The curiosity catch. An exploratory transdiagnostic approach to understanding how different facets of curiosity relate to mental health dimensions

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*D*éclaration d'usage de l'intelligence artificielle (IA)

Je déclare qu'au cours de la préparation du travail *de mémoire intitulé THE CURIOSITY CATCH. A transdiagnostic approach to understanding how different facets of curiosity relate to anxiety, depression, obsessive-compulsive behaviors, and cyberaddiction*

☒ *J'ai utilisé ChatGPT dans le but de recevoir un soutien quant à la justesse grammaticale et orthographique de mon texte, que j'ai rédigé personnellement au préalable. Après avoir utilisé cet outil, j'ai révisé et édité le contenu selon les besoins et assume l'entière responsabilité du contenu de la publication.*

Les parties concernées sont : Abstract, Theoretical part, Curiosity and mental health, Project objectives and research question, Methodology, Results, Discussion, Conclusion.

Dans le cadre de l'évaluation de ce travail il peut m'être demandé de fournir les prompts utilisés.

☐ *je n'ai pas utilisé de technologies d'intelligence artificielle générative pour la préparation de ce travail.*

Genève, le 12 août 2025

Floriana Poggia

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ABSTRACT

Curiosity is an intrinsic desire to acquire new knowledge and experiences driving exploratory behavior and it appears to play an ambivalent role in relation to mental health. This may be partly due to the diversity of assessment measures employed across the literature. To gain a more holistic understanding of which aspects of curiosity may support or hinder mental health, we investigated the interplay between its multiple facets - using the Five-Dimensional Curiosity Scale Revised (5DCR) - and common aversive mental conditions, including anxiety, depression, obsessive-compulsive behaviors, and cyberaddiction. Adopting a transdiagnostic perspective, we first conducted an exploratory factor analysis to identify core dimensions underlying these conditions. In a second step, we performed a network analysis including the extracted factors and the curiosity subscales. Results revealed that different facets of curiosity were differentially related to mental health outcomes. Particularly, stress tolerance emerged as a central facet, showing the strongest associations with anxiety-depression, compulsive behavior, and problematic media use, and partially acting as a bridge between those dimensions and other facets of curiosity. Additionally, thrill-seeking - through its link to impulsivity - was identified as potentially unfavorable, particularly in its relation to problematic media use. The remaining curiosity facets showed weaker or no direct associations with mental health factors. The study suggests that the ability to tolerate the stress caused by a lack of information and channeling thrill-seeking into constructive activities seem to be key conditions for curiosity to foster learning and growth, rather than to be associated with aversive mental states.

1. Introduction

Curiosity is a fundamental driver of human behavior. Whether expressed through the endless stream of "why" questions children ask or the historical voyages of explorers venturing beyond the Pillars of Hercules, curiosity reveals our desire to understand the unknown. Today, it drives researchers to study the Martian soil in search for past extraterrestrial life and when aided by modern technology, curiosity prompts individuals to delve into the biography of artists to guess the meaning behind their lyrics, stay updated on a friend's latest weekend trip, or discover a complete stranger's career journey on social media. Although defining curiosity has challenged researchers for over 70 years - and remains a work in progress - one broadly accepted definition describes it as a desire to acquire new knowledge and experience that intrinsically motivates exploratory behavior (Berlyne, 1954; Kashdan & Steger, 2007; Kashdan & Silvia, 2009; Loewenstein, 1994), with its core function being to drive learning (Kidd & Hayden, 2015). Research on curiosity has highlighted the numerous benefits of this openness to exploration, such as enhanced memory for the content an individual is curious about (Gruber et al., 2014; Kang et al., 2009); greater curiosity is associated with better academic performance (Von Stumm et al., 2011), higher work engagement and satisfaction (Kashdan et al., 2020), greater creativity (Schutte & Malouff, 2020) and contributes to the pursuit of a meaningful and satisfying life (Kashdan & Steger, 2007; Tan et al., 2023). When nurtured over time, curiosity helps grow knowledge, improve skills, strengthen social connections, and consequently support overall mental well-being (Gallagher & Lopez, 2007; Kashdan & Steger, 2007; Silvia & Kashdan, 2009).

In relation to mental health, research suggests that curiosity can enhance resilience in populations experiencing psychological distress. Indeed, curiosity has been found to protect against suicidal thoughts (Denneson et al., 2017; Kachadourian et al., 2019) or to promote self-compassion (Kwok et al., 2022). Curiosity can likewise attenuate the effect of daily stressors on negative mood (Drake et al., 2022) and it is associated with lower levels of depression and anxiety (Kaczmarek et al., 2014; Lydon-Staley et al., 2020; Zainal & Newman, 2023). On the other hand, curiosity seems to play an ambivalent role in inducing addictive behaviors, serving as facilitator of alcohol consumption (Lindgren et al., 2010) and social media addiction (Zahoor et al., 2022). This raises the question: are there *adaptative* and *maladaptive* types of curiosity? Studying these diverse relationships seems important for understanding how varying sides of curiosity can positively or negatively influence mental well-being.

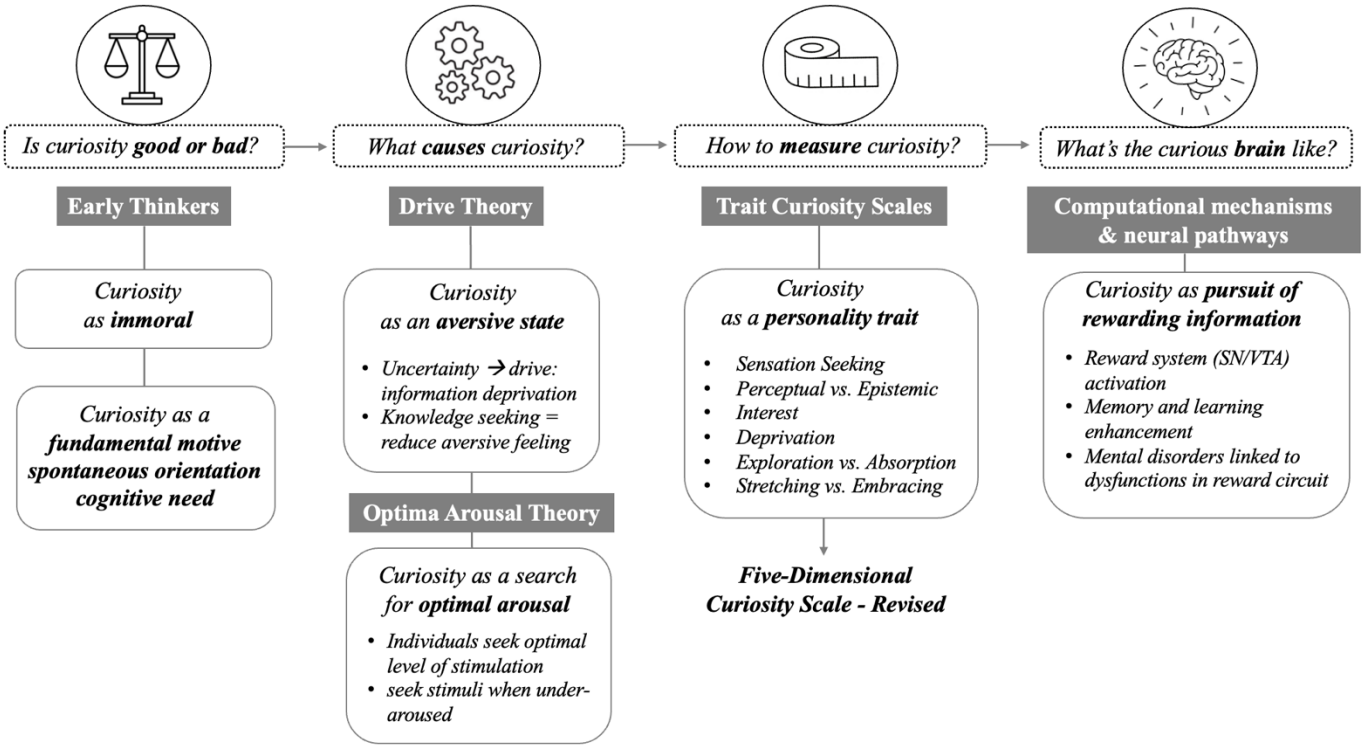
2. Theoretical part

Defining curiosity: key theories, models and scales

Part of the reason behind these mixed results is likely to be the rather disparate development of the definition of curiosity throughout the literature, with opposing or unrelated views leading to different models and scales. In this section, we will provide a historical overview of the study of curiosity (Figure 1).

Figure 1

Historical evolution of the study of curiosity



Early thinkers of curiosity

Despite the many benefits associated with curiosity, it hasn't always been regarded as desirable and such ambivalence continues to intrigue researchers. Discussions around curiosity predated the emergence of psychology as a scientific field and were first led by philosophers and religious intellectuals who focused on its *moral* implications (Loewenstein, 1994). In the Middle Ages, influential Italian priest Aquina (Littlejohn, 2017) deemed curiosity as a vice when the pursuit of knowledge stemmed from inappropriate reasons and methods - in modern terms, he could have occasionally referenced the saying *curiosity killed the cat*. Later on,

psychologist William James (1899) regarded curiosity as a fundamental psychological motive, describing it as an "impulse towards better cognition*"* (p. 37), meaning the intrinsic desire to understand the unknown. Physiologist Pavlov interpreted the spontaneous orienting behavior in dogs to novel stimuli (called the *what-is-it?* reflex) as a form of curiosity (Pavlov 1927, as cited in Kidd & Hayden, 2015). Maslow (1970, as cited in Kashdan, 2020) later identified curiosity as a cognitive need within his renowned hierarchy, driving the pursuit of knowledge and facilitating personal growth. These merely descriptive models of curiosity were eventually outshined by an increasing body of scientific research, experiencing two significant waves of activity. The first wave, in the 1950-60s, primarily examined the psychological *causes* underlying curiosity. A second wave emerged in the mid-1970s, focusing on the challenge of *measuring* curiosity (Loewenstein, 1994).

Before diving into the major lines of thought and theoretical models of curiosity, a fundamental distinction must be made between *state* and *trait* curiosity. State curiosity is elicited by a specific situation and is therefore temporary. In contrast, trait curiosity is defined as a relatively stable personality disposition that drives individuals to seek out experiences that stimulate curiosity (Markey & Loewenstein, 2014).

Drive theory of curiosity

So, what triggers curiosity? Initially, theorists sought to explain state curiosity and it was first regarded as an unpleasant experience, a drive. Most renowned drive theorist Hull (1943, as cited in Silvia, 2012) proposed in his *drive-reduction-model* that when an organism is faced with a strong external stimulations or internal deficits, it experiences an aversive state of drive. Because reducing this drive feels rewarding, behaviors capable of drive reduction are performed and reinforced in the long run. Daniel Berlyne (1954), a pioneering researcher in the study of curiosity, initially adhered to this view and introduced the concept of *epistemic curiosity* - defined as a *drive to know*, which can be satisfied through information-seeking behaviors. Epistemic curiosity is to be distinguished from *perceptual curiosity*, which is rather triggered by sensory stimulation as visual, auditory, and tactile stimuli, and refers to a *drive to experience and feel*. In Berlyne's view, epistemic curiosity arises when individuals encounter *uncertain* situations, and this experience induces a distressing sense of information deprivation. In this perspective, individuals are curious or seek knowledge so to reduce this uncomfortable feeling

of uncertainty. In Silvia's (2012) words, drive theorists liken curiosity to "scratching a mental itch" (p. 158).

Although the concept of curiosity as a drive was later challenged, including by Berlyne himself (Berlyne, 1966), curiosity-reduction models have experienced renewed attention, largely influenced by the work of Loewenstein (1994) and his *information-gap-theory*. In line with drive theory, Loewenstein suggests that curiosity arises when individuals detect a gap between what they know and what they wish to know in a certain situation. This perceived information discrepancy creates a sense of deprivation, motivating individuals to seek information so to bridge this gap. This theory suggests that as individuals acquire a small amount of knowledge, their desire for more information increases significantly, expanding the perceived information gap. However, once a certain level of understanding is reached, this gap diminishes, leading to a decline in curiosity. In line with the famous proverb *appetite comes with eating*, a small appetizer of information intensifies the craving for more, while an abundance of information diminishes curiosity, much like satiety after a meal. Kang et al. (2009) later tested Loewenstein's hypothesis that curiosity reflects an information gap demonstrating that curiosity about the answer to a trivia question is an inversed U-shaped function of confidence about knowing the answer. Specifically, curiosity is lowest when individuals have either no knowledge of the answer or were completely certain about it; as per information-gap theory, individuals with little knowledge haven't yet had their curiosity tickled, while those with extensive knowledge are already satiated. Conversely, curiosity peaked when individuals had some knowledge but lacked confidence, hence when they sensed a significant information gap.

Optimal Arousal Theory of curiosity

But how would drive theory explain voluntary information- or experience-seeking behaviors such as wanting to know how black holes were discovered, sitting at a Philip Glass opera for the first time or trying psychedelics? If curiosity is a drive, and drives are aversive, one would expect people to want to minimize curiosity rather than pursue it. A collection of studies on non-human primates exhibits curiosity-driven behaviors, seeking information and novel experiences beyond the satisfaction of basic drives as hunger or safety. Indeed, Harlow (1950, 1953) showed that rhesus monkeys display exploratory behavior by voluntarily spending time solving mechanical puzzles without any extrinsic reward, and Fowler (1958) demonstrated that when rats are set in a T-maze, they show curiosity by increasing their exploration of novel or

altered stimuli in their environment. More recent studies indicate that monkeys would even sacrifice rewards to obtain information about counterfactual outcomes (Wang & Hayden, 2019). Studies on humans investigated the effect of lack of stimulation on cognition (Bexton et al., 1954; Heron, 1957), which, for drive theorists, should represent an ideal state. In Bexton et al.'s (1954) study, students were placed in a deprivation room that minimized all sensory stimulation, including tactile, visual, and auditory input. The results showed that after only a few hours of deprivation, they experienced perceptual deficits and cognitive disturbances such as decreased performance on numerical tests, and an inability to concentrate. Additionally, subjects experienced hallucinations ranging from mild visual effects like seeing dots of light to dreamlike distortions, hearing voices, or even a sense of having two bodies side by side. These studies demonstrate how under-stimulation can have non-adaptive effects. People prefer any kind of stimulation, even electric shocks (Eder et al., 2022; Wilson et al., 2014), rather than a complete lack of it. Such behaviors posed a paradox for drive theorists: if an organism voluntarily sought out curiosity-arousing stimuli, then there had to be something more than mere drive reduction motivating their exploration.

