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Fighting instinct: The Brain, Emotions and Decision-making in the Water

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Abstract

This conceptual paper explores the complex interplay among the human brain, emotions, and decision-making processes, particularly in aquatic environments. Integrating insights from neuroscience, psychology, and behavioural economics, we investigate how instinctual responses and emotional states influence our decisions during water-related activities. By analysing both biological and psychological factors, the paper aims to illuminate the intricacies of human behaviour in various aquatic settings and highlights significant gaps in the research on emotional decision-making that warrant further investigation. Additionally, the paper suggests interventions, including plausible communication strategies, to mitigate the impact of instinctual responses and improve safety and decision-making efficiency.

Keywords: instinct, decision-making, emotions, aquatic environments, psychology, behavioural economics, interventions

Introduction

The allure of water, an ubiquitous element in human experience, evokes a profound physiological response deeply ingrained in our biology. As many have observed, proximity to water often triggers a parasympathetic response, signalling the body to enter a state of rest and digest. This phenomenon is characterized by a reduction in heart rate and blood pressure, accompanied by a sense of relaxation and tranquillity (Nichols, 2018). It is no wonder that individuals who frequently engage in water-related activities find solace and joy in these aquatic environments, where the very presence of water symbolizes freedom and liberation (Nichols, 2018). Despite the allure of the water and what is seemingly good for us, the water can also be a dangerous place, since accidental deaths from drowning are a major public health issue.

This paradoxical juxtaposition arises when attempting to convey safety messages or warnings in such settings. Despite the inherent dangers, communicating risk factors associated with water often encounters resistance, as it seems to contradict the sense of freedom and optimism bias associated with aquatic environments (Mayer, 2019). This resistance can be attributed to the dominance of emotional decision-making processes, known as *system 1* thinking (Kahneman, 2011), which could govern human behaviour when immersed in water-centric contexts. In this state, individuals are guided primarily by instinct and emotion rather than rational analysis or logical deliberation (Damasio, 2006).

Recognizing the challenge posed by emotional decision-making in water safety communication, leading organizations like the Royal National Lifeboat Institution (RNLI) in the UK have endeavoured to employ rational messaging strategies, such as the 'Float to Live' campaign, aimed at promoting the life-saving floating position during emergencies (RNLI, 2020). The efficacy of such strategies hinges on the individual's ability to engage in *system 2 thinking*—characterized by rationality and logic—rather than succumbing to emotional impulses (Evans, 2008).

This conceptual paper embarks on an exploration of the intricate interplay among the human brain, emotions, and decision-making processes within diverse water-related environments and activities. Drawing upon insights from neuroscience, psychology, and communication studies, it seeks to elucidate novel interventions and communication strategies designed to bolster safety awareness and enhance decision-making capabilities in aquatic settings. By understanding the nuances of human cognition and emotion in relation to water, the paper endeavours to pave the way for further research into more effective and adaptive approaches to water safety communication.

Literature Background

Understanding Human Behaviour in Aquatic Environments

Understanding human behaviour in aquatic environments holds significant importance, as underscored by the National Water Safety Forum (NWSF). In the UK, drowning incidents surpass the annual toll of accidental deaths from home fires or cycling accidents on roads (WAID, 2023). Statistics reveal an average of 300 accidental drowning deaths annually across coastal and inland water in the UK, alongside numerous near-fatal incidents resulting in profound and lasting consequences, such as brain injuries induced by oxygen deprivation and post-traumatic stress disorder (PTSD). According to The Royal Society for the prevention of Accidents (RoSPA, 2024), reportedly over 100,000 water-related rescues occur annually, placing a huge burden on families and society.

The economic ramifications of such fatalities are substantial, with an estimated cost of £2 million per fatality, using the current value of prevented fatality (VPF) used by the Department for Transport (DfT) in the UK at 2018 prices and is based on a stated preference study conducted in the 1990s, which elicited individuals' to reduce their risk of death and injury from road traffic accidents (Carthy et al., 1998). Additionally, according to the Maritime Coastguard Agency (MCGA) search and rescue costs are significant, potentially running into tens of thousands of pounds per incident. RNLI (2022) estimates that £188 million is spent annually on running the UK rescue response in addition to the onward costs of morbidities and co-morbidities. Indeed, life-changing injuries have a substantial impact both personally and financially. Each death is estimated directly to adversely affect the wellbeing of 20 family and acquaintances.

Additionally, the World Health Organization (WHO) in 2014 reported and recommended that every country should have a national water safety and drowning prevention plan. In response, the NWSF created a UK drowning prevention strategy in 2016, setting out a clear multi-sector framework in collaboration with organizations such as the RNLI, RLSS, MCGA, and RoSPA. One of the key strategic themes of the strategy was to prioritize drowning prevention activities, such as improving understanding of behaviours to design relevant behaviour change messaging aimed at reducing drowning fatalities by 50% by 2026. Globally, males are 80% more likely to drown than females, specifically middle-aged men, and teenage boys (WHO, 2014). Men are more often found in the water and exhibit riskier behaviours, such as swimming alone and at night, consuming alcohol, and neglecting to wear life jackets. Research also suggests that the increase in male drowning is due to social pressures and underestimation of risk (Hamilton et al., 2018). Occupationally men are more likely to work on or near water, leading them to contribute a substantially higher proportion of drowning fatalities compared to females (Hills et al., 2021). Therefore, research and evidence suggest the need to focus on understanding the drivers of human behaviour, specifically among men, in aquatic environments.

