and controlling impulsive behaviour. Finally, we held a co-creation session to gain input on how behavioural insights and best practices in financial literacy can be applied to responsible gambling initiatives. We compiled the research findings, qualitative data from interviews, and ideas from the session to develop our recommendations.

### **Literature review**

We reviewed over 80 academic articles in the areas of self-control, probability assessment, risk perception, and judgment under uncertainty. Literature was selected from peer-reviewed journals including *Journal of Behavioural Decision Making*, *Journal of Economic Perspectives*, *Journal of Consumer Research*, *Journal of Addiction Research & Therapy*, and *The Journal of Risk and Uncertainty*.

To understand classic theories related to individual gambling and spending behaviour, we covered seminal papers dating back to 1990 and thereafter. Search words in online databases included risk assessment, compulsive behaviour, self-control, melioration, and dynamic inconsistency. We also reviewed older literature dating back to the 1970s that were cited in these papers (e.g., articles by Kahneman and Tversky on judgment under uncertainty and articles by Ainslie on self-control).

For applied empirical research related to gambling, spending behaviour, and financial literacy, we reviewed literature mainly published after 2005. Search words included investing, gambling fallacies, psychology of risk, impulsive spending, mental accounting, budgeting, and consumer savings. Papers were categorized based on the type of research conducted: field trials, lab experiments, statistical analyses, and meta-analyses of existing literature. For field trials and lab experiments, only experiments that have statistically significant sample sizes were considered.

In addition to the academic literature, we reviewed financial literacy programs and policies that have been implemented through governments, nonprofit initiatives, and banking institutions in Canada and abroad. These include reviewing publications such as white papers, program evaluations, conference reports, and bulletins published by task forces. In particular, we tried to understand the program structures and identify areas for improvement.

### **Interviews with experts and end users**

To gain an in-depth perspective, we conducted interviews with subject matter experts, managers from industry, and gamblers.

- **Responsible gambling experts (5 participants):** We probed experts to understand the current gambling landscape, and how “responsible gambling” is currently defined. These experts were a good starting point to direct us to relevant research and findings on the challenge.
- **Behavioural science experts (3):** They helped identify common behavioural grounds between gambling behaviour and financial decision making.
- **Financial literacy experts (5):** They pointed us to key components of policies and programs that have led to promising results, as well as the gaps and failures.
- **Managers from industry (3):** Managers provided insight into general trends in how gaming and financial authorities are promoting responsible gambling behaviour among consumers.
- **Gamblers (10):** Participants came from a broad spectrum of gamblers – from recreational to problem gamblers. Discussions provided us with an understanding of how gamblers think about risk and uncertainty; and what types of psychological, social, and cognitive forces influence betting decisions.

## Co-creation session

Before solidifying our recommendations based on the findings from the two activities above, we invited 16 users to a co-creation session (using a convenient sampling of staff and students in the Rotman school), where they brainstormed ways to encourage responsible gambling. Participants came from varied backgrounds: gambling end users carefully selected from the previous interviews, experts in behavioural economics and financial literacy, and MBA and Commerce students. This session was run in collaboration with Business Design experts at DesignWorks in Rotman. The 2-hour session consisted of the following elements:

1. A brief overview of the key findings on responsible gambling and effective financial literacy initiatives from our primary and secondary research.
2. An activity where each of the four groups was assigned a “persona” – a fictional character with distinct gambling habits and motivations – and tasked with brainstorming measures that would help the persona gamble responsibly. The characteristics of the personas were based on actual end-user interviews.
3. A collective discussion where each group shared their personas and suggestions, and other groups responded with feedback and comments.

The co-creation session gave us an overarching view from multiple perspectives and helped reinforce our initial research findings.

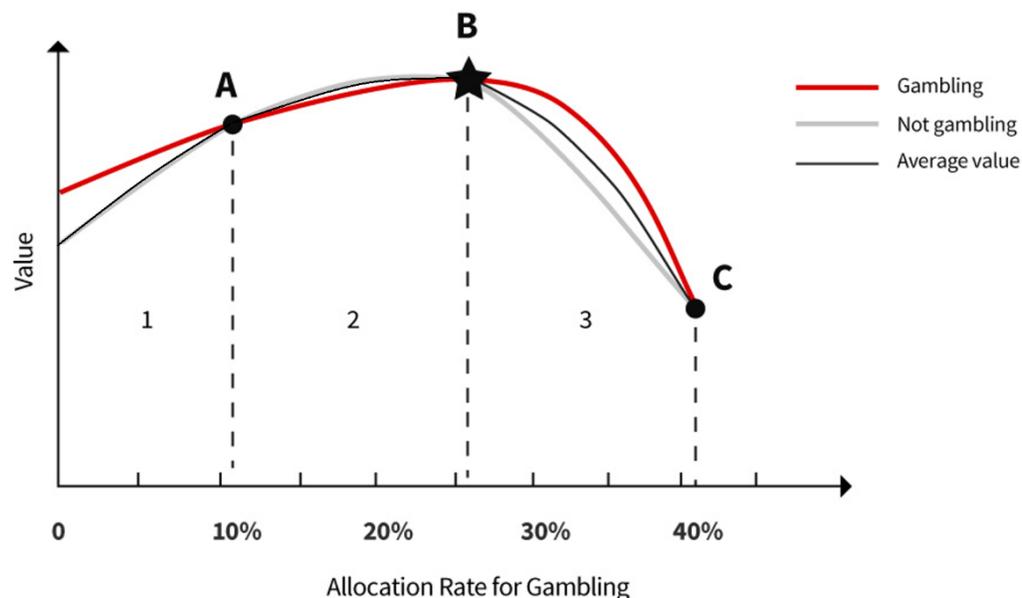
### 3. Behavioural Insights in Gambling

We often think of gambling as a static choice made at a specific point in time. But in reality, a person does not make a once-and-for-all choice to become a recreational gambler or a problem gambler (Herrnstein & Prelec, 1991). Instead, gambling behaviour is defined by the aggregate of many smaller decisions a person makes over a period of time. In other words, *repeatedly* choosing gambling over other alternatives is what leads a person to become a problem gambler. The decision of interest, then, is about a person's *allocation* for gambling.

The passage to problem gambling can be viewed as a primrose path – one that many people go down believing there is little danger of losing control (Herrnstein & Prelec, 1992). However, through a series of seemingly insidious choices, the individual may gradually slip into a pattern of compulsive gambling behaviour. For example, he may enter a casino thinking that he will enjoy a night of moderate risk taking, but repeatedly give into impulse and end up spending his month's worth of income playing poker.

In their chapter titled "A Theory of Addiction," Herrnstein and Prelec (1992) provide a behavioural explanation as to why a person may find himself choosing to gamble too much, even when he can be much better off by gambling less. An adapted version of their widely accepted behavioural model of addiction is presented in Figure 2. According to this model, Point B is the unstable "tipping point" where a gambler begins to go down the slippery slope of problem gambling.

Figure 2. Behavioural model of gambling



Adapted from A theory of addiction, by R.J. Herrnstein and D. Prelec, 1992, in *Choice over time*, by G. Loewenstein and J. Elster (eds.), New York: Russell Sage Press. Copyright 1992 by the Russell Sage Foundation.

In our adaptation, we labelled each category in the model, characterized by how often the individual chooses to indulge in gambling over other activities. Below is our description of the different spectrum of gamblers:

**1. Recreational gamblers:** In the first region of allocation, a person is indulging in gambling at a low rate. He is still developing a taste for the activity, or honing whatever skills may be involved for successful play (Herrnstein & Prelec, 1992). Intuitively, as he gambles more, the growing familiarity will increase his enjoyment of gambling (hence the upward slope). At the same time, more gambling is likely making non-gambling activities more enjoyable as well, whether it be because of social benefits or by alleviating other issues in his life. At and around Point A, we find a stable equilibrium for the recreational gambler, where he is content to have an equal and relatively average enjoyment level from both gambling and not gambling (Herrnstein & Prelec, 1992). At this allocation level, gambling would seem to be under good control.

**2. Frequent gamblers:** Past Point A, gambling is less enjoyable than the non-gambling alternative. We can, therefore, expect the average person to return to the stable equilibrium, Point A (Herrnstein & Prelec, 1992). However, for some people, other factors – like a growing social network of gambling friends or a change in their environment – may push them to gamble more and more (Herrnstein & Prelec, 1992). As these frequent gamblers continue to increase their allocation for gambling, they head toward a new, *unstable* equilibrium Point B – or, the “tipping point.”

**3. Problem gamblers:** In the third region of allocation – past the “tipping point” – we find that the primrose path has given way to dangerously high levels of gambling indulgence (Herrnstein & Prelec, 1992). The gambler experiences rapidly declining levels of enjoyment from both gambling (e.g., due to financial distress, social disapproval) and not gambling (e.g., from spillover of gambling consequences to personal and professional life). Yet, in this region, gambling is still more enjoyable than the non-gambling alternative *at the current moment*; so he continues to overindulge, driving himself to extremely low levels of well-being (Herrnstein & Prelec, 1992).

For the rest of this section, we will delve into the behavioural antecedents of gamblers ranging from recreational to problem types. Table 1 summarizes the key behavioural phenomena and concepts that can explain why one may diverge from responsible gambling behaviour.

Table 1. Summary of behavioural phenomena and concepts

<b>Behavioural Phenomena and Concepts</b>	
<b>Distributed choice</b>	Series of choices distributed over time, each of which has small individual impact but significant aggregate impact.
<b>Melioration</b>	Favouring higher immediate reward over a higher overall gain. The meliorating consumer does not necessarily take into account the negative impact of current choice on future pleasure, and may fail to optimize total overall satisfaction.
<b>Intertemporal choice</b>	Decisions in which the benefits or consequences occur at different points in time.
<b>Hyperbolic discounting</b>	Valuing outcomes experienced earlier more highly than outcomes experienced later. In the same way, costs paid in the future are not felt as deeply as costs that are paid now.
<b>Dynamic inconsistency</b>	A systematic reversal in preferences in favour of the smaller-but-sooner reward over a larger-but-later reward as the sooner reward becomes temporally proximal.
<b>Double switching</b>	Understanding that gambling is a chance-governed activity with risks, but abandoning such logical thought processes while engaged in the activity.
<b>Allais Paradox</b>	This paradox shows that, depending on how choices are framed, the less risky choice is preferred over higher expected payoff, while in other cases, the reverse is true.
<b>Ellsberg Paradox</b>	Preferring to take on risk in situations where the odds of winning are apparent (even if the probability is very low) over situations where the odds are ambiguous.
<b>Illusion of control</b>	Believing that random events can be influenced by one's own actions.
<b>Representativeness heuristic</b>	Judging the frequency or likelihood of an event by the extent to which it resembles the typical – or representative – case.
<b>Conjunction fallacy</b>	Inferring that a conjunction of two events is more probable than one of the events in a direct comparison.
<b>Monte Carlo fallacy</b>	Believing that a series of independent events are more likely to happen because they have not occurred in multiple tries, or are less likely to happen because they have occurred recently.
<b>Availability heuristic</b>	Using information that readily comes to mind to make a decision or judge the likelihood of an event.

### 3.1 Distributed Choice and Melioration

Gambling behaviour is characterized by a series of choices made over a period of time. In fact, most lifestyle choices fall into this category of “**distributed choice**” – like the frequency of athletic exercise, rate of savings, and allocation of leisure time (Herrnstein & Prelec, 1991). Interestingly, when people express dissatisfaction or regret about their choices, their discontent seems clustered around these distributed choices (Herrnstein & Prelec, 1991). Examples include complaints that one is exercising too little (or too much), overspending (or being too frugal), working too hard (or not hard enough), and so on.

So, why is it that people experience particular difficulty with distributed choices?

One explanation suggests that people are primarily able to assess how much they like specific activities and objects – whether they like gambling more than watching TV, for instance (Herrnstein & Prelec, 1991). What they have difficulty with, however, is in assessing the relative standing in the entire distribution mix – whether a 10-90 mix of gambling and TV is preferred over a 50-50 mix (Herrnstein & Prelec, 1991). Hence, a person may repeatedly choose the option that offers the higher immediate enjoyment, even though the resulting distribution is suboptimal – and even self-destructive – in a broader time frame. This phenomenon of favouring high immediate rewards over a higher overall gain is known as “**melioration**” (Herrnstein & Vaughan, 1980).

