

Review

Into the unknown: A review and synthesis of contemporary models involving uncertainty



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ABSTRACT

The current review and synthesis serves to define and contextualize fear of the unknown relative to related constructs, such as intolerance of uncertainty, and contemporary models of emotion, attachment, and neuroticism. The contemporary models appear to share a common core in underscoring the importance of responses to unknowns. A recent surge in published research has explored the transdiagnostic impact of not knowing on anxiety and related pathologies; as such, there appears to be mounting evidence for fear of the unknown as an important core transdiagnostic construct. The result is a robust foundation for transdiagnostic theoretical and empirical explorations into fearing the unknown and intolerance of uncertainty.

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1. Introduction

The current review and synthesis provides a contemporary foundation for researchers and theorists working to understand the

roles of unknowns and uncertainty in emotional disorders. There exist theoretical models that consider uncertainty as critical; but, these models have typically focused on specific disorders or pathology and few have distinguished definitions for fear of the unknown and related constructs. The current review and synthesis offers such delineations and integrates theoretical models of emotion, attachment, and neuroticism, all of which converge to underscore the importance of fear of the unknown, not only to psychopathology, but to psychology.

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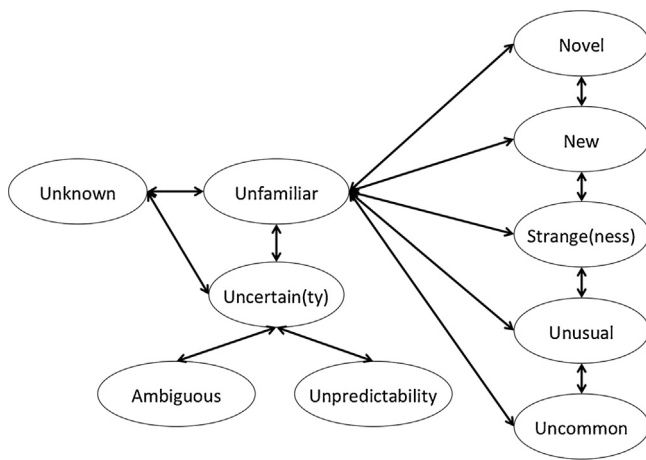


Fig. 1. Relational map of dictionary definitions.

2. Fear of the unknown

An unknown is the perceived absence of information at any level of consciousness. Per that definition, the unknown is a foundational and necessary core component of several closely related words and constructs such as uncertainty, novelty, unfamiliarity, and strange (Carleton, 2012; Dictionaries, 2016; Dictionary.com, 2016). Lovecraft (1927) suggested “the oldest and strongest emotion of mankind is fear, and the oldest and strongest kind of fear is fear of the unknown” (as cited in (Joshi & Schultz, 2001; p. 255)). Similarly, Carleton, Sharpe and Asmundson (2007; p. 2314) argued that fear of the unknown may “be the most basic component of pathological anxiety” and “a fundamental component of all anxiety disorders”. The argument was brokered on prior research conducted with *Intolerance of Uncertainty* (IU; Andersen & Schwartz, 1992; Freeston, Rhéaume, Letarte, Dugas, & Ladouceur, 1994; Krohne, 1989, 1993; Kruglansky, 1990).

Freeston et al. (1994) first defined IU as “a relatively broad construct representing cognitive, emotional, and behavioral reactions to uncertainty in everyday life situations”. Despite the definition of IU, neither intolerance nor uncertainty were explicitly defined, therein implying the dictionary definitions. Intolerance refers to “incapacity or indisposition to bear or endure” (“intolerant,” n.d.). An unendurable stimulus would be aversive. When encountered or anticipated, such a stimulus would be reasonably expected to induce a negative emotional response (e.g., fear or anxiety). Uncertainty refers to experiencing an unknown (“uncertainty,” n.d.). Uncertainty is related to, but distinct from, ambiguity (Carleton, 2012; Grenier, Barrette, & Ladouceur, 2005), which results from features perceived as equivocal or perceived with insufficient knowledge for a singular definitive interpretation (e.g., figure/ground images like the Rubin vase; apophenia). Dispositional capacity to endure uncertainty is defined by the interaction and the associated aggregate emotional response to the perceived unknowns. Unknowns are internal percepts of absent information (i.e., the perceived absence of information at any level of consciousness or processing); moreover, the dictionary definitions for a variety of related terms appear dependent on definitions of uncertainty and unknown (Fig. 1). Accordingly, despite several redefinitions since 1994 (see, for reviews, Birrell, Meares, Wilkinson, & Freeston, 2011; Carleton, 2012), I propose that IU is an individual’s dispositional incapacity to endure the aversive response triggered by the perceived absence of salient, key, or sufficient information, and sustained by the associated perception of uncertainty.

The definition of IU allows for distinguishing between the triggering stimuli (i.e., an unknown), the response (i.e., fear of the unknown), and the incapacity to endure that aversive (i.e., fearful) response which is sustained by the associated perception of uncertainty (i.e., IU), while recognizing the importance of distinguishing between subjectively relevant and irrelevant information. The definition also allows for distinctions between fear of the unknown, IU, and each of the cognitive, emotional, and behavioural reflections of that incapacity to endure. For example, some persons with high IU might respond to unknowns and uncertainty by becoming cognitively avoidant, some might ruminate, and others might engage in substance abuse. In addition, Carleton’s (2012) suggestion that the core of IU was an inherent, dispositional fear of the unknown fits well with the definition.

Carleton’s (2012) suggestion gave insufficient consideration to Barlow’s (2000) delineation of fear and anxiety, and an explicit definition for fear of the unknown was not provided; as such, providing such considerations and definitions appear important next steps. Barlow described anxiety as focused on threats that may occur in an unknowable future and contrasted that with fear, which focused on present and imminent threats (Barlow, 2000). Barlow’s (2000) distinction was extended by Carleton (2012) who argued that a person perceiving sufficient knowns or agency when encountering a potential threat experiences either calm because there is no threat or fear because the threat is being realized; however, the person would not experience anxiety. The distinction is complicated because unknowns are internal percepts of absent information that necessarily occur in the present for the thinker; as such, an unknown could simultaneously induce fear (i.e., the absence of information is perceived as dangerous, present, and imminent) and anxiety (i.e., the perceived absence is expected to continue and alludes to one or more potential events that are uncertain, possibly positive, but potentially negative).

To define fear of the unknown, the word *fear* will be used flexibly to describe an incremental range of physiological changes, emotional intensities, and associated adjectives. For example, a dog phobia might induce relatively little fear when thinking about a dog (i.e., conjuring an internal percept), slightly more when encountering a juvenile Pug, more still when encountering a Border Collie, intensity causing a panic attack and a fight-or-flight response when encountering a Labrador, or paralyzing terror (i.e., tonic immobility—a nearly reflexive freezing response; Abrams, Carleton, Taylor, & Asmundson, 2009) when encountering a Rottweiler. Importantly, the intensity would be moderated by context (i.e., the objective and subjective aggregation of salient and key knowns and unknowns). For example, encountering a sleeping and caged Rottweiler would likely evoke a very different emotional intensity than encountering an enraged and charging Rottweiler. The distinction assumes, in part, perceived certainty that the dog is actually asleep and the cage is sufficiently secure. Across the encounters the emotional experience could be very broadly described as “fear”; however, the different intensities would likely involve different intensities of physiological activation and be described by different adjectives. For example, a low intensity might be described as dislike or bother; a moderate intensity might be described as fear or intolerance; a high intensity might be described as terror or dread. In this definition, fear is not considered an absolute dichotomous state (i.e., entirely experienced as paralyzing terror or entirely experienced as absent), but rather as a continuum.