In the 1960s, the Optimal Arousal Theory addressed this crack in the wall, by offering an alternative explanation for curiosity and exploration behaviors. It suggested that humans and animals are driven to maintain an *optimal* level of arousal (OLA), which is pleasurable, while both under-arousal and over-arousal are unpleasant (Litman, 2005). As a result, an organism will tend to withdraw from stimuli when overaroused (i.e., when afraid or overwhelmed) but will actively seek out curiosity-provoking stimuli when underaroused (i.e., when bored), so to raise arousal to an optimal level. Unlike drive theorists, proponents of the optimal arousal model argued that exploratory behavior is aimed at *stimulating* curiosity rather than *satisfying* it and proposed that the arousal associated with curiosity is a positive emotional experience (Litman & Jimerson, 2004; Litman & Silvia, 2006). In Kuhn's (1962) sense, this shift marked a change of paradigm in the understanding of curiosity.

In 1966, Berlyne adopts this new approach, now proposing two types of curiosity and exploration modes, both driven by the need to reach an optimal level of stimulation. He labeled these types as *diversive* and *specific* exploration. Common to both types is firstly the idea that they are triggered when organisms encounter a specific set of stimulus properties, which he termed *collative*. These properties include the degree of *novelty, unexpectedness, incongruity, complexity,* and *variability* of a stimulus. The greater the presence of these properties, the more

likely it is that encountering such stimuli will trigger internal conflict in the subject, creating a sense of uncertainty and thereby motivating exploration. Secondly, exposure to collative stimuli increases a person's arousal level - a psychophysiological response defined as a state of alertness or excitement at a given moment - which ultimately drives the need to explore. In contrast, as a stimulus loses its novelty through repeated exposure, its ability to elevate arousal also diminishes. *Diversive* exploration is a reaction to under-stimulation due to sensory deprivation or exposure to monotonous environments, inducing a low level of arousal. This feeling of boredom is aversive and drives the organism to seek stimulation, regardless of its source or content, as long as it is novel and complex enough to raise its arousal up to an optimal level. This type of exploration could explain sensation-seeking behaviors like the previously mentioned preference for electric shocks over no activity or rats preferring to explore unfamiliar parts of a maze. Anyone who has spent hours waiting at an airport, hoping for anything to break the monotony, can probably relate to this need for stimulation. *Specific exploration*, on the other hand, is driven by a lack of information when confronted with collative stimuli, causing a conceptual conflict with one's knowledge. The inadequacy of the information held then raises the arousal level, resulting in an aversive state of uncertainty and an investigation to acquire specific information capable of reducing such conflict is therefore initiated. For instance, monkeys exhibit specific curiosity when solving mechanical puzzles without any extrinsic incentive. One could therefore be curious and explore either to alleviate monotony or close an information gap, both behaviors aiming at reestablishing an optimal level of arousal, whether by raising or reducing it.

Curiosity as a personality trait and the emergence of scales

While optimal-arousal theorists attempted to explain the fundamental causes of curiosity and exploratory behavior, it became increasingly clear that this *optimal level* of arousal differed from person to person and is therefore potentially linked to personality. Eysenck (1967) examined the link between arousal, affect, and personality in introverts and extroverts, finding that introverts are more easily aroused than extroverts, who therefore seek higher stimulation levels. Expanding on this, Geen (1984) showed that both types aim for optimal arousal but have different thresholds: introverts felt overstimulated by noise levels preferred by extroverts, while extroverts found introverts' chosen noise levels under-stimulating. Zuckerman (1979) highlighted that the tendency to seek stimulating experiences is a stable personality trait. These studies then fueled the idea that curiosity might not only be a mere reaction to external stimuli

(state curiosity) but also a *personality trait.* This recognition started the second wave of curiosity study in the 1970s, during which researchers explored different aspects of trait curiosity, resulting in isolated strands of research and an eclectic range of scales designed to assess individual differences (Litman & Silvia, 2006). For example, Zuckerman's (1964, 1979) Sensation Seeking Scale (SSS) assessed individual tendencies to seek novel sensory stimulation through social exploratory behavior. Other scales were grounded in Berlyne's theoretical framework of perceptual and epistemic curiosity (Litman & Spielberger, 2003).

However, the field's most animated debate concerns whether exploration of novel stimuli is experienced as positive or aversive. Some scales define curiosity as a pleasurable sense of interest and enjoyment when engaging with new stimuli (Kashdan & Silvia, 2009; Litman & Silvia, 2006; Spielberger & Starr, 1994). In contrast, others adopt the drive-reduction perspective, viewing curiosity as an uncomfortable state of uncertainty compelling individuals to seek information and close the knowledge gap (Litman & Jimerson, 2004; Loewenstein, 1994). While these perspectives may seem contradictory, they aren't mutually exclusive. Indeed, Litman and Silvia (2006) found that these two views of trait curiosity are correlated, yet distinct and which aspect prevails depends on dispositional characteristics in response to curiosity-evoking stimuli. Curiosity researcher Todd Kashdan has, over the years, developed various scales designed to capture different aspects of curiosity. For instance, as a two-factor construct, consisting of *exploration* and *absorption*. Exploration refers to the tendency to seek out new information and experiences, while absorption is the ability to become deeply focused on tasks, similar to a state of *flow* (Kashdan et al., 2004). He and his colleagues later introduced the aspects of *stretching* and *embracing* (Kashdan et al., 2009), with stretching referring to the motivation to actively seek out new knowledge and experiences, while embracing captures the willingness to accept the uncertainty inherent in life.

This broad range of co-existing measures supports the idea that curiosity is a multidimensional trait. Building on this understanding, Kashdan et al. (2018) recently proposed an integrative model that captures curiosity as a multifaceted construct. This model challenges the assumption of a homogeneous population that can be classified along a single continuum from incurious to highly curious. Instead, it suggests that individuals have unique curiosity profiles shaped by different scores across various facets - and, consequently, different motivations for exploration.

The Five-Dimensional Curiosity scale (5DC)

To synthesize the existing isolated body of research on curiosity Kashdan et al. (2018) reviewed prior scales mentioned above and developed new items capturing various aspects of the construct. On one hand, the items reflect curiosity as both a desire to seek out information and novel experiences for enjoyment, as well as a drive to explore to fill information gaps. On the other hand, the authors propose that effective exploration requires individuals to manage the negative emotions that often arise when engaging with complex or unfamiliar information. Therefore, their scale incorporates the ability to tolerate the stress associated with facing information gaps. Additionally, inspired by research on sensation-seeking and adventurousness, items capture the intrinsic thrill individuals experience from novelty. Finally, recognizing the social nature of humans, the scale also accounts for social curiosity - the pursuit of information to strengthen interpersonal relationships. Exploratory factor analysis revealed five distinct but related dimensions of curiosity, and the strong convergence with validated curiosity scales supports the validity of these dimensions. Test-retest data suggest that these curiosity dimensions are relatively stable over time. Building on these findings, Kashdan et al. (2018) proposed the Five-Dimensional Curiosity scale (5DC), an integrative framework that allows researchers to incorporate these different aspects rather than choosing between competing measures. The scale includes the following five dimensions:

1. **Joyful exploration,** characterized by a tendency to view challenging situations as opportunities for growth and learning, with individuals actively seeking experiences that challenge their self-perception and understanding of the world. This process requires deep reflection, and those who exhibit joyful exploration often find the acquisition of new information fascinating.
2. **Social curiosity** is closely related, reflecting a focused interest in understanding others, their habits and the reasons behind their thoughts and behaviors. People with high social curiosity enjoy listening to conversations, even those implying conflict, as they seek to uncover its underlying motivations.
3. **Sensation seeking**, a trait marked by a preference for thrilling activities that evoke excitement and a sense of vitality. Sensation seekers take risks enthusiastically, prefer spontaneous over planned activities, and are drawn to friendships that bring excitement and unpredictability.
4. **Stress tolerance** is defined as the ability to manage the discomfort that arises from facing uncertainty, a fundamental skill necessary for engaging in exploration.

Individuals low on this facet may find that even minor doubts prevent them from engaging in new experiences, as they struggle to manage the stress that accompanies uncertainty. For these individuals, functioning in novel and unfamiliar situations can become difficult, with concentration and confidence hindered, making them reluctant to explore new environments unless they feel secure.

5. **Deprivation sensitivity** also arises in situations of uncertainty, and it involves seeking information to escape the tension of not knowing something. Those high in deprivation sensitivity often cannot set aside unresolved issues and may persistently focus on difficult conceptual problems, sometimes even losing sleep due to the frustration of not finding the answer. This relentless drive to resolve questions mirrors the curiosity seen in joyful exploration, but manifests as an urgent need for understanding, making it difficult to relax without closure.

Shortly after, Kashdan et al. (2020) found evidence for a distinction within the social curiosity dimension, separating it into *overt* and *covert* social curiosity. The first refers to a direct interest in other people's behaviors, thoughts, and feelings, while the second involves the same interest, but the information is acquired through what they describe as "surreptitious" means (p. 2) - that is, in a secretive and hidden manner, without being seen. This distinction was subsequently incorporated into their Five-Dimensional Curiosity scale - Revised (5DCR).
The six facets combine both positive and potentially harmful aspects of curiosity, highlighting the need to examine curiosity in a differentiated way.

Contemporary research on curiosity

Contemporary research on curiosity is primarily concerned with understanding the psychological and computational mechanisms of information-seeking behavior, particularly in the absence of extrinsic rewards (Murayama, 2022), as well its neural pathways. Indeed, research has highlighted the importance of key brain regions involved in *reward*, *memory*, and *learning* (Cervera et al., 2020). The reward system, primarily linked to the brain's capacity to experience pleasure, drive motivation, and reinforce learning, relies heavily on dopamine, with dopaminergic neurons being mainly located in midbrain structures such as the substantia nigra and the ventral tegmental area (VTA; Arias-Carrión et al., 2019). Research by Chau et al. (2004) indicates that during reward anticipation, dopaminergic projections from the VTA activate areas like the nucleus accumbens and caudate nucleus (parts of the striatum), thalamus, and

amygdala, while reward consumption predominantly activates subregions of the prefrontal cortex, especially the orbital and medial frontal cortices, with reduced activity in the caudate, accumbens, and amygdala. While subcortical regions are crucial for the motivational and emotional aspects of rewards, frontal subregions are responsible for evaluating their value and emotional intensity. In perhaps one of the earliest neuroscientific studies on human curiosity, Kang et al. (2009) demonstrated the critical role of reward system activation in curiosity. Participants read trivia questions, rated their curiosity to know the answers, and then received the answers, all while lying in fMRI scans. The findings showed that while reading the question, self-reported curiosity levels correlated with caudate nucleus activity. Subsequent studies replicated these findings, reporting activation in the midbrain and striatum during the anticipation of information (Bromberg-Martin & Hikosaka, 2009; Charpentier et al., 2018; Gruber et al., 2014). These results support the view that curiosity involves anticipating rewarding information and even more, that information has an inherent rewarding value that reinforces our information-seeking behavior, even without external rewards (Murayama, 2022). Another essential function linked to curiosity is its role in enhancing *memory and learning*. Kang et al. (2009) found that when trivia answers were revealed, areas associated with learning and memory, such as the parahippocampal gyrus and hippocampus, showed stronger activation if the participant's prior guess was incorrect. This suggests curiosity enhances memory for surprising new information. Additionally, higher curiosity levels about trivia questions correlated with better recall weeks later (Kang et al., 2009; Gruber et al., 2019).

Together, these findings suggest that curiosity engages the brain's reward regions to drive information-seeking behavior, so to reduce uncertainty about the world. Dysfunctions in these pathways are linked to various conditions, such as mood disorders, obsessive-compulsive disorder and addiction (Chau et al., 2004; Figee et al., 2011; Ng et al., 2019). On this basis, curiosity may play a central role in mental health, although the specificity and direction of this relationship remain to be clarified.

2 Curiosity and mental health

The World Health Organization (WHO) defines mental health as a "state of mental well-being that enables people to cope with the stresses of life, realize their abilities, learn well and work well, and contribute to their community… with mental health being more than a simple absence of illness" (WHO, 2025a May 1st).

Curiosity and mental well-being

As previously mentioned, research on the links between curiosity and mental health reveals ambivalent associations. On the positive side, Gallagher et al. (2007) examined the relationship between trait curiosity (as exploration and absorption) and psychological, social, and emotional well-being, finding that curiosity, particularly the exploration aspect, is positively associated with well-being. Similarly, Vermeer et al. (2022) found a positive link between curiosity as information-seeking for one's interest (i.e., for adopting healthy behaviors during the Covid-19 pandemic) and well-being measures, yet mediated by loneliness, meaning that more curious people tend to feel less lonely, which in turn boosts well-being.

Closely related to well-being is the concept of flourishing, defined as a state of *holistic* well-being encompassing emotional resilience, social involvement, intellectual fulfillment, and mental health; flourishing extends beyond mere happiness to include meaningful engagement and contribution to society (Schotanus-Dijkstra et al., 2016). In this regard, Le Cunff (2024) found that curiosity, understood as a deliberate decision to explore rather than an impulsive response, directly contributes to flourishing through the intellectually fulfilling experience of learning. Indirectly, it enhances factors that contribute to flourishing - for example, seeking novel experiences with others can improve social relationships, which in turn supports flourishing. Regarding social aspects, Kawamoto et al. (2017) found that curious people tend to be less affected by social rejection - partly because they are less sensitive to it and partly because they seem better equipped to cope with such experiences. Indeed, they show heightened ability to manage conflict and uncertainty, lower anxiety in social situations, and reduced tendency to respond aggressively when feeling hurt, all contributing to resilience, higher life satisfaction and less tendency towards depression (Kawamoto et al., 2017). Such heightened resilience has also been observed in studies on military veterans suffering from PTSD symptoms. Denneson et al. (2017) found that the most curious individuals tend to experience fewer suicidal thoughts when faced with emotional distress (i.e., due to flashbacks). Similarly, when examining protective factors against suicidal thoughts in this population, Kachadourian et al. (2019) identified a negative association between curiosity and suicidal ideation. Furthermore, a study on adolescents having experienced emotional abuse in childhood, showed that greater curiosity in these teens is associated with more self-compassion (Kwok et al., 2022).

Some nuancing on the power of curiosity on well-being is however introduced by various studies. Jovanovic and Brdaric (2012) measured curiosity as stretching and embracing and showed that highly curious individuals exhibited positive correlations with measures of well-being (life satisfaction, purpose in life, and positive affect), compared to those with low or moderate levels of curiosity; however, no significant differences were found in measures of emotional distress (anxiety, depression, stress, loneliness) among the three groups, suggesting that curiosity may facilitate well-being but does not necessarily prevent the experience of emotional distress. These authors consider these two emotional states to be distinct factors rather than opposite ends of the same continuum.