The Concept of Instinct and Its Role in Human Decision-Making

The concept of instinct has captivated scholars across diverse disciplines, ranging from psychology and neuroscience to evolutionary biology and philosophy. Instinct, often characterized as innate, automatic, and unlearned behaviour that emerges in response to specific stimuli, has been recognized for its profound influence on human decision-making processes (Balcombe, 2011; Lorenz, 1950; Tinbergen, 1951).

Instinct plays a fundamental role in shaping human behaviour, guiding individuals' responses to various environmental cues and challenges. Nowhere is this more obvious than in situations of danger or hazard, such as in the water. For example, if we hit cold water unexpectedly our instinct kicks in and triggers various responses, including heightened alertness, increased adrenaline levels, and automatic physiological reactions geared towards survival, like holding our breath, fighting to stay afloat and uncontrollable gasping (Barwood et al., 2013). We also use our instinct to respond to entering the water for a swim or a paddle on a hot day to cool down.

Furthermore, instinct plays a role in guiding individual choices (not just responses), such as the decision not to wear a life jacket before engaging in water activities because the water appears calm and inviting, leading one's instinct to signal that it is safe (Gigerenzer, 2008). Situations such as these can mean that relying on instinct can anchor flawed decision-making and lead to dangerous consequences. For example, one might be fooled into thinking a canal is shallow and safe, whereas they tend to be deeper and colder, harbouring hazards such as submerged objects and reeds (Canal and River Trust, 2024)

Research has also shown that automatic gut feelings could be particularly useful in high-stakes environments. For example, experienced firefighters and emergency responders often rely on their intuitions, honed through years of experience and exposure, to make split-second decisions that can save lives (Klein, 1998). Similarly, in the financial sector, traders sometimes use their gut feelings to make investment decisions, especially when markets are volatile and data is rapidly changing (Lo et al., 2005).

Theoretical Perspectives on Instinct

Historically, instinct has been a central concept in understanding human behaviour, dating back to the early works of psychologists such as William James and Sigmund Freud (Freud, 1920; James, 1890). James proposed that instinctual behaviour arises from innate biological drives, whereas Freud emphasized the role of unconscious instincts, particularly libido and aggression, in motivating human actions. These early theories laid the groundwork for subsequent research on instinct and decision-making.

In contemporary psychology, evolutionary theories of instinct have gained prominence, drawing on the principles of natural selection and adaptation (Darwin, 1859). According to evolutionary psychologists like E.O. Wilson and Steven Pinker, instinctual behaviours evolved over time to enhance survival and reproductive fitness in ancestral environments (Wilson, 1975; Pinker, 2002). This perspective emphasizes the genetic basis of instinct and its adaptive function in guiding human behaviour. Examples include the fear response, which aids in avoiding threats like predators; parental care instincts, ensuring offspring survival; mate selection preferences for traits indicating reproductive fitness; social bonding instincts, fostering cooperation and support networks; and food preferences favouring energy-rich foods. These instincts, shaped by our ancestors' environments, persist in modern humans, guiding behaviour to maximize genetic fitness. Understanding these instinctual underpinnings sheds light on various aspects of human behaviour, highlighting the adaptive functions that they serve.

Theoretical perspectives on instinctual differences between men and women have also been explored within evolutionary psychology and socio-biology. Evolutionary psychologists argue that gender-specific instincts evolved as adaptive responses to ancestral environments, shaping behavioural tendencies related to mating, parental investment, and resource acquisition (Buss, 1995; Eagly & Wood, 1999). Sociobiological perspectives, as exemplified by Trivers (1972) and Wilson (1975), suggest that biological imperatives shape gender-specific instincts, leading to divergent reproductive strategies influenced by evolutionary pressures. These frameworks provide insights into the origins of gender-specific instincts and their implications for human behaviour and decision-making. While research on instinctual patterns in water-related activities based on gender is limited, broader findings, such as men being more likely to drown than women (WHO, 2014), hint at potential gender differences in instinctual behaviours even in such contexts.

Evolutionary psychology posits that gender-specific behavioural tendencies, shaped by evolutionary pressures, may influence individuals' actions in water-related scenarios. For instance, men's predisposition towards risk-taking behaviour can be attributed to their ancestral roles as hunters and protectors (Geary, 2010). Conversely, women, historically responsible for childcare and nurturing, may prioritize precautionary measures in such contexts. This division of labour is believed to have originated from the differing reproductive strategies of our ancestors (Trivers, 1972), where men typically competed for mates while women invested more in offspring care (Buss, 2016). Thus, these evolved behavioural inclinations could manifest in contemporary scenarios such as swimming, with men often displaying more adventurous tendencies showing off their heroism, while women exhibit a greater inclination towards safety and risk avoidance.