For pathological consumption patterns distributed over time – like that of problem gambling – the melioration theory is strictly at odds with standard economic theory. The latter postulates that a decision maker takes into account the impact of future benefits and consequences of the current choice to optimize their total satisfaction (Herrnstein, 1990). By contrast, the melioration model assumes that people are not such forward-looking optimizers; rather, they often fail to take into account the future reduction in pleasure caused by the current choice (Herrnstein, Loewenstein, Prelec, & Vaughan, 1993). The melioration model, then, suggests a general underinvestment in beneficial behaviour (for which enjoyment increases with greater investment) and overinvestment in activities that exhibit decreasing enjoyment with a greater rate of investment (Herrnstein, 1990).

In gambling, a meliorating player past the “tipping point” in Figure 2 will drive himself down the dangerous slippery slope because *at any given point along the curve in this allocation region*, the immediate enjoyment from gambling is greater than the alternative. Indeed, he may be the last one to recognize “how far he has slipped,” and may take corrective action only when prompted by others (Herrnstein & Prelec, 1991).

## 3.2 Hyperbolic Discounting and Time-Inconsistent Preferences

**Intertemporal choices** are decisions in which the benefits or consequences occur at different points in time (Loewenstein & Thaler, 1989). The decision to gamble is an intertemporal one: while the enjoyment gained from gambling is immediate, the consequences (losing money or the inability to spend it on more meaningful activities) are delayed in time. Intertemporal choices are ubiquitous in everyday life, from deciding between a brownie and fruit for dessert, to choosing how much schooling to obtain and how much money to save for retirement. In each scenario, the individual needs to trade off the value of one outcome that is temporally proximal (e.g., the taste of a brownie or the happiness derived from current spending) to one that is temporally distant (e.g., health consequences of consuming high caloric foods or the difficulties associated with being strapped for cash).

Research on intertemporal choices has repeatedly demonstrated that future outcomes are discounted (or undervalued) relative to immediate outcomes (Ainslie & Haslam, 1992). In other words, an identical reward will become increasingly attractive as it nears the time of decision making. This explains why individuals are willing to accept a small sum of money today in exchange for a larger sum in the future (Thaler, 1981), and why people display extreme myopia in purchasing cheap but highly inefficient energy-consuming devices (Hausman, 1979).

The dominant model of intertemporal choice used by economists is the discounted utility model formulated by Samuelson in 1937 (Frederick, Loewenstein, & O'Donoghue, 2002). The central assumption in this model is that people discount future value exponentially at a constant rate per unit of time (Samuelson, 1937). It implies that individuals will have a stable preference between two outcomes separated by a fixed time delay; a one-day delay has the same significance if it means deferring an outcome from today to tomorrow, or from today to a year and a day from today. As first noted by economist Strotz (1955), this model has the desirable property of implying that behaviour will be consistent over time.

The problem with the exponential discount model is that it does a poor job of explaining or predicting behaviour (Thaler, 1981). Indeed, there are many instances in real life where people act as if their discount rates vary with the length of time to be waited (see Kirby and Herrnstein, 1995; Rachlin & Green, 1972; Thaler, 1981). For instance, most people will choose to forgo receiving \$100 in 30 days to receive \$110 in 31 days. But if the choice is between receiving \$100 immediately and \$110 tomorrow, the immediate alternative suddenly becomes more attractive (Frederick et al., 2002).

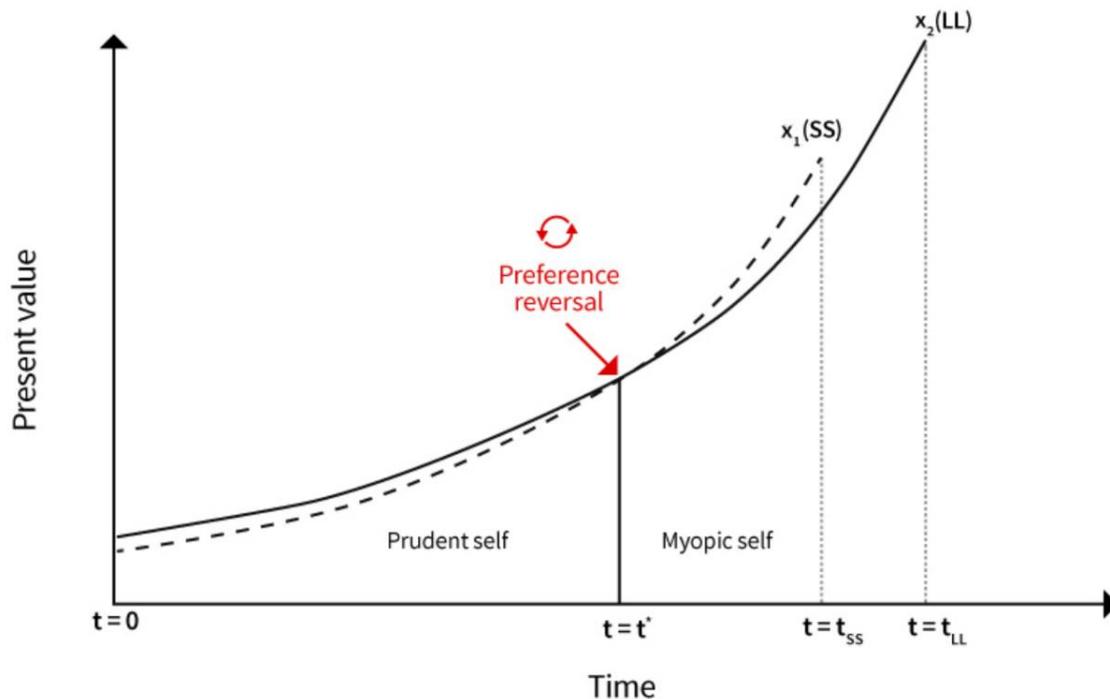
To explain such systematic changes in preferences, Mazur (1987) introduced a model known as **hyperbolic discounting**. It is represented by the function:

$$v = \frac{A}{(1 + kD)}$$

where  $v$  is the subjective value of the delayed reward,  $A$  is the amount of the delayed reward,  $D$  is the delay between choice and the acquisition of the reward, and  $k$  is a constant determining the degree of discounting. The fundamental property of hyperbolic discounting is the idea that discount rates are not constant but increase rapidly as the event in question becomes temporally proximal. Hence, the closer in time people are to the short-term reward, the greater the urge for immediate consumption. The formal term for this systematic change in preferences is “**dynamic inconsistency**” (Strotz, 1955).

In an experiment by Kirby and Herrnstein (1995), subjects were given a choice between a smaller-but-sooner (SS) reward and a larger-but-later (LL) reward. After showing a preference for the SS reward when offered immediately, experimenters then added a delay to both outcomes such that the temporal interval between them was maintained. Results showed that subjects typically switched to the LL outcomes, even for very small amounts of added delay (Kirby & Herrnstein, 1995). Figure 3 shows the corresponding curves, which are drawn using hyperbolically discounted values of rewards SS and LL as seen from different points in time. The figure also shows that rewards SS and LL will happen at times  $t_{SS}$  and  $t_{LL}$ , respectively.

Figure 3. Hyperbolic discounting and preference reversal



Adapted from Preference reversals due to myopic discounting of delayed reward, by K. N. Kirby and R. J. Herrnstein, 1995, in *Psychological Science*, 6(2).

Looking to the distant future from  $t=0$ , it is easy to see that the discounted value of LL is greater than the discounted value of SS. However, when time passes and  $t^*$  is reached,

there is a reversal in preferences where the discounted value of SS appears larger than LL. This reversal in preferences is due to different rates of temporal discounting of the LL and SS outcomes (Rachlin & Raineri, 1992). Such reversals among delayed rewards are common in everyday life, and often labelled as “impulsiveness” (Rachlin & Raineri, 1992).

The most influential explanation for time inconsistency in the presence of myopic discount curves relies on the notion of multiple selves, and struggles between those selves (Schelling, 1992). According to Thaler and Shefrin (1981), humans are both a “farsighted planner and a myopic doer” (p. 392). The planner looks at the long run (e.g., perspective from  $t=0$ ), but the doer wants immediate gratification and seizes control when faced with a tempting opportunity.

This conflict between the planner and the doer has important implications on how we think about educational interventions. As a society, we often rely on education as a panacea, believing that greater knowledge and awareness will help people to make better decisions. Yet, this model of dynamic inconsistency suggests that knowledge can influence the planner, but has little power to influence the doer, who seizes control at the sight of temptation. In the zone between  $t^*$  and  $t_{SS}$  in Figure 3, even the most prudent individual may stray from his/her best laid plans (Soman, 2011).

The concept of “**double switching**” illustrates how behaviour changes when the doer seizes control in the context of gambling. In an experiment by Sevigny and Ladouceur (2003), the majority of players displayed erroneous thoughts and behaviour (e.g., confusing games of chance with games of skill) while playing video lottery terminals, even if, before and after the gambles, they understand the risks and can articulate the games as a purely chance-governed activity. These results indicate that having a high level of knowledge in statistics and mathematics is not a protective factor against impulsive tendencies.

Ainslie and Haslam (1992) view time inconsistency as a pervasive problem only to be overcome through efforts at self-control. Self-control devices are referred to as “precommitments” or “personal rules” in the literature, and essentially entail a cost that the planner imposes on certain behaviours, using the advantage of foresight (Ainslie & Haslam, 1992). A frequently cited example is the story of Ulysses having his sailors block their ears with wax and ordering them to tie him to the mast of his ship to nullify the appeal of the Sirens (Elster, 1979). Other researchers argue that social norms (e.g., eat only three meals a day) and other social mechanisms (e.g., giving one’s car keys to a friend at a party) provide additional safeguards against the lure of temptation (Herrnstein & Prelec, 1992; Shefrin & Thaler, 1992). Examples of such mechanisms in the context of financial literacy will be discussed in section 4.

### 3.3 Misperceptions of Risk and Probability

Decision making under risk and uncertainty permeate in everyday life, such as when a person consumes medication (against the risk of side effects), trades risky stocks (against the risk of financial losses), or selects a retirement plan (under the uncertainty of future old-age needs). Standard economic theory argues that decision makers will choose between probabilities in a way that maximizes their expected payoff (Savage, 1954). Yet, observations in real life show that most people have little expertise in making risk assessments and evaluating probabilities of mixed outcomes.

Research in the domain of health decision making has shown that many adults fail to solve simple ratio and decimal problems – concepts that are essential for understanding health-related risks (Reyna & Brainerd, 2008). And people tend to be simplistic when determining probabilities, expressing limited possibilities such as “very likely,” “somewhat likely,” and “unlikely,” rather than pure probabilities (de Bruin, Fischhoff, Millstein, & Halpern-Felsher, 2000; Fischhoff & de Bruin, 1999).

In gambling, an activity wholly made up of probabilistic outcomes, the failure to understand how probability works can influence betting behaviour and outcomes. For instance, a study by Allais (1953) showed that, when presented with two choices of gambles, most participants chose the less risky choice (100% chance of winning \$1M) over the choice with a higher expected payoff (89% chance of winning \$1M, 1% chance of winning nothing, and 10% chance of winning \$5M). He called this “the preference for security in the neighbourhood of certainty” (Allais, 1997, p. 6).

In the same study, Allais also demonstrated that the framing of gambles change people's preferences. When the gambles above were presented differently, the majority preferred the higher expected payoff (90% chance of winning nothing and 10% chance of winning \$5M) to the less risky choice (89% chance of winning nothing and 11% chance of winning \$1M).

This inconsistency is called the **Allais Paradox** because mathematically, the two sets of options are identical, yet people show inconsistent preferences depending on how they are framed. By contrast, standard economic models predict that people's choices are consistent across transformations of options (Markman & Douglas, 2002). The influence of framing on decision making has also been illustrated in other domains, like medical decision making (Tversky & Kahneman, 1974, 1981, 1986; McNeil, Pauker, Sox, & Tversky, 1982).