Similar ambivalence is found by Mishra (2024), who found that while both stretching and embracing correlate with aspects of well-being (as life satisfaction or positive experiences), these associations are mediated by an individual's self-efficacy beliefs, suggesting that seeking knowledge and accepting uncertainty can enhance well-being only when individuals are able to regulate their thoughts and behavior to achieve their goals. Hence, if one seeks information in a state of distress, this type of curiosity won't lead to well-being. In line with this idea, Li et al. (2023) examined the relationship between curiosity - as joyous exploration and deprivation sensitivity - and various dimensions of well-being (physical, dietary, emotional, psychological, and academic) in early adolescents. These authors found positive associations between joyous exploration and all measures of well-being, whereas deprivation sensitivity showed no significant link with any indicator. Since deprivation sensitivity reflects a state in which individuals seek information primarily to relieve anxiety and stress caused by an information gap, this facet of curiosity doesn't seem to contribute to well-being.

In what is probably the most advanced study to date of curiosity in relation to specific mental conditions, Kashdan et al. (2018) examined how each facet of their Five-Dimensional Curiosity model, relates to a range of psychological factors, including emotional experiences, anxiety, depression, and avoidance behaviors. Findings reveal that certain dimensions of curiosity positively contribute to mental health, while others are linked to negative outcomes. Joyous exploration and stress tolerance, for instance, are consistently associated with adaptive and healthy outcomes, showing a protective effect against symptoms of depression and anxiety. Deprivation sensitivity, or the "urgent need to know" aspect of curiosity, is expectedly the dimension most strongly associated with anxiety. Unlike joyous exploration or deprivation sensitivity, which are oriented towards learning, thrill seeking is more about pursuing excitement and positive emotions for their own sake, often through exposure to risky physical,

social, or financial situations; this dimension was found to be unrelated to anxiety and depression but could be related to impulsivity. An inverse relationship was found between stress tolerance and social curiosity, possibly because individuals with low stress tolerance may experience heightened discomfort when lacking relevant information about their social network. These findings highlight the potential benefits of leveraging individual curiosity profiles into promoting overall well-being. For instance, a strong inclination to explore, paired with a high tolerance for stress when faced with new experiences, tends to foster greater well-being compared to those with lower stress tolerance. Alternatively, a high sensation-seeking score can be a double-edged sword. Without being directed into constructive outlets like performance or sports, it can become a vulnerability, compromising an individual's health and safety.

These studies show the complex relationship between curiosity and well-being. If links between the positive facets of curiosity - such as stretching, embracing, or joyous exploration - seem robustly positive, the relationship between other facets - as deprivation sensitivity, stress tolerance, and thrill-seeking - and mental disorders could benefit from further research. According to the WHO, approximately 1 in 8 people - equivalent to 970 million individuals worldwide - are living with a mental disorder, with *anxiety*, *depression*, *obsessive-compulsive behaviors*, and *addictions* being among the most prevalent (WHO, 2025b May 1st). Understanding how curiosity dimensions may protect from such disorders or contribute to their development seems a crucial point to elucidate.

Understanding mental disorders

This section presents an overview of the epidemiology, phenomenology, and current etiological knowledge of the main mental disorders that we focused on in the current research, along with their known links to curiosity.

Anxiety disorders

Anxiety is an emotional response, closely related to fear. They both involve intense negative feelings, strong bodily manifestations, and avoidance tendencies. However, if fear is triggered in response to actual imminent threat (post-stimulus exposure), anxiety is felt in anticipation of potential future threats (pre-stimulus), causing heighten vigilance, worry and a tendency to avoid anxiety-eliciting situations (APA, 2022; Chorpita & Barlow, 2018; Öhman, 2008). Like

curiosity, anxiety can be differentiated into trait and state anxiety. Trait anxiety is a rather stable tendency or disposition to experience anxiety, whereas state anxiety is defined as a transitory emotional state elicited by a specific situation (Spielberger, 1983; Grös et al., 2007). This latter type is strongly related to the concept of stress, an emotional response of an organism following the perception of a threat in its environment (Fink, 2010) - such as an aversive event - that is considered significant to the individual's goal pursuit yet exceeds their perceived ability to deploy effective coping strategies to face the stressor (Folkman et al., 1986).
Stressful life events can induce a state of anxiety that prompts behaviors enhancing an individual's ability to cope with similar potential threats in the future. However, for some people, this response may generalize, triggering anxiety even in the absence of real threats. Although the generalization of emotional responses is an adaptive process for survival, excessive generalization to harmless stimuli that only vaguely resemble or are loosely associated with a learned threat can become a burden to daily life (Dunsmoor & Paz, 2015). In such cases, anxiety loses its adaptive function and can lead to exaggerated states that, over time, may contribute to the development of mental illness (Leuner & Shors, 2013).

Today, nearly 4% of the global population suffers from anxiety (WHO, 2025c May 1st). The DSM-V classifies anxiety as a mood disorder and identifies different forms, such as social anxiety, agoraphobia, panic disorder, and specific phobias (i.e., fear of spiders), with generalized anxiety disorder (GAD) being the most common (APA, 2022). This latter form of anxiety is characterized by persistent, excessive worry and apprehensive expectations that occur on most days for at least six months. Common symptoms are restlessness or feeling on edge, fatigue, difficulty concentrating, or having a blank mind, irritability, muscle tension, and sleep disturbances, including trouble falling or staying asleep. To be diagnosed as anxiety, these symptoms must cause significant distress or impair functioning in social, occupational, or other important areas.

Psychological processes involved in anxiety seem to be mainly related to interpretation and attention, with literature highlighting at least three types of cognitive biases. Firstly, identified by father of cognitive-behavioral therapy Aaron Beck, anxious individuals seem to present an interpretation bias, as a cognitive filter, or dysfunctional beliefs unique to each individual, coloring their appreciation of the world. Indeed, anxious people tend to view the world as a dangerous place, overestimating threats and underestimating their coping potential (Beck & Clark, 1978; Bower, 1981; Mathews & Mackintosh, 2000). A second, very much researched

and replicated bias is the selective attention bias, a tendency to allocate attention to threat-related stimuli rather than non-threatening ones (Mogg & Bradley, 2016). Anxious individuals tend to detect threatening stimuli more quickly than non-anxious ones, with such bias playing a vital role in the causation and maintenance of anxiety (Williams et al.; 1996, 1998). Finally, anxious individuals exhibit an inhibition bias, making it difficult to disengage once their attention is captured by a threatening stimulus (Heeren et al., 2011; Rudaizky et al., 2014).
In sum, anxious individuals may have experienced stressful events that shaped their perception of the world as a dangerous place, heightening their hypervigilance and sensitivity to potential threats. These threats may be directly linked to the original event or generalized to similar stimuli, triggering a fear response due to anticipated harm to their well-being and once these threats are perceived, individuals may struggle to disengage from them. The ongoing anticipation and avoidance of confrontation with the threat can perpetuate a state of uncertainty, reinforcing the need for vigilance, strengthening cognitive biases, and sustaining anxiety.

In their recent review, Hilmerich et al. (2024) examined existing studies on the neuroanatomical underpinnings of both anxiety and curiosity. Interestingly, the anterior cingulate cortex (ACC), a structure also known for its role in processing prediction errors resulting from the comparison between expectations and actual outcomes, appears to be a key region involved in both emotions. The authors propose that individuals form expectations about how stimulating, demanding a stimulus or situation will be. When faced with the actual situation, if a mismatch appears between their expectation and the actual stimulation demand, a prediction error occurs. If the stimulus is less arousing or threatening than the individual's level of readiness or motivation to engage - so the situation is perceived as manageable despite uncertainty - curiosity is likely to arise, leading to approach behavior. In contrast, if the stimulus is more arousing than the person's willingness or ability to engage - meaning the situation feels too intense or uncertain compared to their preparedness - anxiety shall emerge, prompting withdrawal. Hilmerich et al. therefore conclude that anxiety and curiosity lie at opposing ends of the same continuum, and that individuals may lean toward one side or the other depending on their expectations regarding their coping capabilities (see also Erdemli et al., 2024).

Gruber and Ranganath (2019) support this view, arguing that an individual's emotional and behavioral response - curiosity or anxiety, and approach or withdrawal - depends on how they appraise their ability to cope with the uncertainty present in a given context. This idea seems to align with Silvia's (2005) notion that curiosity (or rather the closely related emotion of interest)

is elicited by novel and challenging stimuli, yet comprehensible, therefore manageable. Muis et al. (2018) builds on such appraisal structure adding that if a stimulus is novel and complex, yet lacks comprehensibility, individuals are more likely to experience confusion, which may eventually lead to anxiety if confusion remains unresolved.

Finally, Kashdan et al. (2018) found that higher levels of anxiety were associated with lower scores on the stress tolerance facet, indicating that a reduced ability to cope with the stress elicited by a given situation, can lead to anxiety. These studies suggest that one same situation may elicit either anxiety or curiosity, depending on how the individual appraises their ability to cope with the perceived uncertainty and the distress it may cause.

Depressive disorders

Often comorbid with anxiety, *depression* is a relatively common mood disorder affecting around 4% of the global population (WHO, 2025d May 1st). The expression *feeling depressed* has entered the everyday vocabulary and is often used to describe fleeting moments of low motivation or sadness arising in situations such as going to work on a rainy Monday or not finding one's shoe size in a store. While these short-lived emotional responses to everyday challenges or mood fluctuations are normal parts of life, clinical depression is fundamentally different, characterized by its prolonged duration and significant behavioral changes at emotional, motivational, cognitive, and motor levels (Nevid et al., 1991). If left untreated, it can become chronic, and even when treated, relapses are more the rule than the exception (Beshai et al., 2011). The DSM-V defines it as a mood disorder characterized by symptoms persisting for at least two weeks, representing a noticeable change from prior functioning. To diagnose major depressive disorder (MDD), five or more symptoms must be present, including at least one symptom of depressed mood or anhedonia, or both. A depressed mood involves a persistent emotional state of sadness or melancholy, often accompanied by crying and increased irritability. Anhedonia refers to the inability to experience pleasure, even from activities that once brought joy, or from receiving praise or rewards. There is often a marked loss of motivation, making it difficult to engage in daily activities or even get out of bed, which can lead to social withdrawal and isolation. Other accompanying symptoms include significant slowing of movement and speech or, conversely, agitation, sleep disturbances (sleeping too much or too little), and changes in appetite, which can lead to significant increase or decrease in body weight. Fatigue, loss of energy, decreased work or school performance, and neglect of

personal appearance are also common. Cognitively, individuals may have trouble concentrating, thinking clearly, and solving problems. Negative thoughts about oneself and the future may arise, leading to low self-esteem, feelings of inadequacy, guilt, and, in severe cases, suicidal thoughts.

Several cognitive mechanisms contribute to the development of vulnerability to depression. First, depressive individuals often exhibit a *negativity bias* in *interpretation* and *memory*. According to cognitive theorists, and Beck (1976) particularly, these individuals process affective, interpersonal, and social information through a distorted filter, producing systematically negative judgments about *themselves* (i.e., *I'm uninteresting*), the *world* (*there's no place for people like me*) and the *future* (*my life can only go wrong*). This bias in turn reinforces negative self-judgments maintaining a vicious circle. Seligman's learned helplessness theory (Peterson & Seligman, 1984) suggests that depressed individuals adopt an attributional style in which bad events are explained by *internal* (*I failed because I'm stupid*), *stable* (*there's no point in preparing for job interviews, I always fail*) and *global* (*job interviews are designed to fail people like me*) beliefs. These models imply that perceived personal flaws are unchangeable, creating a sense of disconnection from the world and reinforcing a feeling of helplessness, trapping individuals in self-confirming negative thought patterns or schemes, impermeable to information that might contradict them. Beck also highlighted a tendency in depressed individuals to focus on negative information, which is more accessible in memory. Consequently, negative memories are more easily recalled, perpetuating a depressive mood.
Secondly, depressed individuals often engage in *rumination* (Nolen-Hoeksema, 2000) - recurrent, self-focused negative thoughts about past events or personal flaws (in contrast to anxiety, which involves future-oriented worries). These ruminative thoughts (*I'm worthless*, *why me?*, *why do I always fail?*) capture attention automatically, keeping individuals fixated on negative past events, thus perpetuating a negative mood.
Lastly, a *deficit in memory specificity or overgeneralized memory* has been identified in depressive individuals (Mackinger et al., 2000). Memories are often recalled in a very general manner, with few details. This reduced capacity to retrieve vivid, detailed memories can impact the ability to generate detailed, prospective images, diminishing motivation and in turn maintaining anhedonia.

From a neurological perspective, dysregulations in the reward circuit have been associated with depression. fMRI studies have identified reduced activation in the ventral striatum, during both

reward anticipation and feedback (Heshmati & Russo, 2015; Keren et al., 2018; Ng et al., 2019; Stringaris et al., 2015) and deep-brain stimulation targeting the ventral striatum for treatment-resistant depression has demonstrated promising results (Naesström et al., 2016), further highlighting the importance of this region's malfunctioning in depression. In other words, stimuli that may be rewarding to a non-clinical individual are not perceived as such by individuals suffering from depression, reflecting feelings of anhedonia and other related symptoms (Hemashi & Russo, 2015). Therefore, curiosity is diminished in depression (Kidd & Hayden, 2015). Consistent with this view, Kashdan et al. (2018) found a significantly lower presence of joyous exploration in individuals showing higher symptoms of depression, together with a diminished ability to tolerate stress, which may result from feelings of distress activating negative thinking biases previously outlined (Lass & Winter, 2020). Inversely, tolerating stress and higher thirst for knowledge seems to protect against depressive symptoms (Zainal & Newman, 2022, 2023), and it can be nourished from a young age. Indeed, Zheng et al. (2025) found a negative association between childhood curiosity and depression in adulthood.

Obsessive – compulsive disorders

Frequently occurring alongside both anxiety and depression, *obsessive-compulsive disorder* (OCD) is a relatively common syndrome with a lifetime prevalence of 2-3% (Ruscio et al., 2010). OCD is characterized by uncontrollable thoughts (obsessions) and repetitive and excessive behaviors (compulsions; APA, 2022). Obsessions are recurrent, intrusive, unwanted thoughts, mental images and urges that are ego-dystonic, meaning they go against the person's moral values. They are accompanied by anxiety and an urge to avoid these distressing thoughts (Stein et al., 2019) leading to the development of neutralization strategies, hence rituals aimed at reducing the anxiety caused by these obsessions (Rachman et al., 1996). These strategies are activated automatically (Van den Hout et al., 2001), even when cognitive resources are limited (Van den Hout et al., 2002), making their inhibition difficult. These rituals, or compulsions, are repetitive behaviors that can be overt (as excessive handwashing) or covert (mental actions, such as counteracting a distressing image with a particular thought) that an individual feels compelled to perform according to rigid self-imposed rules (Belloch et al., 2015). If the ritual fails to lower anxiety, the cycle continues, reinforcing the compulsion.