The definitions offered for *unknown*, *IU*, and contextualized *fear*, provide important foundations for defining fear of the unknown. Dispositional fear of the unknown is an individual’s propensity to experience fear caused by the perceived absence of information at any level of consciousness or point of processing. Considering Mahoney and McEvoy’s (2012b) astute distinction between trait

and state IU, a similar distinction is offered for fear of the unknown. The propensity (i.e., trait fear of the unknown), measured at any point in time, would be a function of inherent disposition primarily influenced by long-standing experience (i.e., learning) and nuanced by situational factors during measurement. In contrast, the intensity of a current emotional experience (i.e., state fear of the unknown) would be specific, having been influenced by both trait levels and situational factors during measurement. Dispositional IU reflects the incapacity to endure the aversive (i.e., fearful) response triggered by the perception of one or more salient or key unknowns and sustained by the associated perception of uncertainty. The definitions make for subtle, but potentially critical, distinctions between two highly related constructs, with fear of the unknown being lower-order relative to IU. Furthermore, both constructs can and should be distinguished from the expected consequences (e.g., frustration; loss; harm) as well as the cognitive (e.g., worry; disorganization) and behavioural responses (e.g., information seeking; inaction) caused by fear of the unknown and IU.

Fearing the unknown and IU could profoundly influence perceptions and desires for predictability and controllability. Prediction and control are sought to affect consequences, presumably reducing aversive consequences and increasing appetitive ones. Predictability involves probabilistic assessments of an event occurring, the timing of an event, the location of an event, and/or the intensity of an event (Grupe & Nitschke, 2013). Accordingly, the construct is necessarily premised on a balance between perceived knowns and unknowns. For example, a person may perceive the influence of gravity as known and with that make a prediction about skydiving; however, the prediction would likely change as a function of perceiving unknowns, such as the quality of a specific parachute. The desire for predictability would then be influenced not only by expected possible consequences (e.g., death), but by the number of unknowns and reactions to those unknowns.

A desire for predictability presumes a desire for controllability. Controllability involves believing with sufficient certainty that available resources can influence the aversiveness of an event (Thompson, 1981), which accords with notions of agency and self-efficacy (Bandura, 1977, 1989, 1997); indeed, the level, strength, and generality of self-efficacy varies based on perceptions of certainty and therein predictability and controllability (Bandura, 1977). Bandura's concepts of agency and self-efficacy describe the perceived capacity to predict and control consequences (Bandura, 1977, 1989, 1997). Perceived agency or self-efficacy necessarily requires several knowns and is necessarily mitigated by the presence of unknowns and the experience of uncertainty. Bandura (1977) described outcome expectancy as the estimation that a given behaviour will lead to certain outcomes. By extension, he described efficacy expectation as the level of certainty the required behavior can be successfully produced (Bandura, 1977). Unknowns necessarily reduce capacity for prediction and control, facilitating fear (Armfield, 2006), and compromising agency and self-efficacy (Bandura, 1997). Accordingly, attempts to increase perceived predictability and controllability serve as coping responses for fear of the unknown and IU, as well as efforts to mitigate potentially aversive consequences. In the skydiving example, fear of the unknown could produce significant behavioural changes favouring increased control (e.g., taking a second parachute), predictability (e.g., researching parachute failure probabilities), and certainty (e.g., not jumping) regarding a desired consequence (e.g., survival). Such behavioural changes reflect attempts to mitigate or eliminate fear of the unknown, as well as to facilitate tolerance (i.e., reduce IU) for the associated and inescapable uncertainty associated with skydiving.

An individual would be best equipped to succeed when unknowns are encountered in sufficiently predictable and controllable contexts, therein facilitating positive responses, such as

curiosity (Berg & Sternberg, 1985); however, "implicit in this understanding of curiosity is that people must feel [i.e., believe with sufficient certainty] they have the ability to effectively cope with or make sense of the novelty, ambiguity and uncertainty being confronted during explorations" (Kashdan et al., 2009). Indeed, perceiving an unknown as positive reasonably requires the perception to occur in the context of sufficient knowns associated with safety. As unknowns increase, compromising predictability, control, and efficacy, a variety of emotional and behavioural responses can be potentiated. Accordingly, understanding the role fear of the unknown plays in contemporary models of emotion, attachment, inhibition, temperament, anxiety, and neuroticism may be critical for psychology.

3. Fear of the unknown and emotions

There is currently no definitively accepted definition or model for emotion (Gross & Barrett, 2011; Moors, 2009; Mulligan & Scherer, 2012; Scherer, 2005); however, there appear to be some generally accepted elements for a definition. Mulligan and Scherer (2012) proposed a partial definition for emotion that draws on the recent evolution of, and overlap across, emotion models (Gross & Barrett, 2011; Moors, 2009): an emotion (1) is time limited, (2) is triggered by at least one appraisal, (3) is guided by at least one appraisal, (4) contains bodily changes (e.g., arousal) that are felt, and (5) involves a perceptual or intellectual episode. The definition favours theories of emotion wherein appraisal – as a component, a direct process, a recursive process, and an outcome – is considered causally central to emotion (Moors, Ellsworth, Scherer, & Frijda, 2013). The contemporary models also overlap (Gross & Barrett, 2011; Moors, 2009), with particular regards to causality (Moors, 2009; Moors et al., 2013). For example, most emotion models posit cognitive processes as playing a key role that is typically antecedent and initially unconscious or automatic. Most emotion models also include a key role for somatic components, behaviours, and goals or perceived consequences. The relative influence and order of the process components remains debated, with evidence of an evolution towards automatic, perceptual, and parallel processing (Moors, 2009).

Scherer (2013) suggests the emotion process occurs in four sequential categories, each category containing a series of sequential and cumulative "checks" for appraising a stimulus. The checks in each sequential category can be processed simultaneously, interactively, and with recursive feedback across all categories (see Scherer, 2013). The first sequential category is called *relevance*. The first check (i.e., lowest-order, fundamental, basic) in the relevance category evaluates whether the stimulus is "sudden, familiar, unpredictable" (p. 151) or, more succinctly, "unknown" (see Scherer, 2013). The second check evaluates whether the stimulus is aversive or appetitive. The third check evaluates whether the stimulus is relevant to goals or needs. The second sequential category is called *implications and consequences*, and has a series of checks that evaluate causal attribution, outcome probability, discrepancy from expectations, goal/need conduciveness, and urgency. The third sequential category is called *coping potential*, and has a series of checks that evaluate of control, power, and adjustment. The fourth and final category (i.e., highest-order) is called *norm compatibility*, and has a series of checks that evaluate internal and external standards (e.g., self-ideals and social norms, respectively).

The check for unknowns in Scherer's (2013) first sequential category is processed at four levels that interact continuously to produce top-down and bottom-up effects (Scherer, 2009): (1) low-level neural substrates (i.e., mostly genetically determined; criteria consist of templates for pattern matching; includes notions of biological preparedness); (2) fairly automatic schematic memory

traces; (3) automatic or deliberate associations involving cortical areas; and (4) conceptual cortical areas involving propositional knowledge, cultural meanings, and effortful conscious processing. Appraisals occur at each of the four levels and check for unknowns, placing substantial and pervasive importance first on identifying unknowns and second on the causal impact of perceiving unknowns for emotion (Sacharin, Sander, & Scherer, 2012; Scherer, 2009). Therefore, responses to unknowns appear to be critical defining elements for any emotion.