Another perspective, less centred on gender, is the dual-process model proposed by Kahneman (2011). This model distinguishes between instinctual, fast, and automatic *System 1* processes and deliberative, slow, and effortful *System 2* processes in decision-making. For instance, when confronted with a sudden danger like a fire alarm, *System 1* kicks in automatically, prompting immediate action without conscious thought. On the other hand, when making a complex financial investment, *System 2* engages, requiring careful analysis and deliberation. Kahneman's framework acknowledges the interplay between these automatic and controlled cognitive processes in shaping human choices. This dual-process model is particularly relevant to this research because it recognises how both instinctual reactions and rational decision-making processes could form part of human choices and how those choices could be influenced by strategies or communication interventions.

Empirical Evidence on Instinct and Decision-Making

Empirical research on instinct and decision-making has yielded mixed findings, reflecting the complexity of human behaviour and the multifaceted nature of decision processes. Studies investigating instinctual responses to threat stimuli, such as fear or danger, have demonstrated the role of evolutionary instincts, such as the fight-or-flight response, in shaping rapid decision-making under duress (LeDoux, 2012). Furthermore, neuroscientific studies employing techniques such as functional magnetic resonance imaging (fMRI) and electroencephalography (EEG) have provided insights into the neural mechanisms underlying instinctual behaviours. For example, research on the amygdala, a brain region implicated in processing emotions and threat detection, has linked instinctual fear responses to amygdala activation, highlighting the neural basis of instinct-driven decision-making (Davis & Whalen, 2001).

Despite its conceptual and empirical contributions, the concept of instinct has faced critiques and controversies within the scientific community. One critique pertains to the ambiguity and imprecision of the term "instinct" which lacks a clear definition and may encompass a wide range of behaviours with varying degrees of biological determinism (Tinbergen, 1951). Additionally, critics have argued that instinctual explanations of human behaviour may oversimplify complex psychological phenomena and neglect the role of learning, culture, and individual differences in shaping decision-making processes. The deterministic view of instinct as innate and immutable may undermine the agency and autonomy of individuals, overlooking the capacity for cognitive control and rational deliberation in decision-making (Haselton & Nettle, 2006).

The introduction to the concept of instinct and its role in decision-making represents a rich and multifaceted area of inquiry within psychology and related disciplines. While theoretical perspectives on instinct have evolved, from early Freudian notions to contemporary evolutionary theories, empirical research has provided valuable insights into the neural and behavioural correlates of instinctual behaviours.

Critiques surrounding the ambiguity of the term "instinct" and its deterministic implications underscore the need for caution in applying instinctual explanations to human decision-making. Future research should aim to integrate insights from multiple disciplines, including psychology, neuroscience, anthropology, and sociology, to develop a nuanced understanding of instinct and its interplay with cognition, emotion, and culture in shaping human behaviour. By addressing these challenges, scholars can advance knowledge of instinct and decision-making, shedding light on fundamental aspects of human nature and behaviour, to situations of high risk such as in the water.

Fear and Survival Instincts in the Brain

While numerous studies have contributed to our understanding of the neural mechanisms underlying fear processing and survival instincts, there are some limitations and gaps in the existing literature. Firstly, many studies focus on localized brain regions implicated in fear processing, such as the amygdala, hippocampus, and prefrontal cortex (LeDoux, 2000; Phelps & LeDoux, 2005). While these regions undoubtedly play crucial roles, the brain operates as a complex network, and interactions between multiple regions are likely involved in modulating fear responses and survival instincts. Thus, a more comprehensive approach that considers the connectivity and functional integration of these brain regions may provide a more nuanced understanding of fear processing.

Additionally, much of the existing research has been conducted in animal models, particularly rodents, which may not fully capture the complexity of human fear responses (Fanselow & Pennington, 2018). Translating findings from animal studies to humans requires careful consideration of species differences and the relevance of experimental paradigms to human fear processing.

Furthermore, there is a need for more studies that investigate individual differences in fear processing and survival instincts. Factors such as genetics, early life experiences, and psychopathology can significantly influence how the brain responds to fear-inducing stimuli (Davis et al., 2010). Incorporating individual differences into research designs can enhance our understanding of the heterogeneity of fear responses and inform personalized interventions for anxiety-related disorders.

The impact of fear and instinctual responses on decision-making in aquatic environments has significant implications for water safety and accident prevention. Fear, as an adaptive emotion, serves to alert individuals to potential threats and dangers in their surroundings (LeDoux, 2012). In aquatic settings, fear responses can be triggered by various factors, including the perception of danger, unexpected events, or perceived inability to cope with water-related challenges such as rip currents.

Fear responses often lead to instinctual reactions aimed at self-preservation, such as the fight-or-flight response. In water environments, individuals may instinctively attempt to escape perceived threats by swimming away or seeking refuge on solid ground (Wienke, 2015). These instinctual responses are deeply ingrained and can override rational decision-making processes, particularly in high-stress situations.

For example, consider a scenario where a swimmer encounters a sudden change in water conditions, such as strong currents or rough waves. Fear and instinctual responses may prompt the swimmer to panic and exert excessive energy to reach safety, potentially leading to exhaustion or drowning (Smith et al., 2014) Similarly, individuals who are not proficient swimmers may experience heightened fear and instinctual responses when faced with water-related challenges, increasing their vulnerability to accidents.

Understanding the interplay between fear, instinctual responses, and decision-making is essential for developing effective water safety interventions and educational programs. By recognizing the influence of fear on behaviour in aquatic environments, practitioners can implement strategies to mitigate panic reactions, enhance situational awareness, and promote safer decision-making practices (Fong et al., 2017). Moreover, fostering water competency and teaching individuals how to manage fear and instinctual responses can empower them to navigate water-related challenges more effectively and reduce the risk of accidents and drownings.