Another series of experiments conducted by Ellsberg (1961) showed that people's aversion to ambiguity and uncertainty (hence their preference for definite information to indefinite information) influence their probability evaluations (Ellsberg, 1961). This effect, called the **Ellsberg Paradox**, implies that people choose to take on risk in situations where the odds of winning are apparent (even if the probability is very low) rather than situations where the odds are completely ambiguous (but potentially more promising). In other words, people tend to prefer “the devil they know.”

Another common misperception is that one's actions can influence the outcome of random events (Langer, 1975). This erroneous belief is called the **"illusion of control,"** and reflects people's tendency to look for links between independent events, even when it does not make sense to do so (Wolford, Miller, & Gazzaniga, 2000). In particular, when a specific action is reinforced, gamblers continue the action thinking they have controlled their luck – confusing a game of chance with a game of skill.

In an experiment conducted by Langer and Roth (1975), subjects were asked to predict the outcomes for 30 simulated coin tosses. The subjects were unaware that the wins were controlled to follow either an ascending, descending, or random pattern, all with an ending result of 15 heads and 15 tail tosses in each trial. Researchers found that the participants particularly in the descending formation – where wins are heavily concentrated in the beginning – described themselves as skilled and able to perform above average on predicting the outcome of the coin toss (Langer & Roth, 1975). Further, results showed that the more actively involved participants are in the chance task, the more likely they are to experience illusion of control (Langer & Roth, 1975).

Many of the misconceptions mentioned here have been echoed in our end-user interviews. Participants displayed similar ways of thinking, from believing in unrealistic odds of winning to having a false sense of control over the game. Some direct quotes include the following:

"I keep playing because the random ball needs to land in my court one day."

"If I believe I win, then I will win."

"I buy more lottery tickets when the jackpot is more than \$50 million."

These misperceptions of risk and probability will cause little harm for the majority of gamblers who play recreationally. As a recreational gambler, low expertise in assessing risks and probabilities may lead to a relatively small financial toll or a bad day in a casino, but he is unlikely to face long-term consequences. However, the risks become much more significant at higher allocation rates for gambling (see Figure 1). And once a gambler reaches the "tipping point," melioration will make it very difficult for a gambler to scale back.

### 3.4 Heuristic Decision Making

Psychologists Tversky and Kahneman (1974, 1983) have argued that when making decisions under uncertainty, people use a limited set of simple judgment heuristics. While these heuristics are generally useful in reducing the complex tasks of assessing probabilities or predicting outcomes to simpler judgmental operations, "sometimes they lead to severe and systematic errors" (Tversky & Kahneman, 1974, p. 1124).

For example, many people are insensitive to sample size; they fail to understand that winning is common with small samples but increasingly rare with extended play (Leonard, Williams, & Vokey, 2015). Hence, a gambler playing roulette may erroneously

assume that if a ball lands red 7 times out of 10 spins, the 70% ratio would hold even if the roulette was spun 100 times. This is due to a cognitive bias called the “**representativeness heuristic**,” referring to the tendency to judge the frequency or likelihood of an event by the extent to which it resembles the typical – or “representative” – case (Tversky & Kahneman, 1974). Statistically, however, the 70% ratio is much more probable to occur in the small sample of 10, which is more susceptible to deviations than the large sample size of 100. Given that the majority of gambling machines are designed to ensure high variability of short-term outcomes, but long-term statistical advantage to the gambling provider, the failure to understand probability can take a large toll on those who engage in repeated play (Leonard et al., 2015).

The famous “Linda Problem” shows another manifestation of the representativeness heuristic. In experiments by Kahneman and Tversky (1983), subjects were given a short description of Linda:

Linda is thirty-one years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in antinuclear demonstrations.

They were then asked which alternative is more probable:

- (a) Linda is a bank teller.
- (b) Linda is a bank teller and a feminist.

Though the first answer is statistically more likely (b is a subset of a), the majority chose the latter because it difficult to imagine Linda as a bank teller (she does not fit the stereotype), while a feminist bank teller makes for a more coherent story. This example is a case of the “**conjunction fallacy**,” whereby the more specific scenario is inferred to be more likely because of its fit or representativeness, even though the added detail actually makes the scenario less likely. According to Tversky and Kahneman (1974), “Judgments are all based on data of limited validity, which are processed according to heuristic rules” (p. 1124). The Linda Problem, then, exposes people’s tendency to overestimate the probabilities of representative events, and underestimate those of less representative events.

The representativeness heuristic is also responsible for the “**Monte Carlo fallacy**” (a.k.a. the classic gambler’s fallacy). This fallacy refers to the misperception that a series of independent events are more likely to happen because they have not occurred in multiple tries, or are less likely to happen because they have occurred recently (Lyons, Weeks, & Elliott, 2013). For example, a gambler may believe that a slot machine that just gave out a large win would be less likely to do so again in the near future, or that a roulette ball that has not landed reds in a long time is bound to land red soon. People expect that a short run of random outcomes should share properties of a longer run, specifically in that deviations in one direction will even themselves out in the other direction (Leonard et al., 2013).

Further, people often estimate frequency by how available instances of an event are in their memory, and tend to judge an event's probability by how easily instances come to mind. This cognitive bias is known as the "**availability heuristic.**" For example, in the months following the 9/11 terror attack in the United States, there was a significant increase in cars driving long distances (Deonandan & Backwell, 2011). Though there are statistically far fewer accidents on plane than by car, miles traveled via automobile increased by up to 5.3% on interstate highways (U.S. Department of Transportation, 2011). The freshness of the plane crash in people's immediate memory led people to overestimate the probability of plane crashes and believe that traveling by car was safer.

By the same token, gamblers' perception of the likelihood of winning may be skewed due to their susceptibility to the availability heuristic. In casinos, slot machine wins are routinely accompanied by bright flashing lights and loud noises. And since lottery organizers heavily promote jackpot winners, people are constantly hearing about those who have won big; on the other hand, they hear almost nothing about the vast majority of people who have never won (Leonard et al., 2015). Perhaps this is one explanation for why 61.4% of people in Ontario buy Lotto 6/49 tickets with their hard-earned money at a nearly zero chance of winning (RGC, 2014).

Another common judgment bias is, when considering an outcome or hypothesis, people often underweight or ignore alternatives (McKenzie, 1998). A series of experiments by McKenzie (1998) showed that when people are asked to judge the likelihood of a certain outcome, they look for reasons to support its occurrence rather than carefully evaluate other alternatives, unless they are explicitly asked to consider the alternate hypothesis. This decision shortcut may lead gamblers to continue betting without considering alternative activities or outcomes, unless prompted to do so. Successful interventions to help people consider alternatives include presenting both options rather than just one (Beyth-Marom & Fischhoff, 1983), having individuals generate reasons why an alternative hypothesis may be true (Slovic & Fischhoff, 1977), and explicitly telling participants to consider alternative possibilities (Lord, Lepper, & Preston, 1984).

In this section, we described key themes from behavioural insights to give a taste of why a gambler may find it difficult to gamble responsibly. The key elements include the following:

- 1) People are able to easily judge how much they like gambling vs. another activity, but have difficulty finding the right allocation of gambling vs. another activity.
- 2) The preference for gambling increases as the event becomes proximal (i.e., the prudent self switches to the myopic self).
- 3) Most people have little expertise in evaluating probabilities and calculating expected outcomes.

- 4) Choices between probabilities are not always made in a way that maximizes expected value. Other influences – like the way options are framed, aversion to risk, and preference for certainty over ambiguity – affect decision making.
- 5) When making decisions under uncertainty, people use heuristics to guide judgment and assessment of probabilities.

In the next section, we review evidence-based findings from the domain of financial literacy and behavioural economics that can be used to help overcome these difficulties in gambling decision making.

## 4. Findings from Financial Literacy

The recent policy focus on financial literacy began in the mid-1990s, when many governments around the world began to recognize the broader economic implications of their citizens' poor financial knowledge and decision making (Financial Consumer Agency of Canada [FCAC], 2015). In Canada and the United States, this was a time of rising consumer debt, declining personal saving rates, and high levels of household bankruptcies (Braunstein & Welch, 2002).

Many experts, concerned that consumers lacked the knowledge and skills needed to navigate the increasingly complex financial marketplace, resorted to the usual antidote: education (Mandell, 2012). The broad objective of the financial education programs was to present information that would improve consumers' ability to make decisions that were beneficial to their well-being (Braunstein & Welch, 2002). Some offered comprehensive information to a broad audience on topics like savings and credit; some were tailored to specific groups like youth or military personnel; and others were focused on a specific goal, such as home ownership or retirement savings (Braunstein & Welch, 2002).

While financial literacy training programs proliferated, research measuring the effectiveness of the programs did not keep pace (Lyons, Palmer, Jayaratne, & Scherpf, 2006). The majority of financial education programs were still evaluated using "program output" criteria such as the number of program participants, number of programs delivered, and number of educational materials distributed (Lyons et al., 2006). Other criteria being used covered a wide range to determine success – from participation in retirement savings plans to self-reported changes in confidence levels (Braunstein & Welch, 2002).

Then, financial literacy – or the lack thereof – seized the spotlight in the midst of the 2007–08 turmoil that was the global financial crisis. Though there were many stakeholders involved in the housing price bubbles that began the economic downturn, a chunk of the blame was put on poor financial decision making by consumers who took on too much of the wrong sort of debt (Mandell, 2012). Financially literate consumers, it was argued, would have been more cautious in taking on credit they could not afford, avoiding costly financial "mistakes" (Levesque, Godfrey, & Miller, 2009). Most countries surveyed after the crisis have highlighted that, if financial illiteracy could not be pointed at as the main root cause for the crisis, it has certainly played a key role in worsening its effects (OECD, 2009).

The global financial and economic instability prompted governments and interested stakeholders to take a closer look at the current state of financial literacy – and the picture was grim. Canadian and international polls, surveys, and studies have consistently shown that many consumers – young and old, rich and poor – have real challenges with financial literacy, from reading financial statements to managing credit cards to planning for retirement (Task Force on Financial Literacy, 2010). For instance,

Lusardi and Mitchell (2006, 2007) found empirically that less than one-fifth of participants in a study were able to correctly calculate the amount of money they would have in a savings account that had an interest rate of 2% per year after five years. Moreover, the crisis revealed that investments in financial education and training were not necessarily translating to desired financial behaviours or outcomes.

These concerns about financial illiteracy and its consequences have sparked government efforts to improve financial literacy initiatives. At a global scale, the OECD established in 2008 the International Network on Financial Education (INFE) to develop substantial work on the relations between the financial crisis and education (OECD, 2009). Earlier that year, President George W. Bush signed an Executive Order creating, for the first time, a President's Advisory Council on Financial Literacy (The Department of the Treasury, 2008). Canada followed suit, by setting up a national task force on Financial Literacy in June 2009 to strengthen financial well-being and improve the financial decisions of Canadians (Task Force, 2010).

The Task Force report, released in 2010, defined financial literacy as "having the knowledge, skills and confidence to make responsible financial decisions" (p. 10). This definition is broad and reflects the view of financial literacy as going beyond mere education.

In particular, the report recognized that there is a wide range of psychological, social and institutional influences that can impede economically rational decision making (Task Force, 2010). Indeed, many individuals know they should budget; or that they should not spend beyond what they can afford, but they do so anyway. The conundrum of why, in the presence of reliable and credible information, households do not always act in their best financial interest – as the efficient markets model contends they should – has been explored by the discipline of behavioural economics. As part of the National Strategy, the Task Force (2010) expressed their view to incorporating behavioural insights and using "nudging" interventions (or using approaches from behavioural sciences) as a complement to more traditional financial literacy tools and initiatives aimed at empowering Canadians in their financial decision making processes (p. 54).

In the rest of this section, we look at research in financial literacy and behavioural economics, and see how it has been used in policy development and program design to encourage responsible spending. The key findings are summarized in Table 2.