Common themes of obsessions and compulsions in patients with OCD have been identified (APA, 2022; Jalal et al., 2023; Wheaton et al., 2019) and include fear of contamination by germs or dirt, such as from shaking hands or touching objects others have touched, leading to

persistent or prolonged handwashing and cleaning. Others experience intrusive aggressive thoughts related to sexual or religious topics, followed by mental rituals like silently repeating a prayer or phrase. OCD can also manifest as a need for order and symmetry, expressed through arranging objects in a specific way (i.e., ensuring they all face the same direction). Some individuals obsess over losing control, such as shouting obscenities in public or causing harm to themselves or others, leading to compulsive checking behaviors. These may include repeatedly ensuring that stoves are turned off, doors are locked, or driving down a road multiple times to make sure they haven't hit anyone. Common compulsive behaviors also include counting, following strict routines, and seeking reassurance. OCD therefore encompasses a heterogeneous manifestation of the disorder within the same diagnostic category. Most individuals with OCD are aware that their compulsions are excessive and wish they had more control over them, but they fail to inhibit the behavior or mental act (Jalal at al., 2023).

Early efforts to conceptualize OCD suggest that experiencing intrusive cognitions is quite common and occurs in at least 90% of the general population (Rachman & de Silva, 1978). These images and thought are automatically triggered by internal or external reminders, and they are considered intrusive because they interrupt a person's stream of consciousness, as well as being unpleasant (Salkovskis, 1999). The difference between normal and pathological intrusive cognitions lies in how the individual interprets them - while most people dismiss such thoughts as unimportant, those with OCD often assign them exaggerated probability and significant moral weight (Rachman & de Silva, 1978). This cognitive distortion, known as thought-action fusion (TAF), reflects the belief that simply thinking about a negative event makes it more likely to occur (*likelihood TAF*) and that having a disturbing thought (i.e., harming someone) is as immoral as acting on it (*moral TAF*; Hezel et al, 2019; Shafran et al., 1999). As a result, they feel personally responsible for preventing any potential harm associated with these thoughts. Salkovskis et al.'s (1998) model shows how this perceived responsibility biases their attention toward danger-related cues, heightening their sense of threat and discomfort. The resulting anxiety triggers neutralization or ineffective coping strategies, such as thought suppression or avoidance of related situations. These maladaptive responses then reinforce the belief in personal responsibility and further fuel intrusive thoughts, thereby maintaining the cycle of OCD.

Neuropsychological studies indicate alterations in executive functioning, emotion regulation and reward processing (Benzina et al., 2016). Within the reward circuitry, Figee et al. (2011)

found that individuals with OCD show reduced activation in the nucleus accumbens (NAcc) and the left insula - a region involved in interoception and emotional processing - during the anticipation of natural rewards (here monetary), compared to healthy controls; however, no differences are observed during reward receipt. This pattern complements previous findings of increased insular activation in response to OCD triggering stimuli, particularly in cases of contamination (Figee et al., 2011). Together, these findings suggest a dual vulnerability in OCD that undermines the ability to resist compulsions: attenuated NAcc and insula activation during reward anticipation of natural stimuli may impair adaptive decision-making, while heightened insular reactivity to OCD-related stimuli reflects an exaggerated internal response, potentially rendering the relief following compulsions disproportionately rewarding, reinforcing the behavior over time.

To date, studies explicitly exploring links between OCD and curiosity remain scarce.

Behavioral addictions

Although addiction is a broad concept encompassing both substance-related (i.e., alcohol, smoking, and drugs) and behavioral addictions (i.e., shopping, sex, and internet use), only the first group is officially recognized by the DSM (APA, 2022). Grant et al. (2010) define non-substance-related behavioral addictions as the "failure to resist an impulse, drive, or temptation to perform an act that is harmful to the person or to others" (p. 234) reinforcing some researchers' (Lee et al., 2019; Sussman & Sussman, 2011) idea that such repetitive behaviors might be closely associated with compulsions.

Among the fastest-growing problematic behaviors, we find internet (Young, 1998), mobile phone (Billieux et al., 2015), and social networking site (SNS) use (Sun & Zhang, 2021). Although conceptually distinct, these three types of usage are difficult to separate in practice, as most internet users access it via smartphones, with social media being a primary activity (Tateno et al., 2019). In fact, social media addiction has been defined as a specific type of internet addiction (Lin et al., 2021) and such overlaps have prompted the umbrella definition of *cyberaddiction* (Yuryeva & Shornikov, 2023). Advocates for classifying social networking as an addiction (Griffiths & Kuss, 2017) argue that SNS use may cause symptoms traditionally associated with substance addiction; these include SNS becoming a user's main preoccupation, mood modification, tolerance (where increasing usage is needed to achieve the same levels of gratification), withdrawal symptoms such as irritation and anxiety when stopping usage,

relapses, loss of control, and interpersonal conflicts. Expectedly, excessive use of such platforms has been linked to negative physical (i.e., musculoskeletal discomfort) and mental health effects (i.e., sleep disturbances, anxiety, and depression; Chen et al., 2020). Additionally, terms such as "nomophobia" - anxiety related to being without a mobile phone - have been coined to describe emerging issues (Lin et al., 2021).

In an attempt to summarize the plethora of etiological models of social media addiction, Sun and Zhang (2021) have identified various categories. Among them are models emphasizing dispositional differences, such as attachment styles, where individuals with anxious attachment are more prone to using social media to maintain constant connections with friends and seek attention or reassurance online. Other models focus on motivational perspectives, suggesting that people use social media for gratification, fulfilling a need to belong, acquiring information, or engaging in self-exposure. Further models emphasize a learning perspective, proposing that SNS use is a learned response reinforced by repeated exposure to stimuli associated with positive affect. Perhaps the most comprehensive model for explaining the development and maintenance of such behaviors, as well as why some individuals are more vulnerable than others, is the Interaction of Person-Affect-Cognition-Execution (I-PACE) model (Brand et al., 2016). This model considers SNS use disorders as the result of interactions between personal dispositions and maladaptive coping strategies, which contribute to problematic SNS use. Personal predispositions can include neurobiological characteristics, such as neurotransmitter imbalances, as well as psychological and personality traits, such as impulsivity, low self-control, or neuroticism. Pre-existing psychopathology, such as depression and anxiety can increases such vulnerability. When external or internal triggers rise (such as aversive affect), these predispositions activate maladaptive coping strategies, i.e., using social media as a distraction to regulate one’s mood or seeking rewards through receiving likes. Cognitive biases, such as overestimating the value of online interactions, can further reinforce excessive use. As a result, SNS addictive behaviors are driven by both positive reinforcement (i.e., receiving flattering comments) and negative reinforcement (i.e., escapism). Over time, cravings and an urge to use the internet develop, reinforcing problematic usage patterns in a way similar to substance addictions.

In relation to curiosity and addiction, and beginning with its associations to substance use, Lindgren et al. (2010) found that curiosity plays an ambivalent role in addictive behaviors. While the exploration component of curiosity appears to act as a protective factor against

alcohol consumption, high scores on the absorption component seem to facilitate it. Likely due to the novelty of the topic, only limited research exists on the link between cyberaddiction and curiosity. In their study examining the predictive relationship between internet addiction and curiosity - using the Five-Dimensional Curiosity scale Revised - Mahama et al. (2024) also found a complex relationship. Specifically, facets such as deprivation sensitivity, covert and overt social curiosity, stress tolerance, and thrill seeking were positively associated with various aspects of internet addiction, whereas joyous exploration appeared to mitigate the risk. Focusing on social media use, Zahoor (2022) explored the relationship between the social curiosity subscale, social media addiction, and the popular concept of Fear of Missing Out (FOMO) - defined by Przybylski et al. (2013) as the desire to self-regulate the anxiety that others might be having rewarding experiences in one's absence, compelling individuals to stay constantly informed and connected. The study concluded that both social curiosity and FOMO were significant predictors of social media addiction. In a way, the concept of FOMO inherently involves a sense of information deprivation, which may potentially reflect a higher deprivation sensitivity facet in these individuals, and the need to fill the information gap via social media.

A transdiagnostic and network approach

Although the DSM remains the go-to source for disorder descriptions, it classifies them as separate entities; yet this brief overview highlights how comorbidity among them is more the rule than the exception. Building on this observation, Dalgleish et al. (2020) argue that common dysfunctional psychological mechanisms may underlie these various conditions, challenging the traditional diagnostic systems (like the DSM). Other critiques highlight that traditional diagnostic categories often encompass a wide heterogeneity of symptom expression, grouping diverse phenotypes under the same label (Zimmerman et al., 2015). This is problematic because it diminishes the clinical utility of overarching diagnoses for treatment, as each presentation may involve different functional impairments and require distinct, tailored therapeutic approaches (Fried & Nesse, 2014). For these reasons, a transdiagnostic approach to understanding mental disorders has gained traction, inspiring new conceptualizations and interventions that better address the identified issues of heterogeneity and comorbidity.

One way to operationalize the shift toward this approach is through the network model of mental disorders, formally proposed by Dutch psychologist Denny Borsboom (Borsboom et al., 2011), which has since been gaining increasing attention in the field of psychopathology (Serafim et al., 2025). Unlike traditional models that conceptualize disorders as *latent* diseases

causing a set of observable, interchangeable symptoms, this framework argues that mental disorders rather *emerge* from the interplay of bidirectionally interacting symptoms (Epskamp et al., 2018). In this model, symptoms (or nodes) are connected by edges, with edge weights representing the strength of associations (visualized by thicker or thinner lines) and the valence indicating whether the relationship is positive or negative (Epskamp et al., 2012). These edges are *undirected*, meaning they reflect associations without implying causal direction (Epskamp et al., 2018). Networks form symptom clusters in which the activation of one node may trigger others via these edges and the stronger the connection between symptoms, the greater the likelihood of activation spreading throughout the cluster.

Two key concepts are fundamental to the network framework (Fried et al., 2017): first, not all symptoms hold equal influence. Some are more *central*, meaning they are more connected within the network and the centrality of a symptom reflects its potential to influence the overall system. A highly central symptom is more likely to activate other symptoms and sustain the pathological network, which is why identifying and targeting a central symptom can enhance the effectiveness of therapeutic interventions, since addressing them could cause broader changes across the network. Centrality is assessed using three indices. Node *strength* quantifies how strongly a node is directly connected to others, *closeness* reflects how efficiently a node can reach all other nodes indirectly and *betweenness* measures how often a node lies on the shortest path between two other nodes (Epskamp et al., 2018). However, Robinaugh et al. (2016) argue that these centrality measures are typically applied to networks with exclusively positive edges, and since psychological networks like ours often include negative edges, they recommend using *expected influence,* as it accounts for the valence of relationships.
The second key concept is that of *bridge symptoms*, defined as those nodes that connect symptom clusters across different disorders and facilitate the spread of activation among them. This concept may help explain the high comorbidity rates observed between disorders, such as sleep problems serving as a bridge symptom between depression and generalized anxiety. The overarching implication here, is that therapeutic interventions don't need to target a hypothetical latent disease. Instead, if individual symptom networks can be accurately identified, it becomes possible to pinpoint which symptoms exert the greatest influence within a given person's network. This opens the door to tailored interventions that focus on the most central elements unique to each individual: for one person, the key symptom might be self-critical thoughts and for another, it might be a lack of energy - both falling under what is currently categorized as depression but require a different intervention. Reducing the activation or influence of a central

symptom may lead to cascading improvements across the entire network (Borsboom & Cramer, 2013).

In regard to anxiety, depression, OCD, and behavioral addictive disorders, the literature identifies several transdiagnostic symptoms.

Intolerance of uncertainty

One of the most widely recognized transdiagnostic factors is *intolerance of uncertainty* (IU), which is described as a dispositional trait and cognitive bias that influences how individuals perceive, interpret, and react to uncertainty on cognitive, emotional, and behavioral levels (Dugas et al., 2004; Freeston et al., 1994). Individuals with high IU are more likely to interpret ambiguous or neutral situations as threatening compared to those low in IU because of a lower threshold for tolerating uncertainty (Koerner & Dugas, 2008). These individuals tend to experience uncertainty as distressing and unsettling, perceiving it as inherently negative (Dugas et al., 2001; Koerner & Dugas, 2008). They believe uncertainty should be avoided (Carleton et al., 2007) and struggle to tolerate the aversive state triggered by insufficient information - a kind of *fear of the unknown* (Carleton, 2016). This fear stems from the anticipation of negative outcomes in uncertain situations, which is driven by a perceived lack of control over those circumstances (Koerner & Dugas, 2008).

In their meta-analysis, Gentes and Ruscio (2011) conclude that IU is related to GAD, MDD, and OCD, proposing that across these disorders, IU may act as a cognitive vulnerability, a common underlying mechanism that amplifies disorder-specific symptoms and promotes maladaptive thought and behaviors previously described. In GAD, IU intensifies discomfort linked to unpredictability, leading to worry as a maladaptive coping mechanism aimed at anticipating and controlling uncertain future events. This results in avoidance behaviors, hypervigilance, reassurance-seeking, and cognitive biases that reinforce anxiety (as overestimating the likelihood of negative events). In MDD, IU triggers rumination, leading to a focus on past failures, self-critical thoughts, and hopelessness, which fosters learned helplessness and reduces engagement in activities. In OCD, IU fuels doubt, driving compulsive or ritualized behaviors to reduce it. However, this reinforces the belief that uncertainty is dangerous and must be eliminated, perpetuating the OCD cycle. Additional research identified

IU as a transdiagnostic cognitive maintaining factor (Mahoney & McEvoy, 2012; McEvoy & Mahoney, 2012) with robust, moderate links to various disorders (McEvoy et al., 2019).

The literature on the relationship between curiosity and intolerance of uncertainty (IU) tends to find ambivalent results, suggesting that such association depends on the specific facet of curiosity being examined. For instance, Jones et al. (2023) found a negative association between the exploration subscale of curiosity and inhibitory IU (defined as *inaction in the face of uncertainty*), while the absorption subscale was positively correlated with prospective IU (defined as *fear in anticipation of future uncertainty*). Similarly, Whitecross and Smithson (2023) reported that interest-type curiosity is linked to greater tolerance of uncertainty, as individuals view ambiguity as an opportunity for exploration and discovery. In contrast, deprivation-type curiosity was associated with greater intolerance of uncertainty, driven by the frustration of not knowing and a strong desire to resolve uncertainty to alleviate distress. Tian et al. (2025) examined associations between IU and various curiosity measures including epistemic curiosity and social curiosity, and found positive correlations between IU and both epistemic and social curiosity. They suggested that individuals with higher aversion to uncertainty may be more strongly motivated to acquire knowledge about the world and others to reduce the uncertainty.

In sum, the current literature appears to support the intuitive idea that the drive to explore and understand the unknown necessitates some capacity to tolerate the uncertainty inherent in that exploration. When this capacity is lacking, the distress triggered by uncertainty may overshadow the pleasure of exploring and lead to withdrawal.