Risk In Water-Related Activities: Expected vs. Unexpected Water Entry

Various water-related activities pose differing levels of risk, contributing to variations in fatality rates among participants. In-water play, characterized by activities like diving, jumping, and roughhousing in bodies of water, is often associated with high risk and elevated fatality rates (Wilks & Nixon, 2015). The inherent unpredictability of water conditions, coupled with the potential for accidental submersion or collisions with submerged objects, heightens the danger associated with such activities (Peden et al., 2016). Consequently, participants engaging in in-water play may face increased susceptibility to drowning incidents. In contrast, certain water-based pursuits, such as kayaking, entail lower inherent risks and are typically associated with lower relative fatality rates (Mackie et al., 2016). Factors such as the use of specialized equipment, adherence to safety protocols, and training in paddling techniques contribute to mitigating risks associated with kayaking activities. While accidents and fatalities can still occur in kayaking, they are less frequent compared to more hazardous water activities.

Fatality rates vary significantly between activities with expected water entry, like paddleboarding or swimming, and those with unexpected water entry, such as being caught by tides while walking along the shore (Wilks & Nixon, 2015). Expected water entry allows participants to prepare with proper gear, skills, and awareness, reducing risks. In contrast, unexpected water entry is more dangerous due to the element of surprise and lack of preparation, leading to higher chances of drowning and the possibility of injuries sustained before or during the entry – such as a fall. This paper focuses on activities involving expected water entry, where individuals engage in water activities for exercise, leisure, exploration, or work. These scenarios involve conscious decision-making and generally avoidable hazards.

The risk profile and fatality rates associated with water-related activities vary significantly based on factors such as activity type, environmental conditions, participant preparedness, and situational awareness. Understanding these distinctions is essential for implementing targeted interventions and preventive measures to enhance water safety and reduce drowning incidents across diverse aquatic contexts. Table 1 summarises the water activities deemed most risky, their issues, causes and their related demographic. Interesting to note is the demographic most at risk, across all categories of activity, are distinctively males aged 16-74. This concurs with global statistics, where males are 80% more likely to suffer fatality in the water, based on data collected by organizations such as the WHO, national health agencies, and other relevant bodies that track drowning incidents globally (WAID).

Table 1
Expected water entry activities, their risk score, issues and causes summarised

Activity	Risk score	Risk issues	Causes	Demographic most at risk
Motorboating & Sailing	5th highest fatality risk	Equipment failure, stranding/grounding/ Man overboard	Not wearing PFD Not wearing kill cord Not checking tides, Alcohol	Males, specifically 45-59 yrs (boating) 60-74 yrs (sailing)
Swimming	2nd highest fatality risk	Swept out to sea, fatigue, change of sea conditions	Rip currents, waves, cold water, alcohol	Males, specifically aged 16+ yrs
Sub-aqua diving	3rd highest fatality risk	Health issues, lone diving, not prepared for UK diving, underestimate risk	Under-estimating their general health/fitness, lack of understanding on diving, being trained abroad	Males, specifically over 50 yrs
Waterside & In-water play	8th highest fatality risk	Cut off by tide, alcohol, change in weather conditions	Alcohol, slips, rips current, tides	Males, specifically aged 15-29 yrs
Commercial fishing	4th highest fatality risk	Machinery/ equipment failure, capsize/swamping, ill/injured, man overboard	Not checking equipment, lone working, not wearing a PFD	Males, specifically 35-49 yrs

Note: source RNLI

The RNLI has systematically categorized water activity types and profiles based on their associated risk levels, employing a scoring system that considers demographic characteristics, causal factors, and behavioural trends. This approach aims to deepen the understanding of behavioural risks inherent in various water activities and inform targeted water safety initiatives, such as school campaigns, Swim Safe programs, and broader advertising strategies like their respect the water campaign which emphasises the "Float to Live” concept.

By analysing demographic profiles and conducting causal analyses, the RNLI endeavours to identify common patterns and contributing factors related to water-related incidents. This comprehensive approach enables the organization to prioritize interventions and allocate resources effectively to mitigate foreseeable risks and enhance overall water safety; however, what is not clear is how their communication messaging (and other organisations who also communicate about water safety) is used to act as interventions to promote safer behaviours and if they indeed work at that critical moment of distress.