An emotional experience will necessarily be determined by appraising the balance between knowns and unknowns in any given situation, as well as the learned predicted consequences (Boswell, Thompson-Hollands, Farchione, & Barlow, 2013; Gray & McNaughton, 2003; Kagan & Snidman, 2004; Scherer, 2009) and perceived security (Ainsworth, Blehar, Waters, & Wall, 1978; Bowlby, 1973, 1989; van Ijzendoorn & Kroonenberg, 1988). Consider a person who is having a birthday and has been presented a box with unknown contents by a person known to be appetitive (e.g., a close friend) who is demonstrating behaviours known to be associated with appetitive outcomes (e.g., smiling). In such a circumstance the unknown contents of the box are likely expected, on the whole, to be appetitive and facilitate a positive emotional experience (e.g., surprise). Consider instead the climatic scene from the movie *Seven*, where a person who is not having a birthday has been presented a box with unknown contents by a person known to be aversive, and that presenter is demonstrating behaviours known to be associated with aversive outcomes (e.g., creepily describing having access to a vulnerable family member). In this case, the unknown contents are likely expected, on the whole, to be aversive and facilitate a negative emotional experience (e.g., anger, fear). The knowns and unknowns critically determine the overall emotional experience, even though both situations describe a box with unknown contents. Similarly, an unknown (e.g., π to the 10th decimal place) that becomes known as not aversive or as irrelevant (e.g., not on the up and coming exam) will also not produce fear.

In short, different knowns will differentially impact the influence of different unknowns based on individual context, salience, and experience; as such, there is an infinite number of possible specific combinations wherein unknowns could be perceived as aversive, making individual reactivity to unknowns in general (i.e., fear of the unknown) and incapacity to endure that reactivity (i.e., IU) critical for understanding emotional responses. For example, a person may accept as known that an event will happen, that they know what to do when it happens, and that they are skilled enough to respond as needed, and yet still not know *when* it will happen. In contrast, a person may not know *if* something will happen, yet still know when it would happen if it does, what to do when it happens, and that they are skilled enough to respond as needed. Both scenarios have the same number of known and unknown elements, but may produce very different emotional responses depending on individual context, salience, and experience, as well as fear of the unknown and IU.

There is also a potentially critical interactive relationship between emotional responses (e.g., fear) to stimuli (e.g., unknowns) and affective personality traits or emotional dispositions (e.g., neuroticism; Scherer & Brosch, 2009); specifically, "(a) an emotion disposition (trait affect) is a risk factor for experiencing certain emotions more readily and/or more frequently, (b) appraisal bias tends to cause certain emotions to be more readily experienced and may thus lead to the emergence of emotion dispositions and even emotional disturbances and (c) cultural goal, belief and value systems may encourage certain types of appraisal bias and may thus provide an explanation for vestiges of culture-specific modal personality" (p. 265). By extension, if responses to unknowns are defining elements of emotion, and if there is an appraisal bias for unknowns that facilitates fear, that bias should be reflected as

important for existing models of attachment and temperament, as well as clinically-significant anxiety and depression.

4. Fear of the unknown and attachment

Parent-child attachment has long been "related to separation anxiety (see Bowlby, 1960), fear of the strange and strangers (Morgan & Ricciuti, 1969; Schaffer, 1966), and engaging in exploration" (Ainsworth & Bell, 1970; p. 50). Broadly speaking, there are four categories used to describe the quality of attachment between a parent and a child: secure, insecure avoidant, insecure ambivalent, and insecure disorganized (Ainsworth et al., 1978; Main & Solomon, 1990). Children who perceive certainty and predictability in the provision of safety from their parents are more likely to be securely attached. Importantly, insecure attachments facilitate internal working models based on negative expectations (Bowlby, 1989) and are nonspecific risk factors for psychopathology (Brumariu & Kerns, 2010; Fearon, Bakermans-Kranenburg, van Ijzendoorn, Lapsley, & Roisman, 2010; Groh, Roisman, van Ijzendoorn, Bakermans-Kranenburg, & Fearon, 2012; Madigan, Atkinson, Laurin, & Benoit, 2013), as well as symptoms of anxiety and anxiety sensitivity (see Brumariu & Kerns, 2010; Colonesi et al., 2011; Madigan et al., 2013).

The Strange Situation (Ainsworth & Bell, 1970) is among the most recognized behavioural assessment protocols for categorizing attachment (Main & Solomon, 1990; van Ijzendoorn & Kroonenberg, 1988). The Strange Situation places the child into a controlled but uncertain situation (Ainsworth & Bell, 1970) that allows researchers to study attachment and exploratory behaviours as influenced by unknowns (Ainsworth & Bell, 1970). Bowlby (1973) explicitly noted an attempt to balance the unknowns such that the situation would be interesting rather than frightening, implying the researchers already knew the infants were likely to fear unknowns. Indeed, they knew the infant would display intense distress when encountering unknown people or events in the absence of mothering; moreover, changes in noise, illumination, movement, or the presentation of other unknowns or uncertainty produced fear with "little or no learning" (Bowlby, 1973, p. 114). In the Strange Situation, their intent was to observe how well the presence of a significant known (i.e., the mother) would mediate the infant's fear of the unknown (Ainsworth & Bell, 1970). Their results underscored that children find unknowns, particularly approaching unknowns, extremely frightening and approach (Bowlby, 1973).

Research into attachment appears to underscore an important role for unknowns, uncertainty, novelty, and strange situations or strange stimuli. Secure attachment appears premised on perceiving parental figures as knowns that are certain to be safe. Thereafter, secure attachment appears to mitigate fear experienced when encountering subsequent unknowns. Interactions between parental attachment, behavioural inhibition, and temperament can predict anxiety symptoms (Ainsworth & Bell, 1970; Bowlby, 1973; Colonesi et al., 2011; Degnan & Fox, 2007; Lewis-Morrarty et al., *in press*; Madigan et al., 2013); as such, the role of unknowns for behavioural inhibition and temperament may also be important. Indeed, fear of the unknown appears to have broad important implications for children and adolescents disorders as has recently been demonstrated within autism research (Boulter, Freeston, South, & Rodgers, 2014; Hodgson, Freeston, Honey, & Rodgers, 2016; Uljarevic, Carrington, & Leekam, 2016).

5. Fear of the unknown and the behavioural inhibition system

The behavioural inhibition system (BIS) was derived from learning models based on experimental results with non-human animals (Gray, 1976; Gray & McNaughton, 2003). The system describes

neurobiological foundations for behavioural inhibition, risk assessment, increased vigilance, and increased arousal. Those increases are attributed to stimuli associated with pain, loss, and unknowns (Gray & McNaughton, 2003). The BIS speaks directly to neurobiological underpinnings associated with fear and anxiety, such that “anxiety represents activity in the behavioural inhibition system” (Gray & McNaughton, 2003; p. 45).

The BIS functions as a mechanism for comparisons that is congruent with the appraisal processes described by Scherer (2009). The comparisons include any combination of stimuli, predictions, goals, and memory. When there is a mismatch (i.e., an unknown) or a perceived threat (i.e., an aversive known), the BIS is activated in an incremental recursive fashion (Gray & McNaughton, 2003). Indeed, Gray and McNaughton (2003) argue that unknowns are, and should be, treated as potential threats that innately produce fear and anxiety; however, they argue that unknowns are simultaneously considered aversive and potentially appetitive. The perceived absent information then becomes salient, key, or insufficient based on a balance of knowns. Contextual differences, including the relative balance between perceived knowns and unknowns in any given situation, whether an unknown is salient or key, and whether knowns are sufficient, dramatically influence whether an unknown is appraised as probabilistically aversive or appetitive and, thereafter, capacity to endure the subsequent uncertainty. The process favours aversive predictions (Gray & McNaughton, 2003) such that any check for novelty that identifies an unknown in the emotion process (Scherer, 2013) incrementally activates the BIS, facilitating fear and anxiety (Gray & McNaughton, 2003). Sensory stimuli identified as unknown are rapidly sent to the amygdala, but unless something happens to further evidence the unknown as threatening, habituation also occurs rapidly (Gray & McNaughton, 2003). In other words, unknowns are initially perceived as aversive, activate the BIS, and facilitate fear; but without reinforcement that the unknown is, or leads to, an aversive consequence, the appraisal becomes neutral and then appetitive.