Impulsivity

A second transdiagnostic factor identified in the literature, although to a lesser degree, is *impulsivity*. Impulsivity is considered a multidimensional construct, where individuals prioritize immediate rewards over long-term consequences, have quick and unconsidered reactions to stimuli, a lack of thorough deliberation, and engage in careless actions that often result in negative outcomes (Moustafa et al., 2017). Impulsivity has been linked to depression, anxiety, stress (Moustafa et al., 2017; Swann et al., 2008), OCD (Boisseau et al., 2012; Grassi et al., 2015), and behavioral addictions (Lee et al., 2019; Pérez de Albéniz Garrote et al., 2021). In the search for the *p-factor* - the overarching transdiagnostic factor of general

psychopathology - evidence suggests that emotion-related impulsivity is a core component (Pearlstein et al., 2023). Emotion-related impulsivity refers to cognitive or behavioral responses that are immediate or emotionally driven (rather than deliberate). It can manifest in two primary ways: *feeling-triggered action*, where strong emotions directly lead to impulsive speech or behavior, and *pervasive influence of feelings*, where emotions interfere with cognitive regulation, leading to overwhelmed and impaired thinking, paralysis, and inaction (Carver et al., 2011). This construct is associated with both internalizing and externalizing psychopathology, with feeling-triggered action linked to externalizing symptoms (i.e., substance and behavioral addictive disorders) as well as internalizing disorders (i.e., anxiety, depression), while pervasive influence of feelings appears to be more specifically tied to internalizing symptoms (Johnson et al., 2017; Pearlstein et al., 2024). This supports the idea that difficulty in constraining impulsive emotional reactions represents a transdiagnostic dimension of psychopathology. The UPPS scale (Whiteside & Lynam, 2001) provides a foundational framework for understanding impulsivity, measured as *lack of premeditation*, *lack of perseverance, sensation seeking* and *urgency*; this latter dimension was later expanded into *negative* and *positive urgency*.

Literature on the relationship between curiosity and impulsivity, highlights a connection notably explored by Loewenstein (1994). In his framework, the discomfort generated by a knowledge gap triggers a strong and immediate urge to resolve it. In this sense, curiosity's aim is not merely satisfaction but *rapid* relief - a characteristic of impulsivity, given the low tolerance for delay and a drive for quick resolution. A key commonality between curiosity and impulsivity lies in their reliance on shared neural pathways – once again, the frontostriatal circuits and dopaminergic inputs from the midbrain (Gruber & Fandakova, 2021; Marvin et al., 2020; Lau et al., 2020). Gruber and Fandakova (2021) explored the link from a developmental point of view, proposing that the urgency to know observed in curious children may stem from the detection of prediction errors, triggering a drive to explore for answers. Because prefrontal regions are still maturing during childhood and adolescence, this drive can lead to unregulated, immediate information-seeking - resulting in impulsive behavior. Parents who have tried to hold a conversation while being repeatedly interrupted by a child eager for instant answers can probably gasp such connection. Marvin et al. (2020) claim that curiosity and impulsivity are linked because both can manifest as an urgent, immediate drive to act or acquire information. Interestingly, they also mention that behavioral measures of curiosity often rely on impulsivity, although opposite dynamics are found. Indeed, some studies assess the ability to delay

gratification for the sake of getting information, where a greater willingness to wait - hence lower impulsivity - is taken as a sign of heightened curiosity. In contrast, other research adopts the reverse logic, evaluating how much participants are willing to sacrifice (i.e., pay a cost) to receive information immediately - where greater impulsivity is interpreted as a sign of higher curiosity. For example, Lau et al. (2020) found that participants were willing to take risks and even endure electric shocks to satisfy their curiosity about trivia knowledge. Although these approaches differ, they both illustrate how curiosity and impulsivity are behaviorally and neurologically intertwined.

3 Project objectives and research question

The presented overview of the links between curiosity and mental well-being or mental disorders highlights the ambivalence of results currently found in the literature, largely due to the varying definitions and measurement scales used to assess curiosity. Moreover, the lack of integration across these different conceptualizations hinders a holistic understanding of how curiosity's various facets interact and contribute to either the promotion or deterioration of mental well-being. As already mentioned, the relatively recent Five-Dimensional Curiosity scale Revised (Kashdan et al., 2020) integrates previously disparate strands of curiosity research into a single, multidimensional framework. This scale therefore represents a promising tool for overcoming past inconsistencies and identifying distinct curiosity profiles. Instead of simply asking whether curiosity benefits mental well-being, studies could examine *which sides* of curiosity are beneficial and which may be detrimental.

Despite the potential of this unified model, research using this framework is still only burgeoning and studies exploring the links between curiosity facets and mental health remain rare. So far, only topline associations to anxiety and depression disorders have been explored and further research is needed to sustain these links, as well as expand the scope to other major mental health conditions. Additionally, the existing studies consider mental disorders as distinct categories, in line with international diagnostic manuals, and applications of the promising transdiagnostic approach to understanding mental disorders are lacking.

In the present study, we aim to address gaps in the existing literature by investigating the relationships between distinct facets of curiosity and mental disorders - such as anxiety,

depression, compulsivity, and problematic reward-seeking behaviors - within a transdiagnostic and network framework. More precisely, we aim at understanding:

What is the interplay between the different facets of curiosity and anxiety, depression, obsessive-compulsive behavior, and cyberaddiction within a transdiagnostic approach?

Our study could generate insights that inform more clinically oriented research, ultimately opening new avenues for therapeutic intervention by reducing the activation of maladaptive facets of curiosity in one individual and strengthening the adaptative ones.

4 Methodology

Participants

A total of 382 undergraduate psychology students at the University of Geneva were recruited and completed the study in exchange for credits necessary to validate the course. Of these, 105 participants were excluded due to incorrect response to an attention check item. The final sample consisted of 277 participants (mean age = 22.27 ± 4.09; sex: 234 women, 42 men, and 1 participant who chose not to disclose their sex; gender: 232 women, 42 men, 1 non-binary, 1 genderfluid, and 1 participant who chose not to disclose their gender identity). All participants provided informed consent, and the study was approved by the University Commission for Ethical Research in Geneva (CUREG-2023-01-03).

Procedure

This study was part of a broader research project aimed at examining the links between learning and information-seeking behaviors. Within this larger framework, participants completed the questionnaires, as well as other tasks that will not be the focus of our study. Questionnaires were answered online through the platform LimeSurvey (https://www.limesurvey.org/) and their full completion time took about 30 minutes on average.

Questionnaire administration

Trait curiosity

Trait curiosity was assessed using the English version of the Five-Dimensional Curiosity scale Revised (5DCR; Kashdan et al., 2020), including subscales joyous exploration, deprivation sensitivity, stress tolerance, thrill seeking and overt social curiosity and covert social curiosity, and its French translation currently under validation. This questionnaire includes 24 items, which are rated on a 7-point Likert scale ranging from 1 (*Does not describe me at all*) to 7 (*Completely describes me*). The subscales are scored by averaging the items on each specific subscale (score range: 1-7). The Stress Tolerance items are reversely scored (items 9,10,11,12), meaning that a higher score reflects greater tolerance of distress.

Trait anxiety, depression, stress, obsessive-compulsive behavior and habitual behavior

Trait anxiety was assessed using the English version of the State-Trait Inventory for Cognitive and Somatic Anxiety (STICSA; Ree et al., 2008; Grös et al., 2007) and its French translation currently under validation. This questionnaire measures anxiety along two subscales: cognitive and somatic symptoms. It comprises 21 items, which are rated on a 4-point Likert scale from 1 (*Almost never*) to 4 (*Almost always*). No reverse-coded items are present. The subscale scores are calculated by summing the items on each scale, with higher scores reflecting greater levels of anxiety in the respective domain (cognitive anxiety score range: 10-40; somatic anxiety score range: 11-44).

Depressive symptomatology was measured using the 20-item Center for Epidemiologic Studies Depression Scale (CES-D; French version: Morin et al., 2011; English version: Radloff, 1977), which is a typical instrument to assess depressive symptoms in the general population. Participants rated how often they experienced the included symptoms over the past week on a 4-point scale ranging from 0 (*Rarely or none of the time*) to 3 (*Most or all of the time*) and a total score is calculated by summing all the items. Higher total scores indicate more severe depressive symptoms (score range: 0-60). The CES-D includes four reverse-coded items (items 4, 8, 12, and 16).

Perceived stress levels were measured using the Perceived Stress Scale (PSS; French version: Lesage et al., 2012; English version: Cohen et al., 1983). The scale is composed of 10 items

and assesses the frequency with which participants felt or had thoughts related to stress over the previous month. Items are rated on a 5-point Likert scale from 0 (*Never*) to 4 (*Very often*). The score of perceived stress is computed by summing all the items, with higher scores indicating greater perceived stress (score range: 0-50). Four reverse-coded items are included (items 4, 5, 7, and 8).

The Depression Anxiety Stress Scales (DASS-21; French version: Ciobanu et al., 2018; English version: Lovibond & Lovibond, 1995) was also administered to assess anxiety, depression, and stress. Each of the 21 items is rated on a 4-point Likert scale from 0 (*Did not apply to me at all*) to 3 (*Applied to me very much or most of the time*), expressing how much the statement applied over the previous week. The anxiety, depression, and stress scores are calculated by summing the items on each respective subscale and the subscale scores are multiplied by two to calculate the final score. For the anxiety subscale, scores in the 0-6 range reflect normal anxiety, scores between 7-9 mild anxiety, scores in the 10-14 range moderate anxiety, scores between 15-19 severe anxiety, and scores between 20-42 extremely severe anxiety. For the depression subscale, scores in the 0-9 range indicate normal depression levels, scores between 10-12 mild depression, scores in the 13-20 range moderate depression, scores between 21-27 severe depression, and scores in the upper 28-42 range extremely severe depression. Finally, scores between 0-10 on the stress subscale reflect normal stress, scores in the 11-18 range mild stress, scores between 19-26 moderate stress, scores in the 27-34 range severe stress, and scores between 35-42 extremely severe stress.

Obsessive-compulsive symptoms were assessed with the 18-item Obsessive-Compulsive Inventory-Revised (OCI-R; French version: Zermatten et al., 2006; English version: Foa et al., 2002), which includes subscales for Checking, Hoarding, Neutralizing, Obsessing, Ordering, and Washing. Each item is rated on a 5-point Likert scale from 0 (*Not at all*) to 4 (*Extremely*). A total score is calculated by summing all items and higher total and subscale scores reflect greater OCD symptom severity (score range: 0-72).

Habitual tendencies in everyday life were assessed using the 27-item Creature of Habit Scale (COHS; French version: Wuensch et al., 2025; English version: Ersche et al., 2017), including subscales of Routine and Automaticity. Items are rated on a 5-point Likert scale from 1 (*Strongly disagree*) to 6 (*Strongly agree*). The routine and automaticity subscales are computed

by summing the items on each subscale with higher scores indicating stronger reliance on habits (routine score range: 16-80; automaticity score range: 11-55).

Cyberaddiction

Problematic internet use was measured using the 20-item Internet Addiction Test (IAT; French version: Khazaal et al., 2008; English version: Young, 1998). Items assess the extent of internet-related difficulties across daily functioning over the previous month. Each item is rated on a 6-point Likert scale from 1 (*Rarely*) to 5 (*Always*), additionally including 0 (*Not applicable*) and a total score is calculated by summing all the items, with higher scores indicating greater problematic use (score range: 0, 100).

Problematic social media use was measured with the 6-item Bergen Social Media Addiction Scale (BSMAS; French version: Verseillié et al., 2021; English version: Andreassen et al., 2021; 2017). Items reflect core addiction components such as salience, mood modification, tolerance, withdrawal, conflict, and relapse. Participants respond using a 5-point scale from 1 (*Very rarely*) to 5 (*Very often*). A total score is calculated by summing all items and higher scores indicate greater risk of social media addiction (score range: 6-30).

Problematic smartphone use was assessed with the 10-item Smartphone Addiction Scale – Short Version (SAS-SV; French version: Lopez-Fernandez, 2017; English version: Kwon et al., 2013). Items are rated on a 6-point Likert scale from 1 (*Strongly disagree*) to 6 (*Strongly agree*). A total score is calculated by summing all items and higher scores reflect more severe smartphone addiction symptoms (score range 10-60).

Intolerance of Uncertainty

Intolerance of uncertainty was assessed using the 27-item Intolerance of Uncertainty Scale (IUS; French version; Freeston et al., 1994; English version: Buhr & Dugas, 2002), which includes subscales of Negative behavioral and self-referent implications and Unfairness. Items are rated on a 5-point Likert scale from 1 (*Not at all characteristic*) to 5 (*Entirely characteristic*). A total score is calculated by summing all the items, with higher scores indicating a stronger tendency to find uncertainty distressing or unacceptable (score range 27-135).

Impulsivity

Impulsivity was measured using the short version of the UPPS-P Impulsive Behavior Scale (French version: Billieux et al., 2012; English version: Cyders et al., 2014), which assesses five distinct facets: Negative Urgency, Positive Urgency, Lack of Premeditation, Lack of Perseverance, and Sensation Seeking. Items are rated on a 4-point scale ranging from 1 (*Agree Strongly*) to 4 (*Disagree Strongly*). Higher subscale scores reflect greater impulsive tendencies in the respective domain. Reverse-coded items are included (items 2, 3, 4, 7, 9, 10, 12, 14, 15, 17, 18, 20).

In the context of the broader research, participants also completed the Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ-RC), but this data will not be the focus of analysis in this master's thesis.

Descriptive statistics for the questionnaires included in the analysis are reported in Table 1 and the distributions of the questionnaire scores are shown in Figure 2.

Data analysis

Statistical analyses were performed using R (version 4.4.2; R Core Team, 2020) and RStudio (version 2024.12.1+563; Posit team, 2024). As a first step, an exploratory factor analysis (EFA) was conducted to identify transdiagnostic factors among all the questionnaires collected, excluding the curiosity scale 5DCR. Indeed, these many scales could be conceptually overlapping, as for example suggested by the transdiagnostic nature of intolerance of uncertainty across anxiety, depression and OCD (Gentes & Ruscio, 2011). Factor analysis can group these measures into a smaller number of distinct latent dimensions that cut across diagnostic categories, therefore reducing redundancy. In a second step, a network analysis was performed, including the extracted factor scores and the six curiosity subscales, so to examine their unique relationship and allowing us to explore how the various facets of curiosity are differentially linked to the mental health dimensions investigated. Combining factor and network analysis allowed to go beyond disorder specific analysis (as we rather focused on shared transdiagnostic dimensions) and bivariate associations (that don't appropriately account for overlap or complexity in the data set).

Overall, questionnaire reliability was acceptable with Cronbach's α and McDonald's ω scores generally between .80 and .95; slightly lower reliability was found for the curiosity subscale joyous exploration (Cronbach's α = .76, standardized α = .76, McDonald's ω = .78) and impulsivity subscale lack of premeditation (α = .79, standardized α = .79, ω = .79), yet both acceptable.