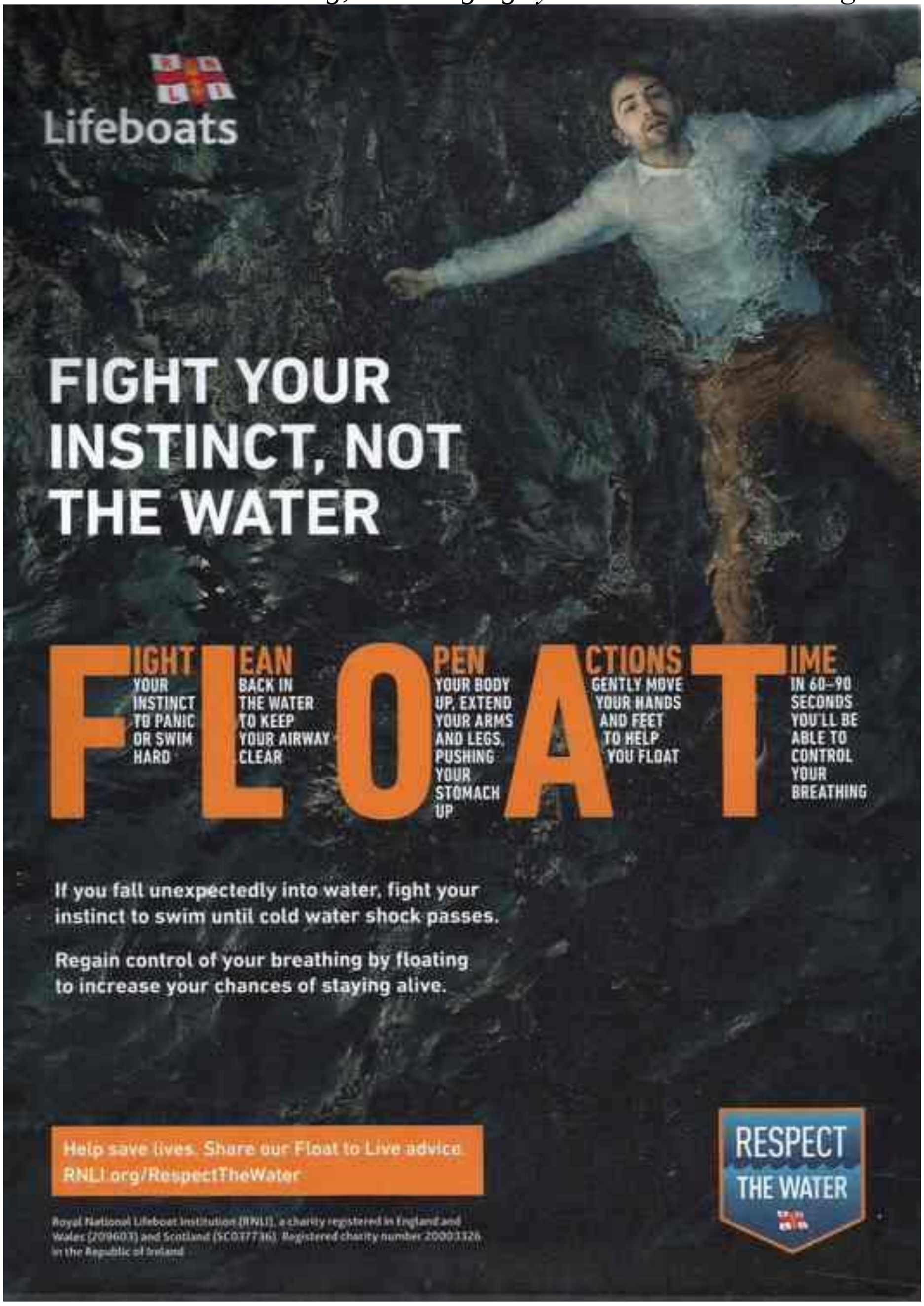
Communicating Water Safety with Advertising

Much work has been actioned around UK-wide advertising campaigns with advertising appeals using persuasive techniques to grab attention, relevance, create awareness, and facilitate action (Armstrong, 2014; Yousef et al., 2021). Advertising appeals can be categorised into various types of either rational or emotional (Zhang et al., 2014; Jovanovic et al., 2016; Cabano & Minton, 2022). Both can be combined to increase the impact of the advertisement. They serve as nuanced approaches, each tailored to resonate with different aspects of human psychology and decision-making processes as they can attract attention through cognitive processes (rational), emotions or a combination of both (Yousef et al., 2021).

The RNLI "Float to Live" campaign leverages these behavioural insights alongside physiological principles governing the cold shock response to promote life-saving techniques during water emergencies. Their campaign messages specifically emphasize the importance of remaining calm and adopting a floating position, assuming the person is thinking rationally in *System 2*, and campaigns such as these, are designed to empower individuals to respond effectively in distressing situations, potentially reducing drowning fatalities (refer to Photo 1).

In the context of the advertisement shown in Photo 1, it is assumed when faced with a water-related emergency, individuals may instinctively panic, which is a System 1 response. The visual of a drowning person and the urgent message "Fight your instincts, not the water" directly address this intuitive response by encouraging individuals to override their automatic instincts and think more rationally about their actions in such situations. The poster's message prompts individuals to engage in *System 2* thinking by considering the rational advice to "fight your instincts" and stay calm in water emergencies. By appealing to both *System 1* (emotional) and *System 2* (analytical/rational) thinking processes, the advertisement aims to influence behaviour change and promote safer practices in water-related activities. There are challenges to this because not everyone makes safe choices and not everyone can engage in system 2 thinking during moments of danger or distress.

Photo 1
"Float to live" advertising, encouraging system 2 'rational and logic'



Source: RNLI (credit; RNLI 2020)

Threats to decision-making ability

As noted in Table 1, the causes of risk have been attributed to environment and machinery causes while others are down to human decisions (not wearing a personal flotation device (PFD), not wearing a kill cord, or not checking tide times).