The neurobiological foundations for the BIS draw heavily on experimental work (e.g., Aggleton, 1993; Davis, 2002; LeDoux, 1996), demonstrating the importance of uncertainty for the amygdala and associated structures. The structures all support the development of non-specific attention or arousal, which manifests in several conditioned responses that enhance sensory processing (Kapp, Whalen, Supple, & Pascoe, 1992). The conditioning is posited as very rapid and based on inherent plasticity of the structures when stimuli are perceived as unknown (Kapp et al., 1992). Encounters with unknowns appear preferentially remembered (Hastie, 1984) and likely to induce sustained neuronal activity in the amygdala irrespective of motivation (Herry et al., 2007; Jackson, Nelson, & Proudfoot, 2015). Furthermore, a recent meta-analysis of neuroimaging studies implicated uncertainty as increasing heart rate variability as well as activation of the amygdala and ventromedial prefrontal cortex (Thayer, Ahs, Fredrikson, Sollers, & Wager, 2012).

The BIS arguably reflects or describes temperament, which is considered a cluster of heritable emotional and behavioural responses (Kagan & Snidman, 2004). In line with the BIS, Kagan and Snidman (2004) suggest temperament is characterized by two categories based on children’s reactions to unknowns: “inhibited and uninhibited to the unfamiliar”. The key discriminating behaviour for the two categories is what extent the child displays fear when encountering an unknown (Kagan & Snidman, 2004; p. 14); indeed, fearful responses to unknowns at 4 months of age can predict behavioural inhibition at 14 months of age (e.g., Moehler et al., 2008).

A recent neurobiological review has also underscored a central role for fear of the unknown that parallels descriptions of the BIS (Grupe & Nitschke, 2013). The review offered an integrated neurological model called the Uncertainty and Anticipation

Model of Anxiety (UAMA), the details of which are beyond the scope of the current review and synthesis. In brief, the authors begin by conceptualizing anxiety “as anticipatory affective, cognitive and behavioural changes in response to uncertainty about a potential future threat” (Grupe & Nitschke, 2013; p. 489). Thereafter, the UAMA describes consequentially negative interactions with uncertainty as facilitating maladaptive responses including increased estimates of threat, hypervigilance, and avoidance (Grupe & Nitschke, 2013). The UAMA presents a neurologically-based model, supported by empirical evidence, that emphasizes BIS activation to unknowns (Grupe & Nitschke, 2013). The available evidence suggests unknowns increase physiological responses to threat (Dickerson & Kemeny, 2004; Grupe & Nitschke, 2013; Hirsh & Inzlicht, 2008; Thayer et al., 2012) and produce sustained increases in the amygdala and the hippocampus of humans (Herry et al., 2007; Jackson et al., 2015). There is also evidence of neural encoding and mechanisms dedicated to processing unknowns (Bach & Dolan, 2012), including evidence that startle potentiation may depend on the presence of uncertainty (Nelson & Shankman, 2011). Indeed, recent behavioural evidence suggests an important interaction between threat perception and IU (Reuman, Jacoby, Fabricant, Herring, & Abramowitz, 2015). Despite the impressive contributions to understanding neural correlates of uncertainty, there is also substantial need for additional research to clarify the relationships between the neural bases, individual perceptions, and clinical presentations (Wever, Smeets, & Sternheim, 2015).

Riskind (1997) and Riskind, Rector and Taylor (2012) have proposed a Looming Vulnerability model wherein BIS activation is associated with a cognitive bias to exaggerate the perception of threat associated with approaching stimuli called Looming Cognitive Style. The bias results from a perceived narrowing of the distance in space associated with an approaching visual object or sound source, which then produces arousal in humans (Ball & Tronick, 1971; Kaye & Van der Meer, 2007) and other animals (Millot, Bégout, & Chatain, 2009). Looming cognitive style has been positively related to anxiety disorders (Riskind, Rector, & Cassin, 2011) and inversely related to depression (Riskind, Kleiman, Seifritz, & Neuhoff, 2014). The construct itself is also in accord with the aforementioned results from Bowlby and colleagues (e.g., Bowlby, 1973) that indicated children find unknowns, particularly approaching unknowns, extremely frightening.

Despite the potential of looming, cognitive appraisals associated with looming would likely remain critical, even if that appraisal was primarily occurring at automatic levels per Scherer’s model (Scherer, 2009, 2013). A rapidly approaching unknown may very reasonably be appraised as threatening, particularly depending on context; in contrast, a rapidly approaching known percept in the appropriate context might be appraised quite differently. For example, an unknown dark object rapidly approaching a person’s head in an unfamiliar forest at twilight might well facilitate fear; in contrast, a baseball rapidly approaching a highly skilled player about to win the World Series is unlikely to facilitate fear.

Exposure to unknowns appears to be causally related to BIS activation, inhibition, and temperament. Kagan and Snidman (2004) suggested their temperament categories (i.e., inhibited and uninhibited to the unfamiliar) have also been called reflective and impulsive, high-reactive and low-reactive, or introverted and extraverted, respectively. Barlow and colleagues extended this relabeling by describing “two genetically based core dimensions of temperament: neuroticism and, to a lesser degree, extraversion. . . these traits have received various labels, including *negative affect*, *behavioral inhibition*, *trait anxiety*, and *harm avoidance* as alternate terms for neuroticism and *positive affect* or *behavioral activation* as alternate terms for extraversion” (Barlow, Sauer-Zavala, Carl, Bullis, & Ellard, 2014, p. 347). Clark and Beck (2010) similarly argued that trait anxiety is “. . . so closely related to negative emotionality

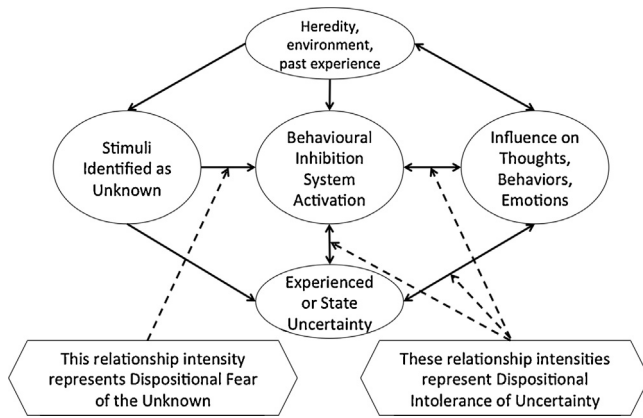


Fig. 2. Relational map of fearing unknowns and intolerance of uncertainty.

(i.e., Neuroticism or Negative Affect) that the two are considered almost synonymous". Barlow, Ellard, Sauer-Zavala, Bullis and Carl (2014, p. 481) went on to describe neuroticism as "a dimension of temperament marked by...the tendency to experience frequent, intense negative emotions associated with a sense of uncontrollability (the perception of inadequate coping) in response to stress" (Barlow, Ellard et al., 2014, p. 481). In doing so, Clark, Beck, Barlow, and colleagues have made several higher-order constructs associated with anxiety and related psychopathology nearly equivalent to each other and to BIS processes, as well as emphasizing the role of responses to unknowns. Accordingly, responses to unknowns across different levels of conscious processing appear to be the most basic component not only of IU, but also of neuroticism (and therein the aforementioned related constructs such as negative affect and trait anxiety), and serve as a key trigger for the BIS activation or analogue thereof (see Fig. 2). To that end, the implicit importance for fear of the unknown has been further explicated in more detailed discussions of their anxiety models.