Table 1

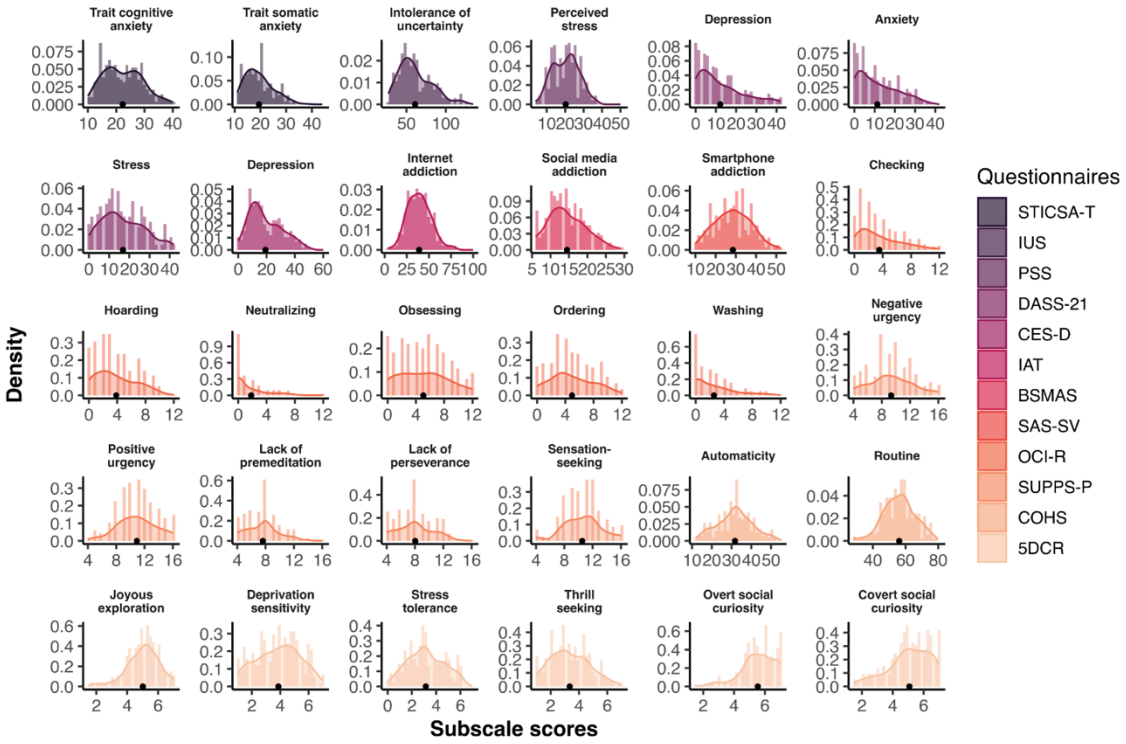
Mean, standard deviation and reliability indices (Cronbach's α, standardized Cronbach's α, McDonald's ω) of the questionnaires used in the analysis

Questionnaire or subscale	M	SD	α	std α	omega
5DCR JOYOUS EXPLORATION	5.01	1.05	0.76	0.77	0.78
5DCR DEPRIVATION SENSITIVITY	3.87	1.52	0.87	0.87	0.87
5DCR STRESS TOLERANCE	3.15	1.50	0.86	0.86	0.86
5DCR THRILL SEEKING	3.35	1.37	0.8	0.8	0.8
5DCR OVERT SOCIAL CURIOSITY	5.54	1.10	0.85	0.85	0.86
5DCR COVERT SOCIAL CURIOSITY	5.08	1.36	0.86	0.86	0.86
STICSA - T COGNITIVE ANXIETY	22.29	6.67	0.87	0.87	0.88
STICSA - T SOMATIC ANXIETY	19.43	5.40	0.82	0.83	0.83
CES-D	19.21	11.50	0.92	0.92	0.92
PSS	20.29	6.99	0.87	0.87	0.88
DASS - DEPRESSION	12.12	11.02	0.9	0.9	0.91
DASS - ANXIETY	11.37	9.68	0.82	0.82	0.83
DASS - STRESS	16.82	10.49	0.87	0.87	0.87
OCI-R TOTAL	21.79	12.56	0.9	0.9	0.94
OCI-R CHECKING	3.51	2.93	0.78	0.78	0.79
OCI-R HOARDING	3.87	2.85	0.76	0.76	0.78
OCI-R NEUTRALIZING	1.82	2.54	0.75	0.77	0.77
OCI-R OBSESSING	5.05	3.40	0.87	0.87	0.87
OCI-R ORDERING	4.95	3.07	0.8	0.8	0.8
OCI-R WASHING	2.59	2.83	0.79	0.79	0.8
COHS AUTOMATICITY	31.74	8.88	0.83	0.84	0.84
COHS ROUTINE	56.10	9.64	0.82	0.82	0.83
IAT	38.94	13.23	0.89	0.89	0.89
BSMAS	14.46	5.01	0.79	0.8	0.8
SAS-SV	28.52	8.94	0.85	0.85	0.85
IUS	61.02	20.79	0.95	0.95	0.95
SUPPS-P NEGATIVE URGENCY	9.33	3.01	0.83	0.83	0.83
SUPPS-P POSITIVE URGENCY	10.92	2.74	0.8	0.79	0.8
SUPPS-P LACK OF PREMEDITATION	7.62	2.34	0.79	0.79	0.79
SUPPS-P LACK OF PERSEVERANCE	8.04	2.58	0.86	0.86	0.86
SUPPS-P SENSATION-SEEKING	10.52	2.64	0.81	0.81	0.81

Note. M = mean, SD = standard deviation, α = Cronbach's α, std α = standardized Cronbach's α, omega = total McDonald's ω, 5DCR = Five-Dimensional Curiosity Scale Revised, STICSA = State-Trait Inventory for Cognitive and Somatic Anxiety Trait Version, CES-D = Center for Epidemiologic Studies Depression Scale; PSS = Perceived Stress Scale, DASS = Depression Anxiety Stress Scales, OCI-R=Obsessive-Compulsive Inventory-Revised, IAT = Internet addiction Test, BSMAS = Bergen Social Media Addiction Scale, SAS-SV = Smartphone Addiction Scale-Short Version , COHS = Creature of Habit Scale, IUS = Intolerance of Uncertainty Scale, SUPPS-P = Short UPPS-P Impulsive Behavior Scale

Figure 2

Questionnaire distributions



Note. DCR = Five-Dimensional Curiosity Scale Revised, STICSA = State-Trait Inventory for Cognitive and Somatic Anxiety Trait Version, CES-D = Center for Epidemiologic Studies Depression Scale; PSS = Perceived Stress Scale, DASS = Depression Anxiety Stress Scales, OCI-R=Obsessive-Compulsive Inventory-Revised, IAT = Internet addiction Test, BSMAS = Bergen Social Media Addiction Scale, SAS-SV = Smartphone Addiction Scale-Short Version , COHS = Creature of Habit Scale, IUS = Intolerance of Uncertainty Scale, SUPPS-P = Short UPPS-P Impulsive Behavior Scale

Exploratory factor analysis

The *psych* package (Revelle, 2023) was used to perform the exploratory factor analysis (EFA) on the questionnaire subscales. Correlations between scales were analyzed using maximum likelihood estimation with an oblimin rotation, as presented in Figure 3. The Kaiser-Meyer-Olkin (KMO) test was applied to assess the suitability of the data for structure detection (Kaiser & Rice, 1974), and Bartlett's test of sphericity was conducted to verify that the correlations between items were sufficiently large (Bartlett, 1951). The number of factors was determined using multiple techniques, including *parallel analysis* with the fa.parallel function (Horn, 1965) and the *minimum average partial test* using the vss function (Velicer, 1976), both within the *psych* package. Additional methods included *optimal coordinates* and *acceleration factor* using the nScree function from the *nFactors* package (Raîche & Magis, 2022), the *Cattell-Nelson-Gorsuch method* via the nCng function from the same package, and the *comparison data*

technique (Ruscio & Roche, 2012) using the EFACompData function from the *RGenData* package (Ruscio, 2018).

Network analysis

To explore the relationships among the extracted transdiagnostic factors and the six 5DCR subscales, we conducted a network analysis. In this context, nodes refer to the extracted factors and the 5DCR subscales, while edges represent the statistical associations between them. We applied a Gaussian Graphical Model, where edges are estimated as partial correlations between nodes - meaning that each association reflects the unique relationship between two nodes while controlling for the influence of all others in the network. The goal of this analysis is to estimate which nodes are connected and how strongly. However, as per Epskamp et al. (2018), calculating all potential links poses challenges in psychological research. On one hand, partial correlations often contain a degree of sample-specific variance, meaning that even unconnected nodes may display small, non-zero coefficients. As a result, estimating all possible partial correlations without constraint can lead to dense networks, filled with negligible associations that complicate interpretation. On the other hand, reliably estimating such a large number of edges typically requires sample sizes much larger than those commonly available in psychological studies.

Regularization

To address these issues and simplify the network model by filtering out weak partial correlations, we estimated the network using the EBICglasso method (Extended Bayesian Information Criterion Graphical LASSO), implemented via the *bootnet* package in R. This method combines three components: Least Absolute Shrinkage and Selection Operator (LASSO; Tibshirani, 1996), graphical modeling (referred to as "glasso"; Friedman et al., 2008), and the Extended Bayesian Information Criterion (EBIC; Chen & Chen, 2008) for model selection. LASSO is a regularization method that minimizes a loss function (which quantifies how well the network structure fits the data) while adding a penalty to discourage excessive complexity. Each time a partial correlation is estimated, LASSO evaluates whether its inclusion improves the network model fit sufficiently to justify the penalty. If the contribution is smaller than the penalty, the coefficient is shrunk to zero (Tibshirani, 1996). Through this mechanism, LASSO retains the strongest connections and eliminates weak or negligible ones, producing a

sparser and more interpretable network. In this study, we applied a variant of LASSO known as graphical LASSO (glasso; Friedman et al., 2008). The degree of sparsity is determined by the LASSO tuning parameter, lambda (λ): smaller values of λ produce denser networks by retaining more edges, while larger values allow sparser networks by shrinking more coefficients to zero. This is because as λ increases, a growing number of coefficients are excluded from the model as they no longer contribute enough to outweigh the penalty, simplifying the structure further. To select the optimal value of λ, we used the EBIC, which evaluates each candidate model. The EBIC includes an additional parameter, gamma (γ), which adjusts the strength of the penalty for complexity. A higher gamma value (e.g., 0.5) imposes a stronger penalty, favoring simpler and more conservative network structures, while lower values (e.g., 0 or 0.25) allow more complex models by penalizing added edges less severely. The λ that produces the network model with the lowest EBIC value is selected as the optimal one, as it represents the best trade-off between data accuracy and parsimony. In our study, we set γ to 0.5, thereby favoring a simpler and more interpretable network model.

We used the *qgraph* package (Epskamp et al., 2012) for network visualization and to compute *expected influence* as a centrality index. In the resulting visualizations, edge color indicated the direction of the partial correlation (green for positive and purple for negative), and edge thickness represented the strength of the association.

Assessment of network structure accuracy and stability

To assess network reliability, we followed the guidelines proposed by Epskamp et al. (2018) using the *bootnet* package in R. Their recommended procedure involves various key steps. The first is *assessing the accuracy of edge weight estimates*. Because the network is based on sample data, edge estimates may vary due to sampling variability. To evaluate their accuracy, we conducted nonparametric bootstrapping, a method that involves creating new samples out of the original dataset; in practice, each new sample is generated by randomly selecting participants from the original sample, allowing for the same participant to be selected multiple times, while others may not be selected at all. This process is repeated many times generating a large number of resamples, each of the same size - in our study, 10’000 bootstrapped datasets were generated (nBoots = 10’000). For each of these datasets, the network is re-estimated, and therefore edge weights recalculated, enabling us to examine how much they fluctuate across samples. If an edge weight changes considerably from one resample to another, this indicates

that the estimate is unstable. If it remains relatively consistent, it is considered stable and rather reliable. To evaluate reliability, for each edge, a distribution of the 10'000 estimated weights is computed, from which a 95% confidence interval (CI) is derived. This CI reflects the 2.5% and 97.5% of the bootstrap sampling distribution of non-zero estimates. A narrow CI suggests that 95% of the edge estimates fall within a small range of edge weight values, indicating a rather stable and trustworthy estimation. In contrast, a wide CI implies greater variability and lower reliability. As Epskamp et al. (2018, p. 199) emphasize, these CIs should not be used to test the statistical significance of edges - that is, whether a CI includes zero should not lead to the conclusion that the edge is statistically non-significant. This is because LASSO regularization already serves as a statistical filter: edge weights shrunk to zero are effectively considered statistically non-significant, so non-zero edge weights already imply significance. We also computed the proportion of times the coefficient was estimated at a zero-value (prop0).

A second step is *assessing the stability of centrality indices*, to ensure that the importance of each node within the network is reliable and support solid interpretations for interventions. Indeed, Epskamp et al. (2018, p. 210) mention that in small or noisy samples, centrality measures can be highly unstable. To evaluate their robustness, we used the case-dropping subset bootstrap, also implemented in the *bootnet* package. In this procedure, increasing proportions of the sample (i.e., 10%, 20%, and so on) are randomly dropped without replacement. The network is re-estimated at each level of case removal, and centrality indices are recalculated. The centrality values from each reduced dataset are then correlated with the original full-sample values. From this, the Correlation Stability Coefficient (CS-coefficient) is computed. This coefficient reflects the maximum proportion of the sample that can be dropped while still maintaining a given correlation level. In this study, we set a correlation threshold of at least 0.7 between the original and subset centrality scores ($CS_{r = 0.7}$). Fifty (caseN = 50) different levels of case removal were tested to assess the stability of centrality indices. A low CS-coefficient indicates that small changes in the sample cause substantial shifts in centrality estimates, suggesting they are unstable and not reliable representations of node importance. A $CS_{r = 0.7} \geq 0.25$ is considered minimally acceptable, while $CS_{r = 0.7} \geq 0.50$ is preferred for meaningful interpretation (Epskamp & Fried, 2018, p. 200).

5 RESULTS

Factor analysis

Exploratory Factor Analysis (EFA) was performed on the 24 computed subscales (Figure 3). The Kaiser-Meyer-Olkin (KMO) test indicated that the data was overall suitable for factor analysis (KMO = 0.87), although the UPPS subscales of Premeditation (KMO = 0.54), Sensation Seeking (KMO = 0.55), and Perseverance (KMO = 0.70) showed the lowest values. Correlations between subscales were sufficiently strong to justify the analysis ($\chi^2_{(276)}$ = 3'674.045, $p < .001$; see Figure 3 for the correlation matrix).