Interestingly, one of the cited causes has been attributed to alcohol consumption. Alcohol can impair the brain’s ability to make decisions (Spagnoli, 2014). Furthermore, it is expected to affect both *System 1* and *System 2* thinking in various ways:

System 1: Alcohol can impair *System 1* thinking by reducing inhibitions, leading to impulsive behaviour and poor decision-making. It can also affect reflexes and reaction times, making individuals more prone to accidents or risky behaviour (such as not wearing a PFD) without fully considering the consequences.

System 2: Alcohol also can impair *System 2* thinking by disrupting cognitive functions such as attention, memory, and problem-solving abilities. This can lead to difficulties in concentrating, processing information, and making rational decisions.

Overall, alcohol's effects on cognitive function can vary depending on factors such as the amount consumed, individual tolerance, and other situational variables (Oscar-Berman, 2007). Alcohol can disrupt both automatic and controlled cognitive processes, potentially leading to impaired judgment and decision-making (Spagnoli, 2014). If a person has consumed alcohol prior to any of the water activities in Table 1, it can therefore be assumed that their ability to make rational decisions (such as wearing a kill cord or floating to live if they get into difficult) will be impaired.

Secondly, cold water immersion poses additional significant risks due to its physiological and psychological effects. Cold water shock, triggered when the body is suddenly immersed in cold water, induces a rapid physiological response, accounting for the majority of deaths (Tipton et al., 2014). This includes vasoconstriction to conserve core body temperature, heightened heart rate and blood pressure as part of the body's "fight or flight" mechanism, and immediate reactions like gasping reflex and hyperventilation (Kelly & Bird, 2021). These responses increase the likelihood of inhaling water and subsequent drowning. Moreover, cold water exposure impairs cognitive function, diverting blood flow and oxygen away from the brain, leading to compromised decision-making and coordination (Golden & Hervey, 1978). Feelings of panic and anxiety exacerbate cognitive impairment, further heightening accident risk. Prolonged exposure to cold water can lead to hypothermia, characterized by deteriorating cognitive function, confusion, disorientation, and loss of consciousness (Tipton et al., 2017). These effects underscore the peril of sudden cold-water immersion, particularly for individuals unprepared for its physiological and psychological impact.

Understanding these physiological and cognitive responses is essential for mitigating accidents and drowning incidents in cold water environments, particularly when alcohol consumption is involved. Alcohol's effects not only impair cognitive function but also exacerbate the physiological responses to cold water immersion, thereby increasing the risk of accidents and fatalities.

When individuals unexpectedly find themselves immersed in cold water after consuming alcohol, their ability to engage in System 2 thinking is further compromised by both factors (Golden & Hervey, 1978). This impairment in cognitive function diminishes their capacity to assess and respond effectively to the dangers posed by the cold-water environment. Even in situations where individuals knowingly enter cold water after alcohol consumption, such as swimming into a cold current, their cognitive abilities remain impaired, further heightening the risk of mishaps and endangerment (Smith et al., 2014).

Emotional Impact on Perceptions and Behaviours

Emotions significantly shape perceptions, motivations, and behaviours in water settings, influencing decision-making and safety outcomes (Peden et al., 2016; Slovic et al., 2004). Anxiety, characterized by feelings of apprehension and uncertainty, can profoundly affect decision-making processes in water activities. Individuals experiencing anxiety may perceive water-related situations as threatening and exhibit avoidance behaviours, such as avoiding swimming in open water or refraining from participating in water sports. This heightened anxiety can impair cognitive functioning, leading to difficulties in evaluating risks and making informed decisions about water-related activities.

Conversely, emotions such as excitement and exhilaration also influence decision-making processes in water activities. For instance, individuals may feel excited about participating in water sports like surfing or white-water rafting, increasing motivation and willingness to take risks (Gillet et al., 2017). Excessive excitement may cloud judgment and lead to impulsive decision-making, increasing the likelihood of accidents or injuries in water environments.

The interplay between emotions and decision-making in water activities extends beyond individual experiences to group dynamics and social interactions. Peer pressure and social norms may influence individuals' decisions to engage in risky behaviours (Xu, 2023) in water settings, such as diving from heights or swimming in dangerous currents Understanding how emotions like anxiety, excitement, and exhilaration affect decision-making provides valuable insights into the psychological mechanisms underlying risk-taking behaviours and safety outcomes in aquatic environments.

Role Of Emotional Arousal in Influencing Risk Perception and Behaviour

Emotional arousal, characterized by heightened physiological and psychological activation, significantly impacts risk perception and behaviour in water activities, especially among young men. This demographic often exhibits higher levels of sensation-seeking behaviour and a greater propensity for risk-taking compared to women or older individuals (Byrnes et al., 1999). This heightened sensation-seeking tendency may lead young men to seek out thrilling water activities, such as cliff jumping or extreme surfing, despite potential hazards and safety risks.

Emotional arousal influences risk perception and behaviour through individual, social, and environmental factors. Peer pressure and social norms may amplify emotional arousal, encouraging young men to engage in risky behaviours to seek social approval or acceptance from their peers (Lambert et al., 2016). In water environments, where group dynamics play a significant role, the presence of friends or peers can heighten emotional arousal and lead to collective risk-taking behaviours, such as diving from heights or swimming in dangerous currents.