6. Fear of the unknown and anxiety models

There are two particularly prevalent contemporary models for describing psychopathology related to fear and anxiety; specifically, the Cognitive Model of anxiety (Clark & Beck, 2010) and the Triple Vulnerability Model of anxiety (Barlow, Ellard et al., 2014; Barlow, Sauer-Zavala et al., 2014). In addition, the Tripartite and Integrative Hierarchical Models (Clark & Watson, 1991; Mineka, Watson, & Clark, 1998) are designed to explain the clinically apparent overlap between anxiety and depression as described by the Cognitive Model. There are also a vast number of other models that focus on one or more specific disorders (e.g., generalized anxiety disorder; panic disorder; posttraumatic stress disorder; see for examples, Antony and Stein, 2009; Stein, Hollander, & Rothbaum, 2010); however, the specific models typically overlap with the general ones, as well as contemporary models of emotion (Moors, 2009; Moors et al., 2013; Scherer, 2013).

6.1. The Cognitive Model of anxiety

The Cognitive Model of anxiety (Clark & Beck, 2010) describes fear as an automatic appraisal of stimuli as imminently threatening or dangerous; in contrast, anxiety is described as the enduring subjective response to having experienced fear. Relative to fear, anxiety is considered a more complex response to situations known to be aversive or to unknown situations. As such, fear is posited as the basic process that underlies anxiety and therein all anxiety disorders. Like appraisal models of emotion (Moors et al., 2013; Scherer,

2009, 2013), the Cognitive Model (Clark & Beck, 2010) is sequential with recursive feedback and begins with appraisal of a stimulus.

A stimulus is first appraised as relevant or not in an *orienting mode*. The orienting mode is preconscious and automatic, identifying stimuli as negative, positive, or neutral by comparing the stimuli to knowns in memory, and then redirecting attention based on personal relevance. If the percept is identified as negative, a *primal threat mode activation* occurs, activating in parallel several basic evolutionarily schemas (i.e., cognitive-conceptual, behavioural, physiological, motivational, affective) that are rigid, automatic, and hypervalent, designed to maximize safety and minimize danger. The cognitive-conceptual schemas involve selection, storage, retrieval, and interpretation of threat-related information. The behavioural schemas involve mobilization and evaluation of early defensive responses (e.g., fight-or-flight). The physiological schemas appear similar to the BIS (Gray & McNaughton, 2003) and involve autonomic nervous system function and prioritized processing of proprioceptive stimuli; specifically, primal threat mode activation involves increased autonomic arousal, defensive inhibitory responses (e.g., escape, avoidance, freezing), cognitive processing errors (e.g., underestimates of coping capacity, focus on inability, unsupported catastrophic thoughts), and automatic threat-relevant thoughts (e.g., involuntary thoughts and images of danger). The motivational schemas involve rules for avoiding threat, reducing unpredictability and therein unknowns, and reducing aversiveness. The affective schemas involve the conscious perception of emotion as a subjective feeling that can be metacognitively assessed and described.

The primal threat mode activation is followed by a secondary elaboration and reappraisal process that occurs much more slowly, moderating the intensity of fear and anxiety depending on several factors that interact with the primal threat mode activation. An evaluation of coping resources and skills is a key factor, the efficacy of which can be critically compromised by unknowns (Clark & Beck, 2010). The secondary process involves searching for known safety cues to reduce short-term anxiety; however, safety cue dependence can exacerbate threat perception when the cues are known to be absent. Threats perceived during the secondary process feed back into the orienting mode, escalating or deescalating fear and anxiety. Persons with anxiety-related pathology are thought to have a bias associated with identifying negative stimuli that facilitates the primal threat mode activation. Furthermore, such persons are also thought to have biases impacting the secondary process, reducing efficacy, increasing safety cue dependence, disrupting problem solving, facilitating uncontrolled threat-oriented worry, and magnifying threat assessments.

6.2. Triple Vulnerability Model

The Triple Vulnerability Model (Barlow, Ellard et al., 2014) builds on Barlow's (2002) and Barlow, Sauer-Zavala et al. (2014) delineation of fear and anxiety, underscoring the causal impact of uncertainty for anxiety (Boswell et al., 2013). Barlow and colleagues define anxiety as an inferred construct involving physiological, behavioural, and cognitive components that are activated by the perception of unknowns and the experience of uncertainty. The Triple Vulnerability Model was designed as an integrative theory to understand the biological and environmental facets underling the development of neuroticism. Like the appraisal models (Moors et al., 2013; Scherer, 2009, 2013) and the Cognitive Model (Clark & Beck, 2010), the Triple Vulnerability Model is sequential with recursive feedback.

The Triple Vulnerability Model (Barlow, Ellard et al., 2014) describes three interacting vulnerabilities that are activated by encounters with unknowns (Boswell et al., 2013): (1) "a general biological (heritable) vulnerability"; (2) "a general psychological

vulnerability consisting of a heightened sense of unpredictability and uncontrollability and associated changes in brain function resulting from early adverse experience”; and (3) “a more specific psychological vulnerability – also largely learned – accounting for why one particular emotional disorder (e.g., panic disorder) may emerge instead of another (e.g., obsessive-compulsive disorder)”.

The general biological vulnerability involves the heritable and neurobiological facets underlying personality or temperament (Barlow, Ellard et al., 2014) that generally align with those in the BIS (Gray & McNaughton, 2003). There is also growing neurological evidence (e.g., Lanius et al., 2010) in line with the emotion literature (Scherer & Brosch, 2009) that repeated activation of the BIS is sensitizing and even potentiating, leading to hypervigilance and increased threat reactivity (Barlow, Ellard et al., 2014), all of which increases neuroticism; however, biological influence is considered insufficient to cause of anxiety-related pathology without perceptions of stressors as unpredictable or uncontrollable. The general psychological vulnerability involves pervasive acceptance that life events are unpredictable and uncontrollable, and that the individual has insufficient resources to cope with negative events (Barlow, Ellard et al., 2014). Persons who have emotional disorders are thought to be more fearful of unknowns, less tolerant of uncertainty, and more dependent on controllability, all of which also increases neuroticism (Barlow, Sauer-Zavala et al., 2014).

Barlow, Ellard et al. (2014) indicate the general biological and psychological vulnerabilities may be enough to facilitate generalized anxiety disorder, considered ‘the phenotypic expression of high levels of neuroticism’ and depression, considered “the expression of high levels of neuroticism coupled with a low degree of positive affect”; however, they indicate other disorders would be dependent on learning involving more focused fearful responses to stimuli. Barlow, Ellard et al. (2014) conclude, in line with other researchers (e.g., Gray and McNaughton, 2003; Kagan & Snidman, 2004), that BIS activation and neurotic temperament is moderated in part by environmental experiences, with particular emphasis on early experiences with uncertainty impacting genetic expressions.