Table 2. Summary of key findings from financial literacy interventions

<b>Findings from Financial Literacy Interventions</b>	
<b>Scope of the training program</b>	Financial training tied to specific goals like homeownership or retirement savings (narrow scope) are more effective than broad programs (e.g., semester-long classes in high school) that take a “one-size-fits-all” approach.
<b>Timing of the program</b>	Knowledge should be conveyed “just in time” to enhance perceived relevance and minimize forgetting.
<b>Feedback-based training</b>	Experiential learning that provides people with the opportunity to make financial decisions and gather feedback enhances financial knowledge.
<b>Heuristic-based training</b>	Rules of Thumb (ROTs) and heuristics can help people to make “reasonably good” decisions without needing to understand all the complex nuances of the situation. They also take less time to implement, thus reducing the risk that people procrastinate in using them.
<b>Precommitment devices</b>	Asking people to commit to making choices for the future reduces the likelihood that they will lose self-control at the lure of temptation.
<b>Information framing</b>	People react more strongly to costs framed in dollar terms (what people are used to thinking about) rather than abstract percentages.
<b>Reminders</b>	Reminding people of their goal or making the goal more salient increases their motivation to work toward it.
<b>Interaction with future self</b>	An encounter with an image of one’s aged self increases empathy to the future self, making the individual more likely to behave in line with his/her long-term interests.
<b>Technology-enabled decision tools</b>	Access to real-time financial feedback can help consumers stop and think about their spending decisions in the context of their financial situation.
<b>Social interventions</b>	Socially driven interventions like self-help groups and shared mobile apps facilitate desired behaviour change by increasing accountability and responsibility for an individual’s actions.

## 4.1 Evidence from Financial Literacy Education

It is difficult to infer the causal impact of financial literacy education on achieving better financial behaviours and outcomes (Robson, 2012). Recently, an extensive meta-analysis conducted by Fernandes, Lynch, and Netemeyer (2014) showed that interventions to improve financial literacy explained only 0.1% of the variance in financial behaviours studied. Though correlational studies that measure financial literacy find stronger associations with financial behaviours (Hastings, Madrian, & Skimmyhorn, 2013), researchers found that the partial effects of financial literacy diminish dramatically when one controls for omitted variable bias (i.e., taking into account psychological traits, etc., that have been omitted in prior research) (Fernandes et al., 2014). Amidst the mixed evidence, this section aims to tease out components of financial literacy programs that have been successful.

### Timing and scope (broad vs. narrow) of the program

Meta-analyses by Fernandes and colleagues (2014) found that like other forms of education, financial education decays over time. As predicted, more hours of instruction produce larger effects on downstream behaviours. Yet, researchers find that even large interventions with many hours of instruction have negligible effects on behaviour 20 months or more from the time of intervention (Fernandes et al., 2014).

The decay of the effects of financial literacy education implies that knowledge may be better conveyed via “just in time” education tied to a particular decision. Indeed, studies generally show a positive correlation between financial training and the achievement of specific goals – like maintaining a mortgage, increasing savings, or participating in employer-sponsored benefit plans – while the results of surveys measuring the acquisition of more general, more comprehensive financial literacy are less clear-cut (Braunstein & Welch, 2002).

For instance, workplace financial education programs have generally seen favourable results due to their relevant and timely nature (Braunstein & Welch, 2002). One study found that employees who attended training workshops subsequently increased their participation in 401(k) plans (Kim, Kratzer, & Leech, 2001). Another national telephone survey showed that those who had taken employer-based financial education on savings had higher rates of saving and participation in 401(k) plans for both respondents and their spouses (Bernheim & Garrett, 2003).

In the domain of mortgages, Freddie Mac, one of the largest purchasers of mortgage loans, conducted a study of nearly 40,000 mortgages under its affordable mortgage loan program (Hirad & Zorn, 2001). Some borrowers had received pre-purchase counseling, and others had not; those who had received counseling had received it from a variety of sources, including government agencies, mortgage insurers, and nonprofit groups. Results showed that borrowers who received counseling had, on average, a 19% lower 90-day delinquency rate than borrowers with “equivalent observable characteristics” who had not received counseling (Hirad & Zorn, 2001).

On the other hand, programs with a broader scope, like youth financial education programs, often take a “one-size fits all” approach in a well-intended effort to provide as much information as possible in a limited amount of time (Braunstein & Welch, 2002). Yet, findings by Fernandes and colleagues (2014) show that there must be some immediate opportunity to use and practice the acquired knowledge or it will decay. Further, a study by Thompson, Gentner, and Loewenstein (2000) demonstrate that it may be difficult for people to retrieve and apply knowledge from education to situations with similar relevant principles but different surface details (Thompson et al., 2000), particularly decisions coming years after the education. Hence, Fernandes and colleagues (2014) argue for “just in time” financial education to enhance perceived relevance and minimize forgetting.

In addition, people are significantly more likely to tackle their goals after reaching a temporal landmark (marriage, pregnancy, etc.). Studies by Dai, Milkman, and Riis (2014) demonstrate that Google searches for the term “diet,” gym visits, and commitments to pursue goals all increase following temporal landmarks. Hence, it is important to choose critical life moments to deliver the knowledge that the educational intervention aims to convey.

## **Experiential and feedback-based learning**

The economist Milton Friedman (1953) famously suggested that, just as pool players need not be experts in physics to play pool well, individuals need not be financial experts if they can learn to behave optimally through trial and error.

There is some evidence that such personal finance learning does occur (Hastings et al., 2013). For instance, researchers find that in credit card markets, the fees paid by new cardholders fall by 75% during the first three years after an account is opened, owing to negative feedback (Agarwal, Driscoll, Gabaix, & Laibson, 2011). By paying a fee, consumers learn how to avoid triggering future fees. The role of experience is also evident in the answers to a telephone survey conducted by the University of Michigan that asked respondents about the most important way they learned about personal finance. Half the respondents cited personal financial experience, which was more than twice the portion who cited friends and family, and four to five times the portion who credited formal financial education as their most important source of learning (Hogarth, Hilgert, & Schuchardt, 2002).

A study on expert predictions demonstrates the positive effect of feedback. When psychologist Tetlock first analyzed the data of experts who made their living predicting and offering advice on political or economic trends, he found that their forecasts barely beat random chance (Tetlock, 2005). The inaccuracies of experts were driven by a long list of cognitive biases, from overconfidence to a tendency to envision only a single possible future. They rarely took their past performance into account or learned from their predictive failures. In a following study, Tetlock and colleagues tested whether they could use feedback to enhance the predictions of a few thousand

amateur volunteers (Mellers et al., 2015). The study found that when volunteers were given extensive feedback about their predictions and taught how to avoid the most common cognitive errors, they became “superforecasters” – those who are able to consistently beat other experts and algorithms (Tetlock & Gardner, 2015). The timely feedback and repeated practice was an important component of the success of the predictions.

Some education programs have incorporated practice-based learning as part of the training. In the United States, some high school students participate in a stock market game, which is a simulation in which students invest a hypothetical sum of money in an online portfolio and track its performance. This interactive activity gives students the opportunity to experience the process of gathering information, making financial decisions, and collecting feedback. Mandell (2008) found that high school students who play the stock market game have significantly better financial test scores on the Jump\$tart survey than did students overall, and better than those who had received other types of training. This positive association has been found in every round of the Jump\$tart survey since 2000, when the stock market game was first included in the survey instrument (Mandell, 2008).

Although experiential learning may train people to avoid similar mistakes in the future, many significant financial decisions such as investing for retirement and choosing a mortgage are undertaken infrequently and have costly consequences that are delayed in time (Hastings et al., 2013). Learning by doing may not be an effective substitute for limited financial knowledge in these situations (Campbell, Jackson, Madrian, & Tufano, 2010). Furthermore, an unfamiliar domain is likely to reduce the ability of participants to transfer any expertise that they might possess (Eisenstein, 2006). In other words, giving subjects immediate, unambiguous, and accurate feedback over a series of repeated games has been found helpful in reducing overconfidence, but only overconfidence about making decisions taking the same form as the game.

## 4.2 Evidence from Heuristic-Based Training

The typical financial literacy program strives to help people make complex financial decisions by providing in-depth information. For example, in the aftermath of the recent financial crisis, some U.S. policymakers proposed finance classes in high school, while others suggested that citizens be taught about the complexities of interest rate models, portfolio allocation, and so on (Schoar & Datta, 2014). In recent years, however, behavioural economists have suggested that this approach may be flawed, since it does not take into account the psychological or behavioural barriers that prevent people from making better decisions (Mullainathan & Shafir, 2013).

Many years of research have shown that people do not like to spend much effort thinking, especially when decisions are complex (Kahneman, 2011; Payne, Bettman, & Johnson, 1988). Instead, they prefer to use heuristics – or simple and efficient rules – to guide judgment. The key attraction of these Rules of Thumb (ROTs) is that they can

help people to make “reasonably good” decisions without needing to understand all the complex nuances of the situation (Schoar & Datta, 2014). For example, the 50/50 campaign guides our nutritional choices to ensure that there is a good amount of fruits and vegetables in a meal without having to understand nutritional science. A single, easy-to-remember rule is also more likely to be recalled and acted upon than a complex underlying theory (Schoar & Datta, 2014).

Drexler, Fischer, and Schoar (2014) conducted field trials to test the impact of different types of financial training for microentrepreneurs in the Dominican Republic. The group that received conceptual-based accounting training showed no significant improvement, while the group that received a simplified ROT-based training produced significant and economically meaningful improvements in business practices and outcomes. In particular, business sales went up for the ROT graduates, especially in bad weeks when improved practices matter most: they had 25% higher revenues in those bad weeks (Drexler et al., 2014). In addition, follow-up surveys showed that students were more likely to implement ROTs than the complex rules of accounting. Figure 4 illustrates some of these rules.

Figure 4. ROT examples from the Dominican Republic field trial

### RULES OF THUMB

-  Assign yourself a wage for the month
-  Keep two drawers - one for the business and one for the home
-  Any “borrowing” from the business has to be paid back in three days and vice versa

Content drawn from Evidence in financial inclusion: New findings and their applications” [PDF document], by IMFR LEAD, Retrieved from [https://www.poverty-action.org/sites/default/files/Session%202-Financial%20Education-Rules%20of%20Thumb%20\(John%20Arun\).pdf](https://www.poverty-action.org/sites/default/files/Session%202-Financial%20Education-Rules%20of%20Thumb%20(John%20Arun).pdf)

Another series of experiments by Eisenstein (2006) looked at the psychological underpinnings of how people estimate compound interest. Results demonstrate that the vast majority of people anchor on simple interest, and then adjust their answer upwards. Anchoring on simple interest means acceptable accuracy for short time periods and for low interests, but massive underestimation for longer time horizons and for higher rates. Given that most of the major financial decisions involve either longer time horizons (e.g., retirement savings, mortgages) or high interest rates (taking on credit card debt), anchoring on simple interest makes for a damaging bias. Yet, researchers found that a small minority were very accurate in their estimates. These subjects used a completely different estimation process, called the “rule of 72” (Eisenstein, 2006). This rule is an accurate approximation of the complex financial

formula, and uses the simpler equation  $y=72/i$ , where  $y$  is the number of years that it takes for money invested (or loaned) at an interest rate of  $i$  to double in value. When participants were trained to use the rule of 72, they attained enormous improvements in accuracy compared to the untrained control group, with no increase in time spent on task (Eisenstein, 2006).

Though ROTs can be very useful in helping individuals make reasonably good decisions, it is important to recognize that ROTs will not necessarily lead to the *best possible* outcome for any individual. In other words, ROTs are desirable when the alternative is learning complex concepts that not only takes time, but also lots of mental energy to absorb and implement.

### 4.3 Evidence from Precommitment Devices

Lynch and Wood (2006) argue that information remedies such as financial education or disclosures can be effective when behaviour is under cognitive and intentional control, but not for behaviours that are controlled by emotion or habit. For the myopic self, focused on immediate reward over long-term consequences, the individual is unlikely to retrieve the knowledge and apply it to the situation at hand (Fernandes et al., 2014). In such situations, precommitment tools for self-control using principles of behavioural insights may produce greater impact (Fernandes et al., 2014).

In the *Save More Tomorrow* program, employees are given the option of committing in advance to allocating a portion of their future salary increases toward retirement savings (Benartzi & Thaler, 2004). Hence, they are not feeling the loss now, but in the future, when they get a raise. In its first implementation, the *Save More Tomorrow* program boost up the average participant's 401(k) savings rate from 3.5% to 13.6% in just 3.5 years (Benartzi, 2015). By shifting the choice from "save more now" to "save more tomorrow," barriers to saving (e.g., self-control and the feeling of loss of income) were overcome.