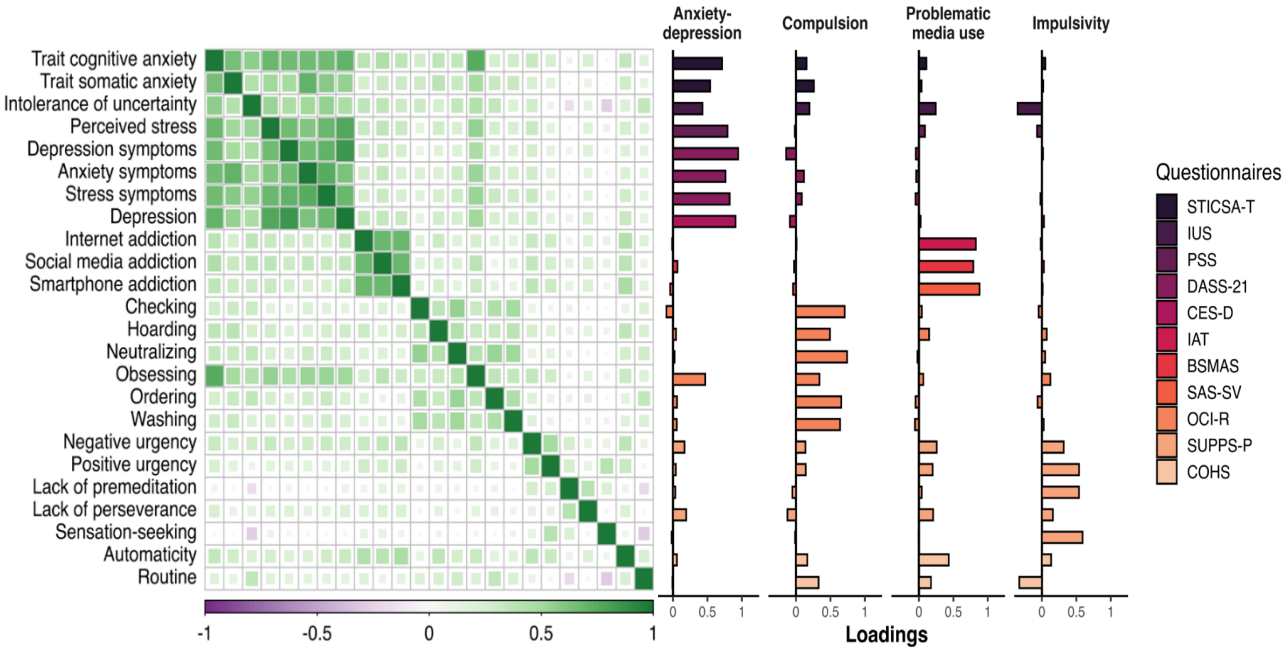
The factor analysis converged toward a four-factor solution. While the Comparison Data procedure recommended extracting six factors and the Cattell-Nelson-Gorsuch method suggested three, the Parallel Analysis, the Minimum Average Partials procedure, and both the Optimal Coordinates and Acceleration Factor methods converged on the recommendation of extracting four factors. Table 2 presents the factor loadings of the different subscales for this solution. The first factor was characterized by high loadings from the DASS-Depression, DASS-Stress, and DASS-Anxiety subscales, CES-D, as well as the Perceived Stress Scale, and the cognitive and somatic subscales of the STICSA-T. Intolerance of Uncertainty also loaded moderately on this factor and so did the subscale OCIR-Obsession. Because this factor appears to capture mainly mood and stress-related measures, we labelled it *anxiety-depression*. It was the factor explaining the highest proportion of variance (20.4%). The second factor was defined primarily by the six subscales of the Obsessive-Compulsive Inventory: Neutralizing, Checking, Ordering, Washing, Hoarding, and Obsessing. Given the rather clear structure of this factor, we labelled it *Compulsion*. Routine subscale of the COHS also showed a moderate loading on this factor, suggesting rigid or structured behavioral tendencies. This factor describes repetitive, ritualized thoughts and behaviors rather than general distress, suggesting a distinct compulsive style that is separable from the broader negative-affect factor, and accounted for 10.9% of the total variance. Factor 3 was best characterized by *problematic media use* (our chosen label), given its strong loadings from the Smartphone Addiction Scale (SAS-SV), Internet Addiction Test (IAT), and Bergen Social Media Addiction Scale (BSMAS), along with a moderate loading from the Automaticity subscale of the COHS. Taken together, these loadings reflect a tendency toward heavy, habitual, use of digital technologies and social media that is difficult to control. We also found smaller but consistent loadings from impulsivity subscales of Negative urgency,

Positive Urgency and Lack of Perseverance. This factor explained 10.7% of the variance. Lastly, the fourth factor was labelled *Impulsivity*, based on its loadings from the four main UPPS subscales: Sensation Seeking, Positive Urgency, Lack of Premeditation, and Negative Urgency. A negative loading was also observed for the COHS Routine subscale, suggesting an inverse association with structured, habitual behaviors. Although this factor explained a smaller proportion of variance than the others (5.6%), it captured a distinct profile. Together, the four factors accounted for approximately 47.7% of the total variance in the data.

Validity coefficients (R^2 = .97 for the anxiety-depression factor, .92 for the compulsion factor, .94 for the problematic media use factor, .83 for the impulsivity factor) assessing the potential impact of factor score indeterminacy (Grice, 2001) were satisfactory. This indicated that the extracted factors were reliable and that the factor scores could be used in the network analysis.

Figure 3

Correlation matrix and standardized loadings of the subscales



Note. STICSA = State-Trait Inventory for Cognitive and Somatic Anxiety Trait Version, IUS = Intolerance of Uncertainty Scale, PSS = Perceived Stress Scale, DASS = Depression Anxiety Stress Scales, CES-D = Center for Epidemiologic Studies Depression Scale, IAT = Internet addiction Test, BSMAS = Bergen Social Media Addiction Scale, SAS-SV = Smartphone Addiction Scale-Short Version, OCI-R=Obsessive-Compulsive Inventory-Revised, SUPPS-P = Short UPPS-P Impulsive Behavior Scale, COHS = Creature of Habit Scale

Table 2

Result of exploration factor analysis with subscale loadings on the four-factor solution

	Saturations			
Questionnaire or subscale	**Anxiety-depression**	**Compulsion**	**Problematic media use**	**Impulsivity**
STICSA - T COGNITIVE ANXIETY	0.712			
STICSA - T SOMATIC ANXIETY	0.540	0.262		
IUS	0.428		0.243	0.352
PSS	0.792			
DASS - DEPRESSION	0.947			
DASS - ANXIETY	0.763			
DASS - STRESS	0.823			
CES-D	0.908			
IAT			0.826	
BSMAS			0.790	
SAS-SV			0.880	
OCI-R_CHECK		0.707		
OCI-R_HOARD		0.493		
OCI-R_NEUTR		0.741		
OCI-R_OBSESS	0.467	0.341		
OCI-R_ORDER		0.658		
OCI-R_WASH		0.640		
SUPPS-P NEGATIVE URGENCY			0.259	0.317
SUPPS-P POSITIVE URGENCY			0.200	0.540
SUPPS-P LACK OF PREMEDITATION				0.539
SUPPS-P LACK OF PERSEVERANCE			0.206	
SUPPS-P SENSATION-SEEKING				0.591
COHS AUTOMATICITY			0.433	
COHS ROUTINE		0.328		-0.328

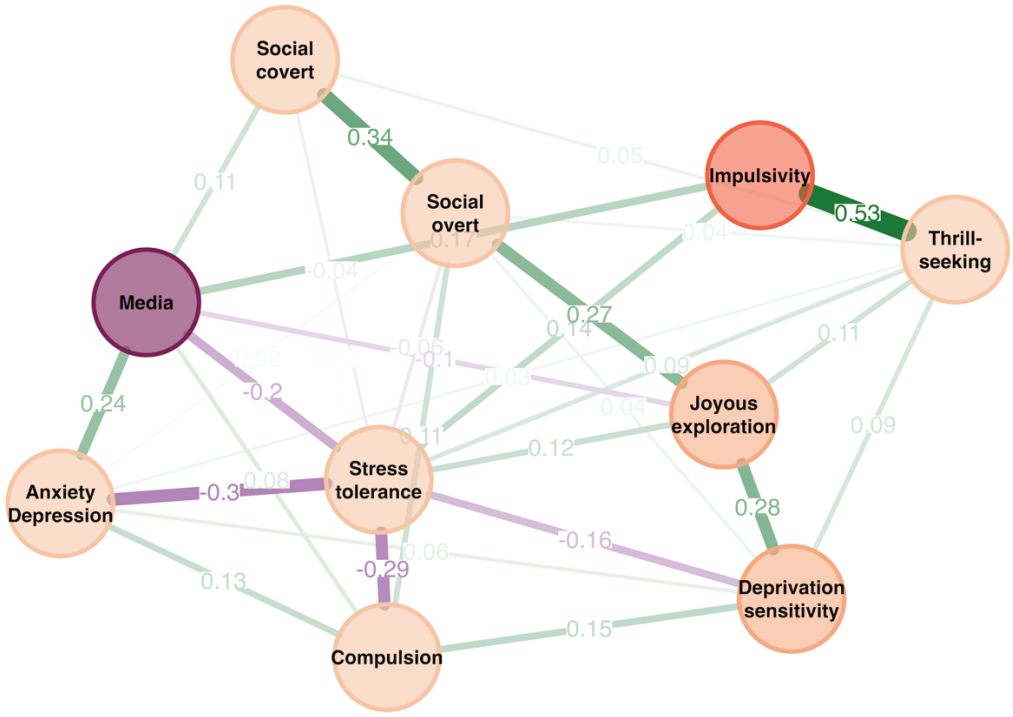
Note. Only loadings > .20 are shown. STICSA = State-Trait Inventory for Cognitive and Somatic Anxiety Trait Version, CES-D = Center for Epidemiologic Studies Depression Scale; PSS = Perceived Stress Scale, DASS = Depression Anxiety Stress Scales, OCI-R=Obsessive-Compulsive Inventory-Revised, IAT = Internet addiction Test, BSMAS = Bergen Social Media Addiction Scale, SAS-SV = Smartphone Addiction Scale-Short Version , COHS = Creature of Habit Scale, IUS = Intolerance of Uncertainty Scale, SUPPS-P = Short UPPS-P Impulsive Behavior Scale.

Network analysis

The network between the six 5DCR subscores and the four EFA-extracted transdiagnostic factor of anxiety-depression, problematic social media use, compulsion, impulsivity was estimated using regularized partial correlations (see Table 3). Figure 4 illustrates the network representing the connections between these dimensions, visualized as nodes, and their connections as edge weights. We additionally computed the expected influence of each node as a centrality index (Table 4).

Figure 4

Network of relationships among the curiosity subscales (5DCR) and EFA-extracted factors



Note. Green edges represent positive connections; purple edges represent negative connections; thicker edges represent stronger connection.

Table 3

Partial correlation matrix of the curiosity subscales (5DCR) and EFA-extracted factors

	Joyous exploration	Deprivation sensitivity	Stress tolerance	Thrill-seeking	Overt social curiosity	Covert social curiosity	Anxiety-depression	Compulsion	Problematic media use	Impulsivity
Joyous exploration		.28	.12	.11	.27				-.10	
Deprivation sensitivity	.28		-.16	.09	.04		.06	.15		
Stress tolerance	.12	-.16		.09	-.06	-.04	-.30	-.29	-.20	0.14
Thrill-seeking	.11	.10	.09		.04	.05	.03			0.53
Overt social curiosity	.27	.04	-.06	.04		.34	.02	.11		
Covert social curiosity			-.04	.05	.34				0.11	
Anxiety-depression		.06	-.30	.03	.02			.13	0.24	
Compulsion		.15	-.29		.11	.01	.13		0.08	
Problematic media use	-.10		-.20			.11	.24	.08		0.17
Impulsivity			.14	.53					0.17	

Table 4

Expected Influence of the graphical LASSO network nodes

Network Nodes	Expected influence
Joyous exploration	0.589
Deprivation sensitivity	0.097
Stress tolerance	-2.336
Thrill seeking	1.116
Social over	0.745
Social covert	0.110
Anxiety-depression	-0.508
Compulsion	-0.475
Problematic media use	-0.249
Impulsivity	0.912

Stress tolerance had the strongest expected influence in the network (see Table 4) and acted as a pivotal node, connecting to anxiety-depression (r_p = −.30; bootstrap: M = −.31, 95% CI = [-.41, -.20], prop0 = .00), compulsion (r_p = -.29; bootstrap: M = -.28, 95% CI = [-.36, -.19], prop0 = .00), and problematic media use (r_p = -.20; bootstrap: M = -.20, 95% CI = [-.32, -.08], prop0 = .00), while showing a modest positive tie to impulsivity (r_p = .14; bootstrap: M = .14, 95% CI = [.05, .24], prop0 = .01). Deprivation sensitivity was positively linked to compulsion (r_p = .15; bootstrap: M = .15, 95% CI = [.05, .25], prop0 = .00) and weakly to anxiety-depression (r_p = .06; bootstrap: M = .06, 95% CI = [.00, .16], prop0 = .17). By contrast, joyous exploration was negatively associated with problematic media use (r_p = -.10; bootstrap: M = -.09, 95% CI = [-.18, .00], prop0 = .05). Thrill-seeking was the curiosity facet with the second strongest expected influence (Table 4). The largest positive edge in the entire network connected this node and impulsivity (r_p = .53; bootstrap: M = .53, 95% CI = [.45, .61], prop0 = .00). Thrill-seeking was also positively, though very weakly, associated with anxiety-depression (r_p = .03; bootstrap: M = .03, 95% CI = [.00, .12], prop0 = .44). Overt social curiosity had a relatively small positive link with compulsion (r_p = .11; bootstrap: M = .10, 95% CI = [.00, .21], prop0 = .03) and very weak with anxiety-depression (r_p = .02; bootstrap: M = .03, 95% CI = [.00, .11], prop0 = .43). Covert social curiosity showed a positive relationship with problematic media use (r_p = .11; bootstrap: M = .11, 95% CI = [.01, .21], prop0 = .02).