Furthermore, the influence of emotional arousal on risk perception and behaviour in water activities can vary depending on contextual factors such as water conditions, familiarity with the environment, and past experiences. Young men may perceive risks differently (Xu, 2023) when participating in water activities in unfamiliar or turbulent waters compared to calm and familiar settings. Emotional arousal also may fluctuate based on the perceived level of control or mastery over water-related challenges, with higher arousal levels observed in situations perceived as more unpredictable or uncontrollable.

Emotions, the Brain, and Decision-Making in Water-Related Activities

Studying the interplay among emotions, the brain, and decision-making processes in water-related activities is crucial for several reasons. Emotions significantly shape individuals' behaviour and responses in water environments (Smith et al., 2014). Fear, anxiety, and panic are common emotional responses to water-related emergencies. Understanding how these emotions influence decision-making can aid in developing effective intervention strategies.

The brain plays a central role in processing sensory information and orchestrating responses to environmental stimuli (Purves et al., 2017). Cognitive functions such as attention, memory, and executive functioning are crucial for making decisions in water-related situations. Studying how the brain processes emotional cues and integrates them into decision-making can provide valuable insights into why individuals may engage in risky behaviours or fail to take appropriate actions to ensure their safety in water environments.

Water-related activities often involve complex and dynamic environments where decisions must be made quickly and under pressure. Understanding the interplay among emotions, the brain, and decision-making processes enables researchers and practitioners to develop targeted training programs and safety protocols to help individuals better navigate water-related challenges and reduce the incidence of accidents and drownings.

Impact of Emotions on Decision-Making in Water-Based Activities

Peer Pressure in Swimming. Peer pressure can play a significant role in shaping decision-making among young swimmers, particularly in group settings. For instance, a case study by Lambert et al. (2016) explored how peer influence and social norms can lead to risky behaviour, such as diving from heights or swimming in dangerous currents, as individuals seek acceptance and approval from their peers. This demonstrated the impact of social factors and emotional arousal on decision-making in water activities.

Risk-Taking Behaviour in Powerboating. Powerboat operators often experience a mix of emotions, including excitement, confidence, and sometimes overconfidence, which can influence their decision-making on the water. For instance, individuals may push the limits of their boat's capabilities or venture into rough waters in pursuit of exhilarating experiences. This can increase the likelihood of accidents and collisions, highlighting the impact of emotions on risk-taking behaviour in powerboating (Vingilis, 2013).

Peer Influence in Recreational Boating. In recreational boating settings, individuals often make decisions in the context of social interactions and group dynamics. For example, novice boaters may feel pressured to keep up with more experienced peers or to engage in risky behaviours to impress others. This can lead to suboptimal decision-making, such as exceeding safe operating speeds or navigating beyond one's skill level, as individuals seek validation or acceptance from their peers (Quirk, 2008).

Water Play in Natural Settings. Emotions such as joy, relaxation, and freedom often characterize swimming and water play in natural settings such as lakes, rivers, and oceans. Individuals may be drawn to these environments to escape the stresses of daily life, connect with nature, and experience a sense of rejuvenation. Concerns about safety, water quality, and environmental hazards may influence decisions about where and how to engage in water-based activities (Mackenzie, 2010).

These examples demonstrate the complex interplay among emotions, social factors, and risk perception in decision-making processes during water-based activities. By understanding how emotions influence behaviour in these contexts, practitioners can develop targeted interventions to promote safer practices and reduce the incidence of water-related accidents and injuries.

Suggestive Interventions for Enhancing Safety & Decision-Making

The reviewed literature has indicated that targeted interventions at various levels, incorporating system 1 and system 2 thinking could potentially enhance safer decision-making in both anticipated and unexpected water entry situations. Here is an outline of some suggestive interventions employing this approach:

Education and Training Programs

Addressing System 1 (Automatic, Intuitive Thinking)

- **Instinctive Fear Responses Training:** Use progressive exposure training where participants experience increasing levels of water immersion in a controlled environment (e.g., a safe pool setting). This helps desensitize them to panic-inducing stimuli and reduces knee-jerk System 1 reactions, like flailing when caught in a current.
- **Automatic Reactions Conditioning:** Introduce habitual drills - such as "call, tell throw" exercises to train participants to instinctively take safer responses when falling into water.
- **Gamified Decision-Making Learning:** Create interactive mobile apps that simulate rapid decision-making in emergency water situations (e.g., whether to swim parallel to a rip current or attempt to fight it). Immediate in-game feedback can reinforce correct choices.

Engaging System 2 (Deliberate, Analytical Thinking)

- **Water Safety Risk Assessment Frameworks:** Teach checklists like a "5-Second Pause Rule" before entering water—assessing water conditions, exit points, and emergency plans before acting.
- **Cognitive Bias Awareness Training:** Conduct workshops that use psychological debriefs after real-world simulations to discuss biases (e.g., overconfidence bias leading to riskier behaviours) and encourage more calculated decision-making.
- **Scenario-Based Reflection Exercises:** Provide case studies or productions of past drownings or near-misses and facilitate discussions on how the victim's thought process played out—highlighting moments where deliberate thinking could have changed outcomes.