In another study, Ashraf, Karlan, and Yin (2006) designed a savings product called SEED that provided individuals with a commitment to restrict access to their savings. Each individual defines either a goal date or amount, and is subsequently unable to withdraw from the account until the goal is reached. For the commitment savings group, average savings balance increased by 42% after six months and by 82% after one year (Ashraf et al., 2006).

Such precommitment devices are effective in exerting self-control because people do not arbitrarily choose tempting alternatives solely on the basis of their attractiveness. Specifically, prior research suggests that consumers try to maintain a sense of accountability (even to their own selves) and succumb to temptation only when they can somehow justify that decision (Kunda, 1990). Therefore, consumers will not knowingly choose tempting options when such a choice contradicts a more justifiable

course of action. For the same reason, setting budgets, which serves as a precommitment device, reduces the likelihood that money will be spent recklessly.

## 4.4 Evidence from Behavioural Economics and Decision Tools

Research in behavioural economics has shown that changes in context disproportionately influence behaviour. According to Thaler and Sunstein (2008), “A nudge is any aspect of the choice architecture that alters people’s behaviour in a predictable way without forbidding any options or significantly changing their economic consequences” (p. 6). A nudge may serve to highlight key information, activate a desired behaviour, remind people of their goals, or passively shape behaviour by framing options in a certain way.

### Information framing

For example, Bertrand and Morse (2011) conducted a field study to test whether the way information is disclosed alters people’s decisions to take payday loans. One group was presented a table that listed the annual effective interest rate they would be paying (443%) compared to comparable loans (16% on a credit card). Another group was instead shown how many dollars they would pay on the loan if they were to repay in two weeks (\$45), a month (\$90), and so on, as compared to if the same amount were borrowed on a credit card (see Figure 5). Researchers found that far fewer customers took the payday loan when the cost was expressed in dollars instead of interest rates (Bertrand & Morse, 2011). Those who came for payday loans are accustomed to seeing, thinking about, and needing dollars. Interest rates, by contrast, are abstract financial concepts that few use in daily life and which require substantial intellectual effort to turn into something more tangible.

Figure 5. Different ways of information disclosure on payday loans

Annual interest rates on different types of loans		How much it will cost in fees or interest if you borrow \$300			
	Median Annual Interest % (from government surveys)	<b>PAYDAY LENDER</b> (assuming a \$15 fee on \$100 loan)		<b>CREDIT CARD</b> (assuming a 20% APR)	
Payday Loan	<b>443%</b>	If you repay in		If you repay in	
Installment Car Loans	<b>18%</b>	2 weeks	<b>\$45</b>	2 weeks	<b>\$2.50</b>
Credit Card	<b>16%</b>	1 month	<b>\$90</b>	1 month	<b>\$5</b>
Subprime Mortgages	<b>10%</b>	2 months	<b>\$180</b>	2 months	<b>\$10</b>
		3 months	<b>\$270</b>	3 months	<b>\$15</b>

Adapted from Information disclosure, cognitive biases, and payday borrowing, by M. Bertrand and A. Morse, 2011, in *The Journal of Finance*, 66(6).

Interestingly, researchers found no response to the disclosure among individuals that take up large payday loans (as a fraction of their income) (Bertrand & Morse, 2011). This last finding might suggest that information disclosures are most effective before an individual has made a habit out of the undesirable behaviour.

## Reminders

Reminders are nudges: They make goals salient and provide associations between future expenditure opportunities and today's choices (Karlán, McConnell, Mullainathan, & Zinman, 2010). In a field experiment by Karlán and colleagues (2010), one group of individuals who opened a bank savings account received monthly reminders of their savings goals via text messages or letters from the financial institution, while another group received no reminders. For those who received monthly reminders, bank balances increased by 6% on average, and they were 3% more likely to reach their goal compared to the no-reminder group (Karlán et al., 2010). In particular, reminders that highlighted the specific savings goal (i.e., paying school fees) were twice more effective than reminders that did not mention the goal.

## Interactions with future self

As mentioned in section 3, individuals are myopic and tend to overemphasize short-term benefits and costs relative to long-term benefits and consequences. Hershfield and colleagues (2011) believed that people sometimes neglect the future consequences of today's actions (not saving enough, eating unhealthy foods, etc.) because they feel disconnected from their future selves. To help overcome this tendency, researchers designed a nudge that aimed to increase empathy with their future selves. In the experiment, participants were exposed to a brief encounter with their aged reflection, enabled by virtual reality technology, before deciding how much money to allocate into their retirement fund. Results showed that participants exposed to their aged avatars put more than twice as much money into the retirement account compared to those who were exposed to their current selves (Hershfield et al., 2011). These findings demonstrate that subjects exposed to an image of their aged self acted in ways more in line with their long-term interests.

Empathy to future self can also be increased by writing a letter to one's future self. In a study by Gelder, Hershfield, and Nordgren (2013), young adults who had been asked to write a letter to themselves 20 years in the future were less likely to say they would make an amoral choice—like buying a stolen laptop—than people who had been asked to write to themselves three months from now.

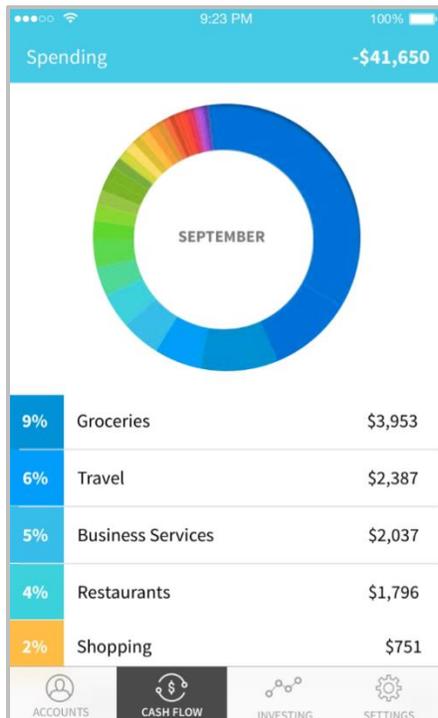
## Technology-enabled decision tools

Recent government surveys show that most mobile banking users check their balances before making large purchases (Board of Governors of the Federal Reserve System, 2014). Of those who check, 50% decide not to buy the item because of the feedback (Board of Governors, 2014). As the survey demonstrates, “just in time” feedback is an effective decision aid that is now possible at people's fingertips, thanks to advances in technology.

For instance, the Personal Capital mobile app is a service that allows an individual to link all active financial accounts in a single place (Levi & Benartzi, 2014). Key features

include a dashboard that allows tracking of spending and investments at a glance (see Figure 6) and alerts about weekly changes in net worth, among others. With easy access to this real-time financial feedback (with a visual breakdown of spending into different categories like entertainment and groceries), users can stop and think about their spending decisions in the context of their financial situation.

Figure 6. Interface of an app that allows access to real-time financial feedback



Excess consumer spending is often described as a problem of limited self-control. In other words, consumers do not have the willpower to forgo a purchase when faced with a tempting opportunity. What researchers found is that a typical user of the Personal Capital app decreased monthly spending by 15.7%, with almost all of this decrease coming in the form of discretionary spending (Benartzi, 2015). This finding demonstrates that feedback at the right time can dramatically enhance individuals' ability to exert self-control.

## 4.5 Evidence from Social Interventions

Studies show that peers influence goal achievement, mainly by increasing accountability and responsibility for one's actions (Matthews, 2015). For instance, an experiment by Matthews (2015) found that 76% of participants who sent weekly

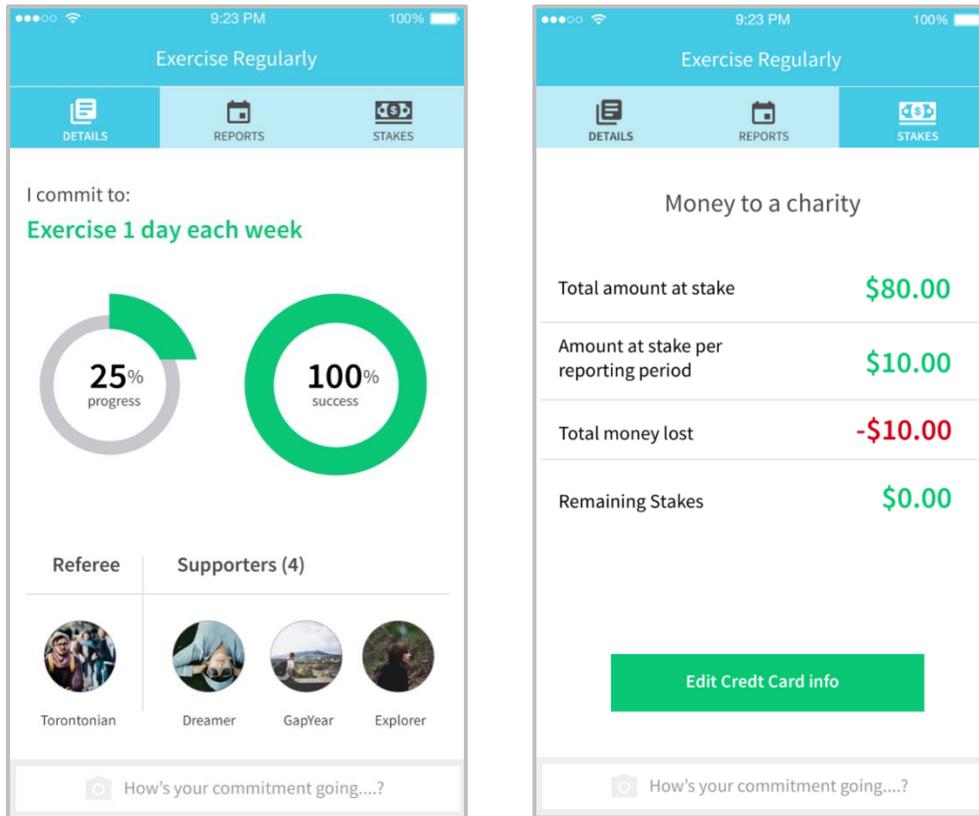
progress updates to a friend reported successful goal achievement, compared to 43% of those who were simply asked to think about their goals.

In another series of field experiments, Kast, Meier, and Pomeranz (2012) indicate that participating in self-help groups can improve savings rates. Individuals set goals publicly, met on a regular basis to report on their savings progress, heard about the progress of their peers, and had the opportunity to share useful financial information. Results showed that the number of deposits grew 3.7-fold compared to the control group (Kast et al., 2012). In a follow-up, participants received text messages that simply reminded participants of their progress and the progress of their peers. Researchers found that receiving feedback by text message increased savings by almost as much as being a member of a self-help group (Kast et al., 2012).

Mobile apps also help build a social circle where people can hold each other responsible for their spending behaviour. For example, an app called Splurge Alert aims to stop users from mindless spending by alerting users and their social circle when users enter “danger zones” (Sherman, 2016). Using Google Maps API to identify danger zones (e.g., shopping malls, liquor stores, fast food restaurants), the app sends warnings to the user to “stay strong and avoid temptation as best you can” (Sherman, 2016). In addition, users can also set up “Splurge Buddies” who get alerts via text message when users enter danger zones. These buddies can then intervene and talk the user out of impulse spending at the precise moment of temptation (Tompson, 2016).

Another app called stickK provides a platform whereby users can set goals and sign a legally binding “commitment contract” that will send their money to third parties – either individuals, organizations, or charities – should they fail to meet the goal (Levitt, 2008). There is also an option to have a friend or family member as a ‘referee,’ who monitors and confirms the accuracy of the individual’s reports to the app (Adams, 2015). According to stickK CEO Goldberg, those who put money on the line *and* have a referee tend to be most successful: 78% of these users achieve their goals, compared to 35% of those who put no money at stake (Schweitzer, 2008). Moreover, those who have a referee to whom they are accountable are twice as likely to reach their goal compared to those with none (Adams, 2015). Figure 7 shows the interface of such an app.

Figure 7. Interface of an app with referees and financial stakes



Looking back to how the Task Force defines financial literacy – “having the knowledge, skills and confidence to make responsible financial decisions” (p.10). – we see that the definition is primarily outcome focused. The conventional wisdom has been that educational programs drive these outcomes. After release of the Task Force report, however, there has been much interest in looking at other forms of achieving this ideal, including using behaviourally informed decision tools and aids, as well as social mechanisms. In the next section, we combine these multiple approaches to arrive at recommendations to encourage responsible gambling.