6.3. Tripartite and Integrative Hierarchical Models of anxiety and depression

The Tripartite and Integrative Hierarchical Models (Clark & Watson, 1991; Mineka et al., 1998) are congruent with the Cognitive and Triple Vulnerability Models; however, the models were designed to explain the clinically apparent overlap between anxiety and depression by focusing on shared and specific underlying factors. The Tripartite Model posits three critical syndrome dimensions, including general distress (i.e., neuroticism as defined above by Barlow, Ellard et al., 2014; Clark & Beck, 2010), physiological hyperarousal (i.e., amount of physical tension and arousal—arguably overlapping with incremental BIS activation; Gray & McNaughton, 2003), and anhedonia (i.e., amount of positive affect). The model describes various combinations of dimension intensity as underlying anxiety, depression, or both. Specifically, (1) anxiety results from high levels of neuroticism coupled with high levels of physiological hyperarousal; (2) depression results from high levels of negative affect coupled with low levels of positive affect; and (3) comorbid anxiety and depression results from high levels of negative affect coupled with high levels of physiological hyperarousal and low levels of positive affect. The high levels of neuroticism represent the shared underlying factor that produces anxiety and/or depression. The Integrative Hierarchical Model (Mineka et al., 1998) extended the Tripartite model in an attempt to integrate components of Barlow’s models (Barlow, 1991; Barlow, Chorpita, & Turovsky, 1996; Zinbarg & Barlow, 1996; Zinbarg, Barlow, & Brown, 1997). The Integrative Hierarchical Model posited the existence of a transdiagnostic component underlying individual differences in

neuroticism (Mineka et al., 1998) that would be pervasively common to mood and anxiety disorders; accordingly, the theoretical importance for IU, and therein fear of the unknown, to neuroticism in the Cognitive and Triple Vulnerability Models can be reasonably extended to the Tripartite and Integrative Models of anxiety and depression.

7. Fear of the unknown, anxiety, and depression

There is now substantial empirical evidence supporting fear of the unknown, most commonly measured indirectly using tools assessing IU, as playing an important foundational role consistent with the models review and synthesized herein. For example, fear of the unknown has accounted for statistically significant variance in symptoms of generalized anxiety disorder and worry (e.g., Dugas & Ladouceur, 2000; Dugas, Buhr, & Ladouceur, 2004; Dugas & Robichaud, 2007; Gentes & Ruscio, 2011; Koerner & Dugas, 2006; Ladouceur, Dugas et al., 2000; Yook, Kim, Suh, & Lee, 2010; Zlomke & Jeter, 2013), but also in symptoms of panic disorder (Buhr & Dugas, 2009; Carleton, Duranceau et al., 2014; Carleton, Fetzner, Hackl, & McEvoy, 2013), social anxiety disorder (Boelen & Reijntjes, 2009; Boelen, Vrinssen, & van Tulder, 2010; Carleton, Collimore, & Asmundson, 2010; Khawaja & McMahon, 2011; Teale Sapach, Carleton, Mulvogue, Weeks, & Heimberg, 2015), obsessive compulsive disorder (Grayson, 2010; Jacoby, Fabricant, Leonard, Riemann, & Abramowitz, 2013; Khawaja & McMahon, 2011; Lind & Boschen, 2009; Tolin, Abramowitz, Brigidi, & Foa, 2003), post-traumatic stress disorder (Boelen, 2010; Oglesby, Boffa, Short, Raines, & Schmidt, in press; Otis, Keane, & Kerns, 2003; White & Gumley, 2009), health anxiety (Boelen & Carleton, 2012; Fergus, 2013; Fergus & Bardeen, 2013; Fergus & Valentiner, 2011; Kurita, Garon, Stanton, & Meyerowitz, 2013), separation anxiety (Boelen, Reijntjes, & Carleton, 2014), and eating disorders (Konstantellou & Reynolds, 2010; Sternheim, Startup, & Schmidt, 2011). Fear of the unknown has also been associated with depression (Meeten, Dash, Scarlet, & Davey, 2012; Miranda, Fontes, & Marroquin, 2008; Miranda & Mennin, 2007; Nelson, Shankman, & Proudfit, 2014; Yook et al., 2010) and personality disorder symptoms (Berenbaum, Bredemeier, & Thompson, 2008; Fergus & Rowatt, 2014).

There have been several broad studies, including a meta-analysis, that have supported fear of the unknown, typically measured indirectly using tools assessing IU, as a transdiagnostic factor that is generally comparable across psychopathologies (Boswell et al., 2013; Carleton et al., 2012; Gentes & Ruscio, 2011; Hong & Cheung, 2015; McEvoy & Erceg-Hurn, 2016; Mahoney & McEvoy, 2012c; McEvoy & Mahoney, 2013; Norr et al., 2013); relatedly, researchers have explored IU as a critical component of hierarchical models (Norton, Sexton, Walker, & Norton, 2005; Sexton, Norton, Walker, & Norton, 2003). Persons with anxiety-related disorders (i.e., social anxiety, panic disorder, generalized anxiety disorder, obsessive compulsive disorder) or major depressive disorder have reported statistically significantly higher fear of the unknown than undergraduate and community samples (Carleton et al., 2012). Furthermore, response patterns to questions assessing IU, and therein fear of the unknown, appear robustly invariant across persons with anxiety and mood disorders, while being significantly different when comparing clinical and non-clinical samples (Carleton et al., 2012).

Hong and Cheung (2015) provided further evidence that fear of the unknown represents a common factor for treating anxiety and mood disorders with a meta-analytic assessment of vulnerabilities for depression and anxiety. The meta-analyses included 73 articles examining relationships between cognitive vulnerabilities implicated in depression (i.e., pessimistic inferential style, dysfunctional attitudes, and ruminative style) and anxiety (i.e.,

anxiety sensitivity, intolerance of uncertainty, and fear of negative evaluation). Their results supported fear of the unknown as accounting for substantial variance in higher-order constructs, but also underscored the primacy of fearing unknowns relative to other cognitive vulnerabilities. “Intolerance of uncertainty had the strongest factor loading—implying that a fundamental fear of the unknown (Carleton, 2012) may feature heavily in this common core. This element of unknown may encompass external environmental uncertainties and threats and an individual’s internally oriented uncertainty about his or her own resources to deal with such threats” (Hong & Cheung, 2015; p. 13).

Fear of the unknown has also accounted for variance beyond anxiety sensitivity (Boelen & Reijntjes, 2009; Carleton, Collimore et al., 2010; Carleton, Sharpe et al., 2007; Dugas, Gosselin, & Landoucheur, 2001), fear of anxiety (Buhr & Dugas, 2009), metabeliefs (de Bruin, Rassin, & Muris, 2007; Dugas et al., 2007), positive and negative affectivity (Carleton, Collimore et al., 2010), and neuroticism (Boelen & Reijntjes, 2009; Mahoney & McEvoy, 2012b). Hierarchical linear regression entry order should begin with underlying or precursory constructs or events that are followed by emergent constructs or subsequent events (Petrocelli, 2003). As such, if responses to unknowns are core components underlying models of emotion (Scherer, 2013), attachment (Bowlby, 1973), the BIS (Gray & McNaughton, 2003), and neuroticism as described by contemporary models of anxiety (Barlow, Ellard et al., 2014; Barlow, Sauer-Zavala et al., 2014; Clark & Beck, 2010), then fear of the unknown and IU could be placed on the first steps (or early steps) of such regressions because they are lower-order mechanisms underlying increasingly higher order fears (and/or constructs), which would be placed on later steps, all of which underlie one of more emergent higher-order factors (i.e., neuroticism), which would be placed on even higher steps. In contrast, if the contemporary definition of neuroticism is interpreted such that it is equated entirely with fearful responses to unknowns as described herein, that equivocality would need to be explicated in a subsequent review.