Communication Interventions

System 1 (Emotional, Automatic Influence)

- **High-Impact Emotional Campaigns**: Use real-life testimonials from survivors who narrowly escaped drowning or from family members who lost loved ones, triggering emotional engagement.
- **Short-Form social media Micro-Ads:** Design 10-second TikTok/ Instagram reels that visually depict life-or-death scenarios—a man jumping off a pier, time slows down, and text overlays: “Would you survive? Think before you jump.”
- **Anchoring Safety in Social Identity:** Frame messages in a way that resonates with masculinity—e.g., “Real strength is knowing your limits” (instead of “Be careful,” which can be perceived as weak) with PR activation campaigns.

System 2 (Deliberate, Analytical Thinking)

- **Pre-Event Risk Prompts:** Install digital interactive kiosks at popular water sites that ask users short but impactful questions before they enter the water (e.g., “What’s your exit strategy?” “Do you know today’s rip current forecast?”).
- **Thermographic Behavioural Nudges:** Deploy temperature-reactive DOOH (Digital Out-Of-Home) billboards near high risk and/or cold-water locations that activate warnings when the temperature drops below 15°C, reinforcing cold shock awareness and prompting cognitive revaluation before water entry. Or consider the warmer temperature locations to activate messages for the public who are expected to enter the water for in-water play i.e. family swimming to warn ahead of the dangers.
- **Decision Point Reminders:** Use geo-targeted mobile push notifications that send alerts when people enter high-risk locations (e.g., “You’re near a high-drowning risk zone. Stay alert. Assess the conditions.”).

Utilization of Technological Aids

- **Smart Wearable Alerts:** Organisations such as RNLI, RoSPA, HM Coastguard to partner with smartwatch companies to develop real-time physiological alert systems that detect stress-induced spikes in heart rate and issue a calming audio guide (e.g., “Relax, float, breathe”) when a person enters panic mode.
- **VR and immersive experiences:** Explore the use of virtual reality (VR) simulations and immersive experiences to simulate challenging scenarios and allow the public to practice decision-making skills in a controlled environment. Investigate the application of virtual reality and immersive experiences to effectively convey the hazards of water, providing individuals with realistic simulations of water-related scenarios to enhance understanding and awareness.

Implementing these strategies could empower the public (with a particular focus on young males and men) to make informed decisions, manage risks, and have safer, more rewarding water activities. Targeted education, training, and technological aids can mitigate instinctual responses and emotional biases, fostering a culture of safety and responsibility in and around water, which can be deployed in a variety of situations, for example within schools, community groups, or with organised activities (i.e. wild swimming groups, motorboating societies). The wider communication interventions can be adapted to suit different targets of the public using higher impact campaigns and nudges. However, it is recognised that further research into emotional appeal strategies and combined technologies like VR are needed to assess their effectiveness in longer-term, sustained behaviour change.

Conclusions

This conceptual paper has delved into the intricate relationships among the human brain, emotions, and decision-making processes within aquatic environments. Drawing upon insights from neuroscience, psychology, and behavioural economics, we have explored how instinctual responses and emotional states can influence decision-making in water-related activities. Through our investigation, several key findings and insights have emerged, shedding light on the complexities of human behaviour and offering valuable implications for safety communication and intervention strategies.

While we have underscored the profound physiological and psychological responses evoked by water, characterized by a parasympathetic reaction that induces relaxation and tranquillity, water environments simultaneously pose massive risk to those who unexpectedly find themselves in cold water and to people who fall into the water unexpectedly who respond to their instincts. Despite this innate connection to water and why individuals often find solace and joy in aquatic environments, this innate connection also presents challenges when attempting to convey safety messages or warnings. The dominance of emotional decision-making processes, particularly *System 1* thinking, can hinder rational analysis and logical deliberation, leading to resistance to communication efforts about inherent risks.

Secondly, we examined the role of organizations like the RNLI in employing rational messaging strategies to promote safety in aquatic environments. Initiatives such as the 'Float to Live' campaign exemplify efforts to counteract instinctual responses by encouraging individuals to engage in *System 2* thinking during emergencies. While these strategies hold promise, their efficacy depends on individuals' ability to override emotional impulses, such as ‘fighting their instinct’ and therefore making informed decisions.

Furthermore, we have highlighted the significance of understanding the nuances of human cognition and emotion in relation to water-related activities. By recognizing the interplay between instinct, emotions, and decision-making, we can develop more effective communication strategies and interventions tailored to specific aquatic contexts, such as boating, swimming, and in-water play. This nuanced understanding is crucial for enhancing safety awareness and decision-making efficacy among individuals engaged in diverse water-related pursuits.

Moving forward, a clear call to action must be sent for further research and practical interventions aimed at enhancing safety and decision-making in water-related activities. Future studies could delve deeper into the mechanisms underlying emotional decision-making in aquatic environments, exploring factors such as situational context, individual differences, gender, and environmental cues. Additionally, practical interventions should focus on empowering individuals to engage in *System 2* thinking during emergencies, equipping them with the skills and knowledge needed to respond effectively to water-related risks.

In conclusion, the importance of understanding the brain, emotions, and decision-making processes in aquatic environments cannot be overstated. By leveraging insights from neuroscience, psychology, and behavioural economics, we must develop targeted interventions to mitigate the influence of instinctual responses and enhance safety in water-related activities. With continued research and collaborative efforts, we can strive towards a future where individuals are better equipped to navigate aquatic environments safely and confidently.

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