## 5. Recommendations

In our research, we explored various definitions of responsible gambling. We commonly came across broad characterizations including gambling behaviour that is “harmless,” “not going beyond means,” or “informed by sufficient gambling literacy.” Few studies have specifically focused on the types of behaviours that are strongly associated with responsible gambling.

In this report, we identify five key behaviours underlying responsible gambling, as illustrated in Figure 8. These behaviours are derived from gambling literature, interviews with experts, as well as informed by findings from financial literacy research.

Figure 8. Behaviours underlying responsible gambling



**Setting limits:** Research suggests that most gamblers regulate their behaviour by setting limits on how much money or time they spend gambling (Hodgins, 2005; Petry, 2005). Budgeting is the most common way to set a financial limit. For example, Brockner, Shaw, and Rubin (1979) showed that when people are prompted to set an investment limit, they are reasonably good at adhering to their limits. Furthermore, people avoid tapping into resources that exist in separate mental accounts. In personal decisions, for example, people allocate specific amounts of money toward this month’s entertainment and household expenses, and they resist exceeding their predetermined expense limits (Heath, 1995). Gamblers can also impose behavioural limits, like spending no more than three hours in a casino or no more than five rounds of poker per visit.

**Tracking behaviour:** Tracking gambling behaviour can help individuals understand their spending and ensure that they stick within their limits. Research in the domain of investing shows that when expenses are salient and people are aware of their own financial status, they are less likely to chase losses (Heath, 1995). In this regard, a record of a gambler’s wins and losses or timely feedback on his financial status can help prevent excessive gambling.

**Impulse control:** People give into impulse partly due to their tendency to value immediate outcomes higher than delayed outcomes (Rachlin & Raineri, 1992). According to financial literacy research, recognizing this tendency is an important step to changing spending habits. Once aware, individuals can use the advantage of

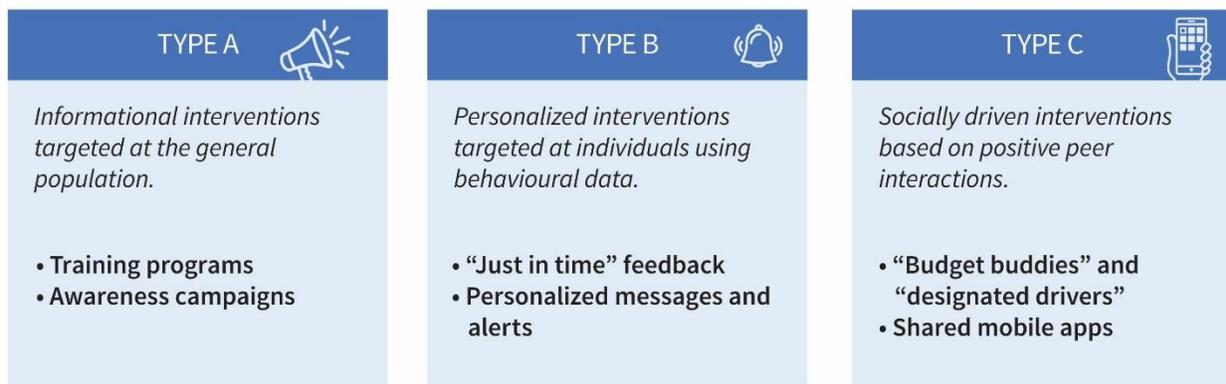
foresight to employ precommitment devices or peer influence to control their impulse at the moment of temptation. Some participants in our interviews were aware of the impulsive nature of gambling and worked toward controlling it – for instance, by having a “designated driver” in the group keep other members’ wallets or by actively avoiding the casino environment.

**Risk perception:** Difficulty assessing probability, erroneous perceptions about the chance nature of gambling games, and selective memory can play an important role in gambling persistence (Delfabbro & Winefield, 2000; Gaboury & Ladouceur, 1989). These beliefs appear to be common in both problem gamblers and responsible gamblers (Sevigny & Ladouceur, 2003). We characterize responsible gamblers as those who are relatively unbiased in assessing risks and probabilities of gambling games.

**Alternative seeking:** Another common judgment bias is underweighting or ignoring alternatives (McKenzie, 1998). This decision shortcut may lead gamblers to continue betting without considering alternative activities or outcomes, unless prompted to do so. Responsible gamblers are more likely to seek alternatives to receive the same enjoyment in gambling in less risky domains, such as in-house gambling or competitive sports. Seeking alternatives is a form of distraction from gambling.

From literacy programs and awareness campaigns to “just in time” feedback, there are many ways to encourage the behaviours listed above. Figure 9 illustrates three sets of interventions we propose to encourage responsible gambling.

Figure 9. Three sets of interventions



**Type A** interventions are targeted at the general population. They are often informational interventions that take the form of training programs and awareness campaigns (posters and labels) to educate and remind people of the consequences of problem gambling, as well as teach them practical skills on how to set limits and control impulses.

As with any informational intervention, it is important to think about the timing and delivery of the program. Given the high comorbidity rate between problem gambling and alcoholism (Zimmerman, Chelminski, & Young, 2006), we can imagine schools teaching gambling literacy or budgeting in parallel with substance abuse education. To increase engagement, the curriculum can use interactive games where students gamble with a hypothetical sum of money and track their performance. The activity will give students the opportunity to learn how gambling games work (i.e., their chance nature) and experience the process of tracking expenses and collecting feedback.

Other types of educational programs targeted at adults can take place online or in the workplace. As shown from the financial literacy trial by Drexler and Schoar (2014) in the Dominican Republic, it may be more practical to teach simple and easy ROTs instead of delving deep into statistics and probability concepts relevant to gambling.

For “just in time” information, we suggest messaging at the back of scratch tickets or in front of ATMs near the casinos (e.g., “Did you pay all your bills this month?”). We can also think about awareness posters that convey simple ROTs (e.g., “Don’t start at tables”) or debunk common myths about gambling (e.g., “Knowing someone who won a gamble does not increase your odds of winning”).

More generally, research in financial literacy shows that the way information is framed has a significant impact on influencing behaviour. As demonstrated in the study by Bertrand and Morse (2011), people find it easier to understand and interpret costs in dollar terms rather than rates. Given this finding, we can imagine labels in machines that display how much, on average, gamblers would need to spend on a game or lottery to win. Probabilities of winning are difficult to grasp, while the money spent to win is easier to understand.

**Type B** interventions use individuals’ behavioural data to influence gambling habits. They engage users by providing intelligent plans, “just in time” feedback and alerts, or tracking spending behaviour.

For instance, we can imagine a mobile app that sends “just in time” messages or alerts to help gamblers stick to their limits. In a study conducted by Stewart and Wohl (2012), 90% of the players who received a pop-up notification when they reached their preset spending limit stayed within their limit while playing slot machines. By contrast, only 43% of participants who did not receive a pop-up reminder stayed within their preset limits. Other apps can be used as a precommitment device with financial stakes (like the stickK app that automatically donates money if individuals fail to achieve a goal), or help visualize a gambler’s losses into more tangible items to increase the impact of the perceived loss (e.g., “You just lost the equivalent of a trip to New York”). One of the groups in the co-creation session also suggested that gamblers collect lottery or scratch tickets in a glass jar to visually grasp how much money they spent buying losing tickets over a time period.

So far, a key challenge in app-based interventions has been that many require manual input of behavioural data by individuals. If an app is user driven, it may seem like a chore and become obsolete. Now, with technological advances, apps can use location data to send reminders and warnings (like the app Splurge Alert that alerts users and their social circle when they enter “danger zones”), and others can employ gamification and other interactive techniques to engage users (e.g., competing with social groups on their wins and losses).

**Type C** interventions are socially driven. Positive peer interactions can encourage responsible gambling behaviour by increasing accountability and peer pressure on the individual. For example, a “designated driver” in the group can ensure that others stick to their limits by holding onto their wallets, and members of a social group can help others seek alternative activities to engage in rather than gambling.

We can also imagine self-help groups where people share their personal experiences of gambling, which will give an opportunity to hear from the vast majority of people who lost money gambling. Taking the approach used by Kast and colleagues (2012) in the trial to increase savings rates, the group can meet regularly to share their progress and hear about the progress of their peers. The group can also share and receive feedback by text message as motivation to continue spending responsibly.

Further, “just in time” involvement by peers is much easier due to advances in technology. For example, individuals can set their gambling limits using an app that others in their social group can “referee” (like in the app stickK). For family members who share banking accounts, we can imagine the gambler's spouse receiving text messages whenever money is withdrawn from an ATM close to a casino.

Table 3 shows a matrix of recommendations on how the three sets of interventions can encourage the five behaviours underlying responsible gambling.

Table 3. Recommendations to encourage responsible gambling behaviour

	Type A	Type B	Type C
Setting limits	Educational programs that teach budgeting. It may be more practical to teach simple and easy ROTs instead of lengthy conceptual-based education.	Using precommitment devices, individuals can set voluntary limits on gambling (e.g., time or money spent). With mobile apps that link to bank accounts, users can even set financial stakes to ensure they stick to a limit.	"Budget buddy" or "designated driver" who holds onto a gambler's wallet to ensure he sticks to his limit.
Tracking behaviour	Interactive educational activity to train people to make a habit of tracking financial expenses.	An app that tracks wins, losses, and betting fees. Visual feedback will let gamblers realize their financial status.  Collecting old lottery or scratch tickets in a glass jar.	A mobile app to track wins and losses among a social circle. Tracking becomes fun as friends compete for the best record.
Impulse control	"Just in time" prompts at cash withdrawal machines near casinos or at the back of lottery tickets. (e.g., "Did you pay your bills this month?")	"Just in time" text reminders when reaching a preset limit.  Preset timed alerts to distract users from gambling games.	Whenever an individual withdraws money from an ATM near a casino, the bank sends an alert to a spouse or a friend.
Risk perception	Awareness campaign debunking common biases of gambling. (e.g., "Knowing someone who won a gamble does not increase your odds of winning.")  Displaying how much, on average, gamblers would need to spend on the lottery or game to win, rather than the average probability of winning. Probabilities are difficult to grasp, while the money value is easier to understand.	An app that ask users to answer questions about probability while they are gambling. This is to keep the gambler in check so that he does not fall prey to erroneous beliefs about how gambles work.	Self-help groups or programs where members share their experiences of losing rather than winning.
Alternative seeking	A campaign encouraging alternative forms of entertainment. For example:  (1) Do you like the thrill? Have you tried competitive sports? (2) Do you like betting money? Host poker nights at home!  (3) Do you like social environments? How about a concert or a bowling night?	App that translates spending per visit to real opportunity costs. (e.g., "The \$500 you spent at the casino is equivalent to a trip to New York.")	Suggesting alternatives – like a home poker night – for families or social groups that go gambling together.

## 6. Discussion

The fact that context influences decision making is key to understanding human behaviour. The way choices are elicited – how options are framed, which features are highlighted, and whether a default exists – influences people's preferences (Tversky & Kahneman, 1981). Context also allows people to make judgments about options in relation to other offerings, as well as make inferences about social norms (Soman, 2015). In both gambling and financial decisions, we believe it is important to continue studying behaviour in different contexts.

The timing of interventions is a key component of context that is understudied in both financial literacy and behavioural sciences research. Previous findings suggest that “just in time” and “at location” interventions are more effective than educational programs years before the decision takes place (Fernandes et al., 2014). Yet, there is little research on exactly when is the best time to provide the reminder or text message alert in the context of financial and gambling decisions. Studies by Dai, Milkman, and Riis (2014) demonstrate that people's motivation to set and tackle goals increase after reaching temporal landmarks. We believe there needs to be more rigorous experimentation in this domain to find out when (e.g., weekdays vs. weekends, and mornings vs. afternoons) interventions are most effective.

A key element in any policy or program is measurement and evaluation. Currently there is no consensus in literature on if and under what conditions financial literacy programs or responsible gambling initiatives are cost effective. For instance, the opportunity to set voluntary limits on the amount of time and money players spend on gambling is widespread practice among gaming operators (Wood & Griffiths, 2010). Yet, there is not enough empirical research on whether these tools work, and under which conditions they are most effective (Auer & Griffiths, 2013). And given the many external factors that contribute to financial well-being, it has been difficult to draw causal inferences about the role of financial literacy in achieving better financial behaviours (Robson, 2012).