8. Fear of the unknown as distinct

Reiss and McNally (1985) may have been the first to take up Spielberger’s (1972) suggestion that anxiety researchers need to identify basic and distinct components of anxiety. To that end, Reiss and McNally (1985) proffered an expectancy model of fear, anxiety, and panic built on initial behaviourist models (e.g., Rachman, 1977), but focused on anticipated consequences, which remains congruent with the Cognitive Model (Clark and Beck, 2010). In 1991, Reiss clarified and refined the expectancy model as using a downward arrow technique to argue the existence of one or more fundamental fears that are rationally related to more common fears but unrelated to each other. Fears of snakes, heights, and anxiety were all used as examples of common fears rationally related by the more fundamental fear of panic symptoms, which Reiss described as anxiety sensitivity. He argued a rational person would not say they fear heights because they fear snakes, but because heights may cause feared panic symptoms. Reiss’ (1991) approach to identifying fundamental fears was further detailed and summarized by Taylor (1993) as follows: “Reiss (1991), and personal communication, June, 1991) used two criteria to define these fears as fundamental: (1) they are fears of inherently noxious [aversive] stimuli, and (2) other, ‘common’ fears can be logically reduced to them (p. 289)”. The revised expectancy theory posited a hierarchical structure for fears that placed anxiety sensitivity, the fear of negative evaluation, and fears of illness or injury as distinct elements underlying all other fears and anxiety (Taylor, 1993).

Anxiety sensitivity was described as the propensity to catastrophically appraise the symptoms or sensations related to anxiety (e.g., increased heart rate, palpitations, trembling; Reiss & McNally, 1985; Taylor, 1993, 1999). Anxiety sensitivity focuses on fearing unrealized or potential consequences associated with the sensations of anxiety, rather than the anxious state itself (Taylor, 1993, 1999; Taylor, Koch, & McNally, 1992). Fear of negative evaluation was described as the propensity to fear being evaluated negatively by others (Heimberg, Brozovich, & Rapee, 2010; Leary, 1983). Illness or injury sensitivity was described as the propensity to fear experiencing physical harm and the associated consequences (Carleton, Asmundson, & Taylor, 2005; Mounce, Keogh, & Eccleston, 2010; Reiss, Peterson, Gursky, & McNally, 1986; Taylor, 1993). Reiss (1991, 1997) argued that the fundamental fears, in conjunction with a history of fearful responding, produce neuroticism or trait anxiety (Lilienfeld, Turner, & Jacob, 1993; Reiss, 1991, 1997). Researchers have subsequently argued that fear of pain (Carleton, Abrams, Asmundson, Antony, & McCabe, 2009) and IU may both be distinct and fundamental fears (Carleton, 2012).

A full discussion distinguishing IU from each of the other putative fundamental fears is beyond the scope of the current review and synthesis. In short, each of the other fears takes a specific object, whereas fear of the unknown by definition involves the absence of a specific object. That said, as argued previously (Carleton, 2012; Carleton, Sharpe et al., 2007), the anxiety – not the fear – associated with each of the fundamental fears depends almost entirely on the presence of at least one unknown and concordant BIS activation because of that unknown. For example, a somatic sensation (e.g., chest pain) that a person knows with sufficient certainty cannot lead directly or indirectly to any other aversive consequence may be uncomfortable, but is unlikely to cause anxiety; by contrast, if a person knows with sufficient certainty that the sensation will lead directly or indirectly to another aversive consequence, the anxiety will refer to the other aversive consequence, but not the sensation (Carleton, 2012; Carleton, Sharpe et al., 2007).

Previous theoretical and psychometric research has provided initial support for the independence of each fundamental fear from each of the other fundamental fears (e.g., Carleton, Thibodeau, Osborne, Taylor, & Asmundson, 2014; Taylor, 1993), from neuroticism or trait anxiety (e.g., Cornwell, Johnson, Berardi, & Grillon, 2006; Muris, Vlaeyen, & Meesters, 2001; Vancleef, Peters, Roelofs, & Asmundson, 2006), and from negative affect (e.g., Thibodeau, Carleton, Collimore, & Asmundson, 2012); however, research has also demonstrated correlations between the fundamental fears ranging from 0.24 to 0.76, indicating important levels of shared variance (e.g., Carleton, Thibodeau et al., 2014; Thibodeau et al., 2012).

9. Fear of the unknown and distress tolerance

Given the proposed definitions for fear of the unknown and IU, a brief comment on the relationship with distress tolerance appears warranted. “Distress tolerance is defined as the capacity to experience and withstand negative emotional states” (Simons & Gaher, 2005; p. 83). The authors describe the construct as a higher-order meta-cognitive construct associated with emotion regulation. Distress tolerance has been associated with several anxiety disorders (Leyro, Zvolensky, & Bernstein, 2010) and is generally thought to be a lower-order factor distinct from, but associated with functioning at a comparable level to, anxiety sensitivity (Bernstein, Zvolensky, Vujanovic, & Moos, 2009). IU is considered to be a lower-order construct that is specific to uncertainty and contributes to a broader higher-order construct that is distress tolerance (Zvolensky, Vujanovic, Bernstein, & Leyro, 2010). Accordingly, the contemporary theories for distress tolerance appear entirely con-

gruent with the proposed definitions and theoretical bases for fear of the unknown and IU. Recent evidence implicates IU as the most prominent lower-order factor underlying the higher-order distress tolerance construct (Bardeen, Fergus, & Orcutt, 2013). Assuming that relationship is robust, fear of the unknown may directly and indirectly undermine distress tolerance, making reductions in fear of the unknown and IU important goals for increasing distress tolerance in general. Evidence for such a proposition has recently been provided in a study exploring distress tolerance, anxiety sensitivity, and IU with patients who had a variety of anxiety-related disorders (Laposa, Collimore, Hawley, & Rector, 2015). Overall, the existing theories and evidence suggests an important relationship between IU and distress tolerance, both of which appear associated with anxiety sensitivity and psychopathology.

10. Fear of the unknown and measurement

Pending broad acceptance of the proposed delineations between fear of the unknown, IU, and expected consequences, as well as the cognitive and behavioural responses thereafter, researchers may benefit from developing distinguishing measures. There are several measures of IU that implicitly assess fear of the unknown; for example, the Intolerance of Uncertainty Scale (Freeston et al., 1994), the Intolerance of Uncertainty Scale short form (IUS-12; Carleton, Norton, & Asmundson, 2007), the Intolerance of Uncertainty Index (IUI; Carleton, Gosselin, & Asmundson, 2010; Gosselin et al., 2008), a situation specific version of the Intolerance of Uncertainty Scale short form (IUS-SS; Mahoney & McEvoy, 2012b), and a measure of IU with disorder-specific language (DSIU; Thibodeau et al., 2015). There are also at least two measures designed to assess IU in children (Comer et al., 2009; Rodgers et al., 2012), which should facilitate researching IU in youth. Across all of the measures, many of the items very reasonably focus on uncertainty, with some assessing IU generally (e.g., the IUS and IUS-12), others distinguishing what might be called trait IU items from the associated cognitive and behavioural responses (e.g., IUI), others focusing on IU within situationally specific contexts (e.g., the IUS-SS), and others within specific symptom categories (e.g., DSIU); however, none explicitly assess fearing the unknown. Future theorists and researchers should consider whether the constructs can and should be distinguished with separate measures. Regardless, more research is needed assessing behavioural correlates of self-reported levels for fearing the unknown and IU.

11. Fear of the unknown and treatment

Clark and Beck (2010) emphasize the importance of reducing fearful responses to unknowns in describing the focus of therapy for reducing anxiety-related pathology. “Cognitive therapy focuses on helping clients recalibrate exaggerated threat appraisals and increase their tolerance for risk and uncertainty related to their anxious concerns” (p. 37). “Increasing self-confidence to deal with threat and uncertainty is an important objective of cognitive therapy for anxiety” (p. 38). Carleton (2012) argued further that, effectively, all therapies involve attempts to mitigate fear of the unknown; specifically, catastrophic misperceptions resulting from absent information can be corrected; realistic threats can be minimized, managed, or removed; uncertainty can be minimized; certainty regarding coping can be increased; or the ability to tolerate uncertainty can be increased. Therapies designed “to remove threats, increase certainty, and create coping capacity, all facilitate a sense of agency – illusory or otherwise – thereby reducing clinically-significant symptoms of anxiety (and probably depression). Increasing tolerance for uncertainty, while potentially more challenging, may well provide the most pervasive benefits” (p.