From a behavioural perspective, the best method to evaluate programs is through randomized controlled trials (RCTs) – an experimental design that randomly assigns participants to a treatment group (group that is given the intervention) or a control group (group without intervention). By keeping all other factors the same, we can tease out the effect of specific behavioural interventions on target outcomes by comparing the outcome of the treatment and control groups. As responsible gambling is still in the early stages of its evolution, knowledge derived from this method of evaluation can be useful in shaping the future of this domain.

We believe that behaviourally informed and well-executed interventions can have a positive impact on encouraging responsible gambling behaviour. But to design cost-effective programs, there needs to be more rigorous experimentation in the field to better understand what works and what does not work. In this regard, we propose a

research program that looks at some of the ideas presented in this report and tests them using multiple methods. Below is a typology of methods that can be used for testing, on a spectrum that goes from control (in a lab setting, experimenter can control all contextual variables) to realism (in the real world, experimenter has less control but is able to measure real human behaviour).

Figure 10. Typology of experiments



Adapted from *The last mile*, p. 131. Copyright 2015 by University of Toronto Press.

To conclude, the focus on seeking behaviourally informed solutions to improve financial well-being only came after the 2007–08 financial crisis. The crisis was a wake-up call to policymakers and organizations to critically evaluate the current state of financial literacy programs, which were not leading to desired financial behaviours and outcomes. In the gambling domain, there has not yet been a crisis. Instead of waiting for a crisis to happen before thinking about consumer-centric solutions, we believe that we can use behavioural insights and experimental techniques to prevent the majority of gamblers from reaching the “tipping point” that leads to problem gambling.

# References

- Adams, P. D. (2015). A tool to help you stickk to your goals. *P.Desmond Adams*. Retrieved from <http://pdesmondadams.com/a-tool-to-help-you-stickk-to-your-goals-ep-139/>
- Agarwal, S., Driscoll, J., Gabaix, X., & Laibson, D. (2011). *Learning in the credit card market*. Working Paper, Harvard University.
- Ainslie, G., & Haslam, N. (1992). Hyperbolic discounting. In G. Loewenstein & J. Elster (Eds.), *Choice over time* (pp.57–92). New York: Russell Sage Press.
- Allais, M. (1953). Le comportement de l'homme rationnel devant le risque: Critique des postulats et axiomes de l'ecole americaine. *Econometrica*, 21(4), 503–546.
- Allais, M. (1997). An outline of my main contributions to economic science. *The American Economic Review*, 87(6), 3–12.
- Ashraf, N., Karlan, D., & Yin, W. (2006). Tying Odysseus to the mast: Evidence from a commitment savings product in the Philippines. *Quarterly Journal of Economics*, 121(2), 673–697.
- Auer, M., & Griffiths, M. D. (2013). Voluntary limit setting and player choice in most intense online gamblers: An empirical study of gambling behaviour. *Journal of Gambling Studies*, 29(4), 647–660.
- Benartzi, S. (2015). *The smarter screen: Surprising ways to influence and improve online behavior*. New York: Portfolio/Penguin.
- Benartzi, S., & Thaler, R. H. (2004). Save more tomorrow: Using behavioral economics to increase employee savings. *Journal of Political Economy*, 112(1), S164–S187.
- Bernheim, B. D., & Garrett, D. M. (2003). The effects of financial education in the workplace: Evidence from a survey of households. *Journal of Public Economics*, 87, 1487–1519.
- Bertrand, M., & Morse, A. (2011). Information disclosure, cognitive biases, and payday borrowing. *The Journal of Finance*, 66, 1865–1893.
- Beyth-Marom, R., & Fischhoff, B. (1983). Diagnosticity and pseudodiagnosticity. *Journal of Personality and Social Psychology*, 45, 88–110.
- Board of Governors of the Federal Reserve System. (2014). *Consumers and mobile financial services*. [PDF document]. Retrieved from <https://www.federalreserve.gov/econresdata/consumers-and-mobile-financial-services-report-201403.pdf>
- Braunstein, S., & Welch, C. (2002). Financial literacy: An overview of practice, research, and policy. *Federal Reserve Bulletin*, 445–448.
- Brockner, J., Shaw, M. C., & Rubin, J. Z. (1979). Factors affective withdrawal from an escalating conflict: Quitting before it's too late. *Journal of Experimental Social Psychology*, 15, 492–503.
- Campbell, J. Y., Jackson, H., Madrian, B. C., & Tufano, P. (2010). The regulation of consumer financial products: An introductory essay with four case studies. HKS Faculty Research Working Paper Series. Retrieved from <https://dash.harvard.edu/handle/1/4450128>
- Dai, H., Milkman, K. L., & Riis, J. (2014). The fresh start effect: Temporal landmarks motivate aspirational behavior. *Management Science*, 60, 2563–2582.

- de Bruin, W. B., Fischhoff, B., Millstein, S. G., & Halpern-Felsher, B. L. (2000). Verbal and numerical expressions of probability: "It's a fifty-fifty chance." *Organizational Behavior and Human Decision Processes*, 81 (January), 115–131.
- Delfabbro, P. H., & Winefield, A. H. (2000). Predictors of irrational thinking in regular slot machine gamblers. *Journal of Psychology*, 134, 117–128.
- Deonandan, R., & Backwell, A. (2011). Driving deaths and injuries post-9/11. *International Journal of General Medicine*, 4, 803–807.
- Drexler, A., Fischer, G., & Schoar, A. (2014). Keeping it simple: Financial literacy and rules of thumb. *American Economic Journal: Applied Economics*, 6(2), 1–31.
- Eisenstein, E. (2006). Psychological processes in financial decision-making: A consumer perspective. In C. Pechmann & L. Price (Eds.), *NA – Advances in consumer research volume 33* (pp. 403–406). Duluth, MN: Association for Consumer Research.
- Ellsberg, D. (1961). Risk, ambiguity, and the Savage axioms. *The Quarterly Journal of Economics*, 75(4), 643–669.
- Elster, J. (1979). *Ulysses and the Sirens: Studies in rationality and irrationality*. Cambridge, U.K.: Cambridge University Press.
- Fernandes, D., Lynch, J. G., & Netemeyer, R. G. (2014). Financial literacy, financial education, and downstream financial behaviors. *Management Science*, 60(8), 1861–1883.
- Financial Consumer Agency of Canada. (2015). *Financial literacy background*. Retrieved from <http://www.fcac-acfc.gc.ca/Eng/financialLiteracy/financialLiteracyCanada/Pages/Background-Historique.aspx>
- Fischhoff, B., & de Bruin, W. B. (1999). Fifty-fifty = 50%? *Journal of Behavioral Decision Making*, 12(June), 149–163
- Frederick, S., Loewenstein, G., & O'Donoghue, T. (2002). Time discounting and time preference: A critical review. *Journal of Economic Literature*, 40, 351–401.
- Friedman, M. (1953). *Essays in positive economics*. Chicago: University of Chicago Press.
- Gaboury, A., & Ladouceur, R. (1989). Erroneous perceptions and gambling. *Journal of Social Behavior and Personality*, 4, 411–420.
- Gelder, J. L., Hershfield, H. E., & Nordgren, L. F. (2013). Vividness of the future self predicts delinquency. *Psychological Science*, 24(6), 974–980.
- Hastings, J. S., Madrian, B. C., & Skimmyhorn, W. L. (2013). Financial literacy, financial education, and economic outcomes. *The Annual Review of Economics*, 5, 347–373.
- Hausman, J. (1979). Individual discount rates and the purchase and utilization of energy-using durables. *Bell Journal of Economics*, 10(1), 33–54.
- Heath, C. (1995). Escalation and de-escalation of commitment in response to sunk costs: The role of budgeting in mental accounting. *Organizational Behavior and Human Decision Processes*, 62(1), 38–54.
- Herrnstein, R. J. (1990). Rational choice theory: Necessary but not sufficient. *American Psychologist*, 45(3), 356–367.
- Herrnstein, R. J., Loewenstein, G. F., Prelec, D., & Vaughan, W. (1993). Utility maximization and melioration: Internalities in individual choice. *Journal of Behavioral Decision Making*, 6, 149–185.

- Herrnstein, R. J., & Prelec, D. (1991). Melioration: A theory of distributed choice. *Journal of Economic Perspectives*, 5(3), 137–156.
- Herrnstein, R. J., & Prelec, D. (1992). A theory of addiction. In G. Loewenstein & J. Elster (Eds.), *Choice over time* (pp. 331-360). New York: Russell Sage Press.
- Herrnstein, R. J., & Vaughan, W. (1980). Melioration and behavioral allocation. In J. E. R. Staddon (Ed.), *Limits to action: The allocation of individual behavior* (pp. 143–175). New York: Academic Press.
- Hershfield, H., Goldstein, D., Sharpe, W., Fox, J., Yeykelis, L., Carstensen, L., & Bailenson, J. (2011). Increasing saving behavior through age-progressed renderings of the future self. *Journal of Marketing Research*, 48(SPL), S23–S37.
- Hirad, A., & Zorn, P. M. (2001). *A little knowledge is a good thing: Empirical evidence of the effectiveness of pre-purchase homeownership counseling*. [PDF document]. Low-Income Homeownership Working Paper Series. Retrieved from <http://www.jchs.harvard.edu/sites/jchs.harvard.edu/files/liho01-4.pdf>
- Hodgins, D. C. (2005). Implications of a brief intervention trial for problem gambling for future outcome research. *Journal of Gambling Studies*, 21(1), 13–19.
- Hogarth, J. M., Hilgert, M. A., & Schuchardt, J. (2002). Money managers: The good, the bad, and the lost. *Proceedings of the Association of Financial Counselling and Planning Education*, 12–23.
- IMFR LEAD. (n.d.). *Evidence in financial inclusion: New findings and their applications*. [PDF document]. Retrieved from [https://www.poverty-action.org/sites/default/files/Session%202-Financial%20Education-Rules%20of%20Thumb%20\(John%20Arun\).pdf](https://www.poverty-action.org/sites/default/files/Session%202-Financial%20Education-Rules%20of%20Thumb%20(John%20Arun).pdf)
- Kahneman, D. (2011). *Thinking, fast and slow*. New York: Farrar, Straus and Giroux.
- Karlan, D., McConnell, M., Mullainathan, S., & Zinman, J. (2010). Getting to the top of mind: How reminders increase savings. *The National Bureau of Economic Research*. Retrieved from <http://www.nber.org/papers/w16205>
- Kast, F., Meier S., & Pomeranz, D. (2012). *Under-savers anonymous: Evidence on self-help groups and peer pressure as a savings commitment device*. Harvard Business School Working Paper No.12-060, Boston, MA.
- Kim, J., Kratzer, C. Y., & Leech, I. E. (2001). Impacts of workplace financial education on retirement plans. In J. M. Hogarth (Ed.), *Proceedings of the 2001 annual conference of the association of financial counseling and planning education* (pp. 62-69).
- Kirby, K. N., & Herrnstein, R. J. (1995). Preference reversals due to myopic discounting of delayed reward. *Psychological Science*, 6(2), 83–89.
- Kunda, Z. (1990). The case for motivated reasoning. *Psychological Bulletin*, 108, 480–498.
- Langer, E. J. (1975). The illusion of control. *Journal of Personality and Social Psychology*, 32, 445–459.
- Langer, E. J., & Roth, J. (1975). Heads I win, tails it's chance: The illusion of control as a function of the sequence of outcomes in a purely chance task. *Journal of Personality and Social Psychology*, 32(6), 951–955.
- Leonard, C. A., Williams, R. J., & Vokey, J. (2015). Gambling fallacies: What are they and how are they best measured? *Journal of Addiction Research & Therapy*, 6(4). doi:10.4172/2155-6105.1000256