942). There is room for debate as to whether therapy reduces fear of the unknown or increases tolerance for uncertainty; nevertheless, there is substantial evidence that changing interactions with unknowns has therapeutic value.

Perhaps the earliest and most recognized dedicated treatment protocol for reducing fear of the unknown was designed by Dugas and Ladouceur (Dugas & Ladouceur, 2000; Ladouceur, Dugas et al., 2000). The treatment is described as specific to IU and effective for reducing generalized anxiety disorder symptoms (Cuijpers et al., 2014; Dugas & Ladouceur, 2000; Dugas & Robichaud, 2007; Hanrahan, Field, Jones, & Davey, 2013; Ladouceur, Dugas et al., 2000), but also produces changes within broader constructs, such as neuroticism (Buhr & Dugas, 2009; Dugas, Laugesen, & Bukowski, 2012; Ladouceur, Dugas et al., 2000; Ladouceur, Gosselin, & Dugas, 2000). Similar reductions have been evidenced using acceptance based behavioural therapies to target IU for generalized anxiety disorder symptoms (Treanor, Erisman, Salters-Pedneault, Roemer, & Orsillo, 2011).

Treatments targeting IU have also produced reductions beyond generalized anxiety disorder symptoms. For example, Hewitt, Egan and Rees (2009) have used the IU section from Dugas and Robichaud (2007) to successfully reduce symptoms of social anxiety in a single patient trial. Similarly, Mahoney and McEvoy (2012a) provided a 7-week cognitive behavioural group therapy for persons with social anxiety disorder. The therapy included teaching participants to tolerate uncertainty before, during, and after social situations. The importance of reducing IU was emphasized throughout treatment, with behavioral experiments framed as tests that (1) examined if feared outcomes occurred, and (2) served as opportunities to practice tolerating not knowing how participants were judged. Reductions in IU predicted subsequent reductions in social anxiety symptoms, implicating a causal relationship in line with propositions from the current review and synthesis. Recently, McEvoy and Erceg-Hurn (2016) demonstrated again that reductions in IU were critically associated with changes in symptoms of social anxiety and generalized anxiety, further supporting the transdiagnostic importance of IU for treatment. Researchers have also compared metacognitive therapy to Dugas and Robichaud’s (2007) IU- focused therapy (van der Heiden, Muris, & van der Molen, 2012); both treatments reduced IU and generalized anxiety disorder symptoms, with van der Heiden’s demonstrating benefits relative to a delayed treatment condition, therein further evidencing the importance of IU to generalized anxiety disorder and the capacity of targeting IU for reducing symptoms.

Extending existing research on IU to support transdiagnostic treatments, per Carleton’s (2012) recommendation, will likely require including specific, explicit, elements for mitigating IU and fear of the unknown that build on the well-established work of Dugas and colleagues (Buhr & Dugas, 2009; Dugas et al., 2012; Ladouceur, Dugas et al., 2000; Ladouceur, Gosselin et al., 2000), among others. Boswell et al. (2013) have provided evidence to support Carleton’s (2012) proposition that reducing fear of the unknown or increasing tolerance for uncertainty represents a common factor for treating anxiety and mood disorders. The Unified Protocol for the Transdiagnostic Treatment of Emotional Disorders (Barlow et al., 2011) has been suggested to be “particularly well-suited to address a shared feature such as IU, due to the treatment’s focus on commonly employed experiential control strategies that have been linked with this dispositional characteristic (e.g., worry, ritualistic behavior, rumination, safety signals), as well as identification of and exposure to situations that are avoided because they may trigger experiences of uncertainty (e.g., situations that may elicit panic sensations)” (Boswell et al., 2013). Patients with various diagnosed disorders (i.e., generalized anxiety disorder, obsessive compulsive disorder, panic disorder, social anxiety disorder, or multiple diagnoses) received the treatment in a 16-week random-

ized control trial (Farchione et al., 2012). The treatment produced substantial reductions in symptoms (Farchione et al., 2012), which a subsequent analysis associated with significant decreases in IU (Boswell et al., 2013). Such research provides important initial evidence underscoring IU and, by extension, fear of the unknown as causally critical for psychopathology.

Perhaps most recently, Einstein (2014) reviewed related treatment models (including the aforementioned work by Dugas and colleagues), proffering thereafter a transdiagnostic model that explicitly focused on IU as part of treatment. Einstein's review offers potential avenues for targeting IU as a transdiagnostic construct within several disorder-specific contexts. The current review and synthesis with construct delineations should help to inform the ongoing development of all such transdiagnostic treatment models, as well as broader models of psychopathology, personality, and psychology.

12. Summary

The current review and synthesis extends previous work with fear of the unknown and IU in several critical ways. First, key elements were defined and fear of the unknown was distinguished from related constructs, particularly IU (see Figs. 1 and 2). Second, fear of the unknown and IU were contextualized within contemporary models of emotion, attachment, inhibition, and neuroticism. Third, contemporary research on the relationship between IU – and by proxy fear of the unknown – and symptoms of anxiety and depression was highlighted.

An unknown is the perceived absence of information at any level of consciousness or processing. Fear of the unknown is an individual's propensity to experience fear caused by the perceived absence of information at any level of consciousness or point of processing. IU describes an individual's incapacity to endure the aversive (i.e., fearful) response triggered by the perception of one or more salient or key unknowns and sustained by the associated perception of uncertainty.

Contemporary appraisal theories of emotion emphasize the importance of identifying and perceiving unknowns, which occurs across each level of emotion processing from low-level neural substrates to conceptual cortical areas (Mulligan & Scherer, 2012; Scherer, 2009, 2013). Accordingly, a response bias to unknowns would be a defining characteristic for emotions, the aggregate of which would define affective dispositions (Scherer and Brosch, 2009). Attachment research has long underscored the critical role of unknowns in developing secure attachment (Ainsworth & Bell, 1970; Bowlby, 1973) and influencing temperament (Colnnesi et al., 2011; Degnan & Fox, 2007; Lewis-Morrarty et al., in press; Madigan et al., 2013). The BIS describes neurobiological foundations of fear and anxiety as activated by unknowns perceived as anxiety-provoking "sources of potential danger" (Gray & McNaughton, 2003; p. 53). Clark and Beck (2010) implicate fear of the unknown and IU as basic cognitive processes underlying all anxiety disorders. Similarly, Barlow and colleagues implicate unknowns and IU as causally influencing anxiety (Boswell et al., 2013).

Across the empirically supported models there appears to be conceptual support for Carleton's (2012) summary proposition that fear of the unknown may represent a "logically necessary . . . transdiagnostic dispositional risk factor for clinically significant anxiety and depression" (p. 943). There is also substantial and growing empirical support that IU, and by extension fear of the unknown, plays a critical and causal transdiagnostic role for anxiety and depression (Hong & Cheung, 2015). Going forward, fear of the unknown and IU should be explored as explicit, rather than implicit, components of psychoeducation and explicit targets

for exposure and cognitive restructuring. If fear of the unknown is the driving element for IU and therein anxiety, understanding and influencing that fear will have broad reaching theoretical and practical utility for predicting and modifying individual differences, behaviours, and transdiagnostic symptoms. As such, fear of the unknown may be a, or possibly the, fundamental fear, representing an Archimedean lever for human psychology.

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