- Levesque, B., Godfrey, N., & Miller, M. (2009). The case for financial literacy in developing countries. *The World Bank*. Retrieved from [https://www.globalbrigades.org/media/Financial\\_Literacy.pdf](https://www.globalbrigades.org/media/Financial_Literacy.pdf)
- Levi, Y., & Benartzi, S. (2014). Economic behavior in the digital age. Working Paper, UCLA.
- Levitt, S. D. (2008). StickK to your commitments. *Freakonomics*. Retrieved from <http://freakonomics.com/2008/01/21/stickk-to-your-commitments/>
- Loewenstein, G., & Thaler, R. H. (1989). Anomalies: Intertemporal choice. *Journal of Economic Perspectives*, 3(4), 181–193.
- Lord, C. G., Lepper, M., & Preston, E. (1984). Considering the opposite: A corrective strategy for social judgment. *Journal of Personality and Social Psychology*, 47, 1231–1243.
- Lostutter, T. W., Lewis, M. A., Cronce, J. M., Neighbors, C., & Larimer, M. E. (2014). The use of protective behaviors in relation to gambling among college students. *Journal of Gambling Studies*, 30(1), 27–46.
- Lusardi, A., & Mitchell, O. S. (2006). Financial literacy and planning: Implications for retirement wellbeing. Working Paper, Dartmouth College, Hanover, NH; and University of Pennsylvania, Philadelphia.
- Lusardi, A., & Mitchell, O. S. (2007). Baby boomer retirement security: The role of planning, financial literacy, and housing wealth. *Journal of Monetary Economics*, 54, 205–224.
- Lynch, J. G., & Wood, W. (2006). Special issue editors' statement: Helping consumers help themselves. *Journal of Public Policy and Marketing*, 25(1), 1–7.
- Lyons, A. C., Palmer, L., Jayaratne, S. U., & Scherpf, E. (2006). Are we making the grade? A national overview of financial education and program evaluation. *The Journal of Consumer Affairs*, 40(2), 208–235.
- Lyons, J., Weeks, D. J., & Elliot, D. (2013). The gambler's fallacy: A basic inhibitory process? *Frontiers in Psychology*, 4(72). doi:10.3389/fpsyg.2013.00072
- Mandell, L. (2008). Financial literacy of high school students. In J. J. Xiao (Ed.), *Handbook of consumer finance research* (pp. 163–184). New York: Springer.
- Mandell, L. (2012). Proposal: To minimize devastating financial mistakes, focus financial education at the point of sale. *Global Economic Symposium*. Retrieved from <http://www.global-economic-symposium.org/knowledgebase/the-global-economy/improving-financial-education-and-literacy/proposals/to-minimize-devastating-financial-mistakes-focus-financial-education-at-the-point-of-sale>
- Markman, A. B., & Douglas, L. M. (2002). Decision making. In D. L. Medin & H. Pashler (Eds.), *Stevens' handbook of experimental psychology: Vol. 2 Memory and cognitive processes* (3rd ed., pp. 413–414). New York: John Wiley & Sons. Retrieved from [http://liberalarts.utexas.edu/\\_files/markman/decisionmaking.pdf](http://liberalarts.utexas.edu/_files/markman/decisionmaking.pdf)
- Matthews, G. (2015). *Goals research summary*. [PDF document]. Retrieved from <http://www.dominican.edu/academics/ahss/undergraduate-programs/psych/faculty/assets-gail-matthews/researchsummary2.pdf>
- Mazur, J. E. (1987). An adjustment procedure for studying delayed reinforcement. In M. L. Commons, J. E. Mazur, J. A. Nevin, & H. Rachlin (Eds.), *The effect of delayed and intervening events on reinforcement value*. Hillsdale, NJ: Erlbaum.
- McKenzie, C. R. M. (1998). Taking into account the strength of an alternative hypothesis. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 24, 771–792.

- McMahon, T. (2013). Doubling down on casinos. *Maclean's*. Retrieved from <http://www.macleans.ca/economy/business/doubling-down-2/>
- McNeil B. J., Pauker S. G., Sox, H. C., & Tversky, A. (1982). On the elicitation of preferences for alternative therapies. *New England Journal of Medicine*, 306, 1259–1262.
- Mellers, B., Stone, E., Murray, T., Minster, A., Rohrbaugh, N., Bishop, M., Chen, E. . . Tetlock, P. (2015). Identifying and cultivating superforecasters as a method of improving probabilistic predictions. *Perspectives on Psychological Science*, 10(3), 267–281.
- Mullainathan, S., & Safir, E. (2013). *Scarcity: Why having too little means so much*. New York: Times Books.
- Organisation for Economic Cooperation and Development [OECD]. (2009). Financial education and the crisis: Policy paper and guidance. OECD. Retrieved from <http://www.oecd.org/finance/financial-education/50264221.pdf>
- Payne, J. W., Bettman, J. R., & Johnson, E. J. (1988). Adaptive strategy selection in decision making. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 14, 534–553.
- Petry, N. M. (2005). Substance abuse, pathological gambling, and impulsiveness. *Drug & Alcohol Dependence*, 63(1), 29–38.
- Rachlin, H., & Green, L. (1972). Commitment, choice and self-control. *Journal of the Experimental Analysis of Behavior*, 17(1), 15–22. doi:10.1901/jeab.1972.17-15
- Rachlin, H., & Raineri, A. (1992). Irrationality, impulsiveness, and selfishness as discount reversal effects. In G. Loewenstein & J. Elster (Eds.), *Choice over time* (pp.93–118). New York: The Russell Sage Foundation.
- Responsible Gambling Council [RGC]. (2014). *Canadian gambling digest 2012–2013*. [PDF document]. Retrieved from [http://www.responsiblegambling.org/docs/default-source/default-document-library/20140725\\_canadian\\_gambling\\_digest\\_2012-13.pdf?Status=Temp&sfvrsn=2](http://www.responsiblegambling.org/docs/default-source/default-document-library/20140725_canadian_gambling_digest_2012-13.pdf?Status=Temp&sfvrsn=2)
- Reyna, V. F., & Brainerd, C. J. (2008). Numeracy, ratio bias, and denominator neglect in judgments of risk and probability. *Learning and Individual Differences*, 18(1), 89–107.
- Robson, J. (2012). *The case for financial literacy*. [PDF document]. Retrieved from <http://prospercanada.org/getattachment/bd2fbe0e-9647-4377-9df6-8cfe3c0cc9f9/The-Case-for-Financial-Literacy.aspx>
- Samuelson, D. (1937). A note on the measurement of utility. *Review of Economic Studies*, 4, 155–161
- Savage, L. J. (1954). *The foundations of statistics*. New York: Wiley.
- Schelling, T. C. (1992). Self-command: A new discipline. In G. Loewenstein & J. Elster (Eds.), *Choice over time* (pp. 167–177). New York: Russell Sage Press.
- Schoar, A., & Datta, S. (2014). *The power of heuristics*. [PDF document]. Retrieved from [http://www.ideas42.org/wp-content/uploads/2015/05/ideas42\\_The-Power-of-Heuristics-2014-1.pdf](http://www.ideas42.org/wp-content/uploads/2015/05/ideas42_The-Power-of-Heuristics-2014-1.pdf)
- Schweitzer, S. (2008). A web contract for personal goals. *The Boston Globe*. Retrieved from [http://archive.boston.com/news/local/articles/2008/04/15/a\\_web\\_contract\\_for\\_personal\\_goals/](http://archive.boston.com/news/local/articles/2008/04/15/a_web_contract_for_personal_goals/)
- Sevigny, S., & Ladouceur, R. (2003). Gamblers' irrational thinking about chance events: The 'double switching' concept. *International Gambling Studies*, 3(2), 149–161.

- Shefrin, H. M., & Thaler, R. H. (1992). Mental accounting, saving, and self-control. Self-command: A new discipline. In G. Loewenstein & J. Elster (Eds.), *Choice over time* (pp. 287–329). New York: Russell Sage Press.
- Sherman, J. (2016). This app warns you and your friends when you're on the verge of a splurge. *Digital Trends*. Retrieved from <http://www.digitaltrends.com/mobile/ally-splurge-alert-app/>
- Slovic, P., & Fischhoff, B. (1977). On the psychology of experimental surprises. *Journal of Experimental Psychology: Human Perception and Performance*, 3, 544–551.
- Soman, D. (2011). *The trouble with consumer credit: Literacy considerations and policy implications*. Research paper prepared for the Task Force on Financial Literacy. Retrieved from <http://www.financialliteracyinCanada.com/documents/consultation-2/Soman-09-02-2011-eng.pdf>
- Soman, D. (2015). *The last mile: Creating social and economic value from behavioural insights*. Toronto: University of Toronto Press.
- Stewart, M. J., & Wohl, M. J. A. (2012). Pop-up messages, dissociation, and craving: How monetary limit reminders facilitate adherence in a session of slot machine gambling. *Psychology of Addictive Behaviors*. Advance online publication. doi:10.1037/a0029882
- Strotz, R. H. (1955). Myopia and inconsistency in dynamic utility maximization. *Review of Economic Studies*, 23(2), 165–180.
- Task Force on Financial Literacy. (2010). *Canadians and their money: Building a brighter future*. [PDF document]. Retrieved from <http://www.edugains.ca/resourcesFL/Background/CanadiansAndTheirMoney-2011.pdf>
- Tetlock, P. E. (2005). *Expert political judgment: How good is it? How can we know?* Princeton, NJ: Princeton University Press.
- Tetlock, P. E., & Gardner, D. (2015). *Superforecasting: The art and science of prediction*. New York: Crown Publishers.
- Thaler, R. H. (1981). Some empirical evidence on dynamic inconsistency. *Economic Letters*, 8, 201–207.
- Thaler, R. H., & Shefrin, H. M. (1981). An economic theory of self-control. *Journal of Political Economy*, 89(2), 392–406.
- Thaler, R. H., & Sunstein, C. (2008). *Nudge: Improving decisions about health, wealth, and happiness*. New York: Penguin Books.
- The Department of the Treasury. (2008). *President's advisory council on financial literacy*. [PDF document]. Retrieved from [http://jumpstart.org/assets/files/PACFL\\_ANNUAL\\_REPORT\\_1-16-09.pdf](http://jumpstart.org/assets/files/PACFL_ANNUAL_REPORT_1-16-09.pdf)
- Thompson, L., Gentner, D., & Loewenstein, J. (2000). Avoiding missed opportunities in managerial life: Analogical training more powerful than individual case training. *Organizational Behavior and Human Decision Processes*, 82(1), 60–75.
- Tompson, S. (2016). Splurge alert app may stop you from buying smoothie. *Detroit Free Press*. Retrieved from <http://www.freep.com/story/money/personal-finance/susan-tompson/2016/04/20/ally-financial-splurge-alert-millennials/83193488/>
- Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science*, 185, 1124–1131.

- Tversky, A., & Kahneman, D. (1981). The framing of decisions and the psychology of choice. *Science*, 185, 1124-1131.
- Tversky, A., & Kahneman, D. (1983). Extension versus intuitive reasoning: The conjunction fallacy in probability judgment. *Psychological Review*, 90(4), 293–315.
- Tversky, A., & Kahneman, D. (1986). Rational choice and the framing of decisions. *The Journal of Business*, 59(4), S251–S278.
- Williams, R. J., & Wood, R. T. (2007). The proportion of Ontario gambling revenue derived from problem gamblers. *Canadian Public Policy/Analyse de Politiques*, 33(3), 367–387.
- Wolford, G., Miller, M. B., & Gazzaniga, M. (2000). The left hemisphere's role in hypothesis formation. *The Journal of Neuroscience*, 20, 1–4.
- U.S. Department of Transportation. Federal Highway Administration. Table: Estimated individual monthly motor vehicle travel in the United States. Retrieved from <http://www.fhwa.dot.gov/ohim/tvtw/02dectvt/table1.htm>
- Wood, R. T., & Griffiths, M. D. (2010). Social responsibility in online gambling: Voluntary limit setting. *World Online Gaming Law Report*, 9(11), 10–11.
- Wood, R. T., & Williams, R. J. (2009). *Internet gambling: Prevalence, patterns, problems, and policy options*. Final report for the Ontario Problem Gambling Research Centre, Guelph, Ontario.
- Zimmerman, M., Chelminski, I., & Young, D. (2006). Prevalence and diagnostic correlates of DSM-IV pathological gambling in psychiatric outpatients. *Journal of Gambling Studies*, 22, 255–262.