With respect to the relationships between the curiosity facets, stress tolerance showed a positive link with joyous exploration (r_p = .12; bootstrap: M = .13, 95% CI = [.01, .25], prop0 = .02) and a moderate negative link with deprivation sensitivity (r_p = -.16; bootstrap: M = -.17, 95% CI = [-.28, -.06], prop0 = .00). Its links to overt (r_p = -.06; bootstrap: M = -.06, 95% CI = [-.17, .00], prop0 = .21) and covert (r_p = -.04; bootstrap: M = -.04, 95% CI = [-.14, .00], prop0 = .29) social curiosity as well as thrill-seeking (r_p = .09; bootstrap: M = .09, 95% CI = [.00, .19], prop0 =

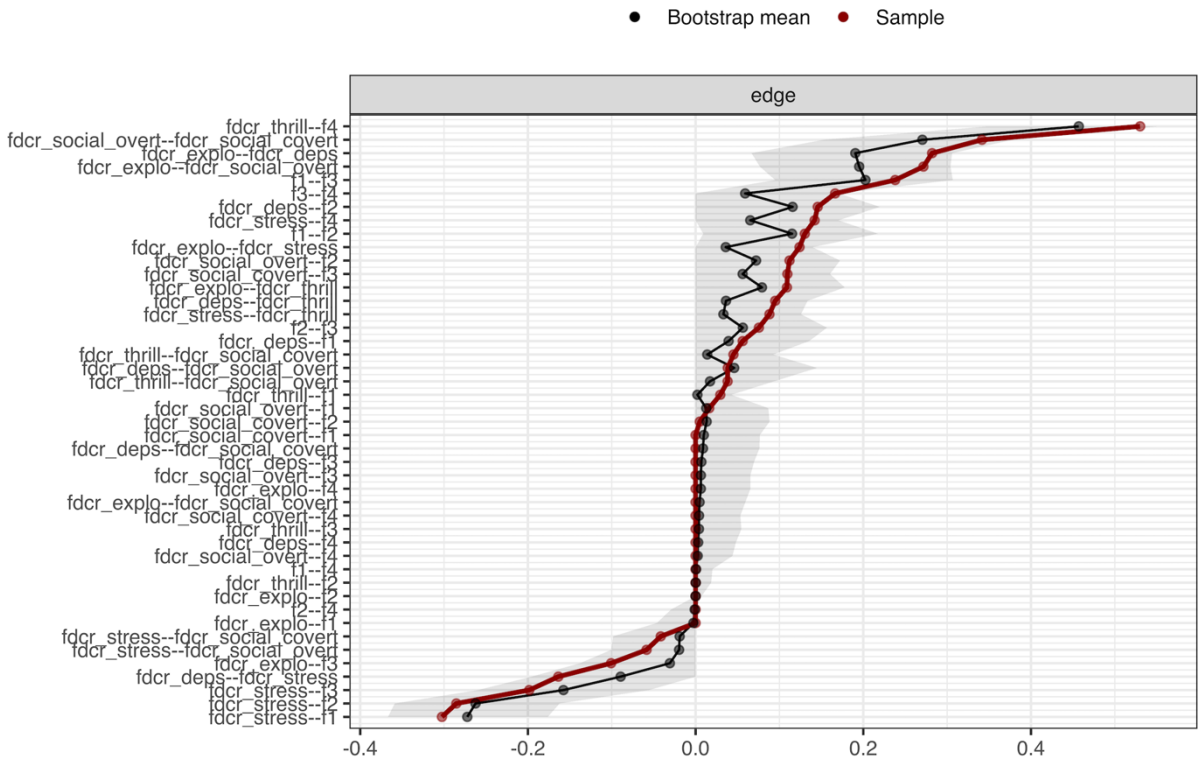
.04) were weaker. Overt social curiosity had strong ties to covert social curiosity (r_p = .34; bootstrap: M = .34, 95% CI = [.22, .45], prop0 = .00) and joyous exploration (r_p = .27; bootstrap: M = .27, 95% CI = [.16, .39], prop0 = .00), but only weak positive edges with deprivation sensitivity (r_p = .04; bootstrap: M = .04, 95% CI = [.00, .13], prop0 = .33) and thrill-seeking (r_p = .04; bootstrap: M = .05, 95% CI = [.00, .15], prop0 = .21), as well as a weak negative link with stress tolerance (r_p = −.06; bootstrap: M = −.06, 95% CI = [−.17, .00], prop0 = .21). Covert social curiosity was positively but weakly associated with thrill-seeking (r_p = .05; bootstrap: M = .05, 95% CI = [0.00, .13], prop0 = .24). Joyous exploration and deprivation sensitivity were positively related (r_p = .28; bootstrap: M = .28, 95% CI = [.18, .38], prop0 = .00). Joyous exploration was additionally positively associated with thrill-seeking (r_p = .11; bootstrap: M = .11, 95% CI = [.01, .21], prop0 = .02). Deprivation sensitivity had a weak positive link with thrill-seeking (r_p = .09; bootstrap: M = .11, 95% CI = [.00, .22], prop0 = .04).

Among the extracted factor nodes, anxiety-depression was positively linked to problematic media use (r_p = .24; bootstrap: M = .23, 95% CI = [.12, .35], prop0 = .00) and compulsion (r_p = .13; bootstrap: M = .13, 95% CI = [.02, .23], prop0 = .01). Compulsion and problematic media use also shared a small positive edge (r_p = .08; bootstrap: M = .08, 95% CI = [.00, .17], prop0 = .06). We additionally found that problematic media use was positively associated with impulsivity (r_p = .17; bootstrap: M = .16, 95% CI = [.06, .27], prop0 = .00).

In assessing the accuracy of edge-weight estimates, Epskamp et al. (2018) recommend inspecting the width of bootstrapped confidence intervals (CIs). Although no universal cut-off is given, the edge-accuracy plot in Figure 5 shows that CI widths are generally < 0.25 and homogeneous across edges, suggesting comparable robustness of the edge weights. For centrality stability we obtained correlation stability coefficients above the recommended 0.50 threshold: $CS_{r = 0.7}$ = .635 for edge strength and $CS_{r = 0.7}$ = .664 for expected influence - both considered satisfactory.

Figure 5

Network edge accuracy plot



Note. The red line indicates the weights in the original sample. The black line represents the average weights across the bootstrap resamples. The light grey band shows the 95% confidence intervals calculated from the distribution of weights in the bootstrap resamples.

6 DISCUSSION

In this study, we explored the interplay between the multifaceted construct of trait curiosity using the 5DCR framework and individual differences in various mental health dimensions. We approached this from a transdiagnostic perspective, so we first conducted an exploratory factor analysis on a broad set of mental health measures (as depression, anxiety, compulsivity, impulsivity, intolerance of uncertainty, habitual tendencies, etc.) so to reduce dimensionality and identify psychological constructs that cut across diagnostic categories. These factors represented our core transdiagnostic mental health dimensions. The exploratory factor analysis identified four distinct factors: anxiety-depression**,** compulsivity**,** problematic media use, and impulsivity. In a second step, we performed a network analysis to examine the relationship of these four factors with the six curiosity facets of joyous exploration, overt and covert social curiosity, thrill-seeking, deprivation sensitivity, and stress tolerance. Our network analysis

revealed that the different facets of curiosity are differentially related to mental health dimensions.

Curiosity and individual differences in mental health dimensions

Stress tolerance as a key curiosity facet

Stress tolerance emerged as the most influential node in the network, showing the strongest negative associations with three mental health dimensions: *anxiety-depression*, *compulsion*, and *problematic media use*. This suggests that a greater ability to tolerate stress when in lack of information may reduce the likelihood of exhibiting maladaptive psychological responses.

These connections seem consistent with the nature of our mental health dimensions, given that low stress tolerance is *embedded* in their maladaptive cognitive and behavioral patterns. Anxiety, for instance, characterized by negative cognitive biases such as overestimating threats, underestimating one's ability to cope (Beck & Clark, 1978), and an inability to shift attention away from perceived danger (Heeren et al., 2011), naturally predisposes individuals to lower stress tolerance: these biases amplify the perceived intensity and unmanageability of stressful situations. The more a person overestimates the intensity and uncontrollability of a situation, the more emotionally demanding the situation may be perceived, making it harder to tolerate distress. Additionally, we can suppose that constant hypervigilance and hyperarousal, maintain individuals in a state of heightened cognitive and physiological alert, potentially reducing cognitive resources and therefore the capacity for emotional regulation and distress tolerance. Similarly, in individuals with depression, uncertainty can activate deeply ingrained beliefs about the self as incapable of overcoming obstacles, the world as unhelpful, and the future as inevitably negative (Beck, 1976), with potential rewards being underestimated (Hemashi & Russo, 2015) - thus reinforcing hopelessness and negative self-judgment (Peterson & Seligman, 1984). This mindset reduces perceived control, and even minor challenges may seem overwhelming, especially when combined with the low motivation typical of depression (Nevid et al., 1991). Individuals may prefer withdrawal when faced with such pressure, not because the stressor is objectively strong, but because they lack the predisposition (such as beliefs in self-efficacy and optimism) that supports emotional resilience and stress tolerance.

As for compulsions, these ritualized behaviors reflect repeated attempts to neutralize the distress generated by obsessions, suggesting a low capacity to endure internal discomfort

(Rachman et al., 1996). Over time, this avoidance may reinforce the belief that distress is intolerable and must be eliminated, preventing the development of more adaptive coping strategies like waiting for the anxiety to lower. As a result, stress tolerance may remain low, as the individual never learns to manage anxiety without relying on compulsions.

In the context of cyberaddiction, excessive media use may function as a regulation strategy to cope with emotional discomfort for people with low stress tolerance. Media engagement offers a quick and easily accessible distraction that temporarily reduces emotional intensity. Over time, this behavior may be reinforced - especially since media platforms are designed to be highly engaging (i.e., through infinite scrolling) - making the distraction effective in reducing distress in the short term. Adaptive coping strategies would require processing the emotion and addressing its underlying cause, which can be challenging when stress tolerance is low.

Our findings align with previous research by Kashdan et al. (2018), who identified stress tolerance as a key facet of curiosity, for managing the discomfort associated with novelty and uncertainty. Higher stress tolerance was linked to lower levels of anxiety and depression, while other facets showed weaker associations - except for deprivation sensitivity, which was also positively linked to anxiety.

The broader literature on the closely related concept of *distress tolerance* seems to point to similar results. Defined as the capacity to endure negative emotional states (Li et al., 2023), distress tolerance has been increasingly recognized as a transdiagnostic vulnerability factor in the development and maintenance of mental health conditions, inversely associated with anxiety, depression, OCD, substance addiction, and borderline personality disorder (Laposa et al., 2015; Leyro et al., 2010; Michel et al., 2016). Individuals with low distress tolerance tend to experience negative emotions as intolerable, judge them as unacceptable, and therefore tend to rapidly avoid or suppress them - both coping strategies that may provide short-term relief but contribute to long-term emotional dysregulation (Li et al., 2023; Simons & Gaher, 2005). In support of its strong association with mental health conditions, there is growing evidence that interventions targeting distress tolerance may reduce vulnerability to mental disorders. For example, Li et al. (2023) found that mindfulness-based interventions effectively enhanced distress tolerance, which in turn reduced symptoms of anxiety and depression. These interventions work by helping individuals develop nonjudgmental awareness and acceptance of internal experiences, including emotional distress, encouraging them to remain present rather

than react automatically with avoidance. This contrasts with the natural tendency of low distress tolerance to escape negative emotions.
Regarding problematic media use, Elhai et al. (2018) found that individuals with higher distress tolerance were less likely to report severe smartphone addiction. They suggested that everyday stressors may drive smartphone use as an automatic maladaptive coping mechanism (we can think of online escapism in response to anxiety) and that individuals with better distress tolerance are more capable of enduring negative emotional states without needing to escape through media consumption. Similarly, Mahama et al. (2024) found that low stress tolerance, among other curiosity facets, predicted internet addiction.

Together, our findings and prior research highlight that the curiosity facet of stress tolerance appears to be a key emotional regulation capacity during exploration - serving as a protective factor against mental disorders when strong, and as a vulnerability factor when weak. Stress tolerance could play a key role on the appraisal mechanism defining whether one same situation may trigger curiosity or rather aversive emotional states, such as anxiety. Building on Hilmerich et al. (2024) particularly, who suggest that curiosity versus anxiety depends on motivational readiness, (di)stress tolerance may influence both how intense a situation is appraised and one's perceived capacity to cope: when (di)stress tolerance is low, situations implying an information gap may seem more threatening, coping abilities lower, increasing the likelihood of an anxious response.

One might therefore be tempted to infer that higher stress tolerance is universally beneficial, allowing individuals to engage in exploration without experiencing excessively negative emotions or dysfunctional behaviors. However, when considering the association between stress tolerance and impulsivity, a more complex picture emerges. Specifically, stress tolerance is positively linked to impulsivity, which, in turn, is positively associated with problematic media consumption. While the direct connection between stress tolerance and impulsivity remains relatively underexplored in the literature, one hypothesis could be that impulsive individuals may act not only due to poor self-control in front of short-term rewards, but also because they tend to underestimate the consequences of their actions (Cosenza et al., 2014). This underestimation could lead to experiencing less stress in response to uncertainty. Hence, the positive link between impulsivity and stress tolerance may not reflect stronger emotional regulation, but instead a diminished perception of how stressful a situation could be.

The ambivalent role of thrill-seeking

Another key facet showing the second highest expected influence in the network is thrill-seeking. In relation to the mental health dimensions, we found this facet to be strongly linked to impulsivity - the largest edge in our network - suggesting that individuals high in thrill-seeking may be particularly prone to impulsive behaviors. Supporting this tie, previous research points to shared neural mechanisms, including heightened reward-related activity and reduced cortical thickness in areas involved in cognitive control (Chase et al., 2017). Both traits have been associated with risky behaviors, as substance use (Holmes et al., 2016); in our data, thrill-seeking is indirectly related to problematic media use through their shared link to impulsivity.

The lack of relevant links to other mental health dimensions - given no connection to compulsion and only a very small positive one to anxiety-depression - seems to suggest that thrill-seeking isn't inherently negative. In fact, its need to experience can represent a powerful engine for discovery and, ultimately, growth. It is when thrill-seeking is paired with impulsivity that this curiosity facet may act as a vulnerability factor.

Ties to deprivation sensitivity, overt and covert curiosity, and joyous exploration

The remaining facets of curiosity showed weaker or no connections to mental health dimensions. Deprivation sensitivity moderately tied to compulsion and weakly to anxiety-depression. One possible explanation is that detecting a knowledge gap may for example trigger checking compulsions as a way to close the gap and reduce the related anxiety by achieving short-term certainty - until a new doubt (or gap) arises. Because deprivation sensitivity is linked to a tension or frustration of not knowing, we would have expected its tie to anxiety-depression to be highly relevant. One reason could be that such association is indirect, occurring through their respective links to stress tolerance. In other words, when stress tolerance is low, both deprivation sensitivity and anxiety-depression tend to be higher.

No direct links were found between deprivation sensitivity and problematic media use either, potentially due to this same indirect dynamic with stress tolerance. This might suggest that it is not the *need to know* itself that relates to problematic media use, but rather the inability to tolerate the stress of not knowing. In this context, Zahoor's (2022) observation that FOMO is a significant predictor of social media addiction prompts the idea that FOMO may represent a manifestation of low stress tolerance in the face of a perceived information gap.

The lack of a direct tie to impulsivity is also intriguing - indeed, one could have expected that sensitivity to not knowing could link to impulsivity as an attempt to calm the frustration. Given the tie of deprivation sensitivity to compulsion, we could make the hypothesis that the rising frustration seeks resolution thought ritualized behaviors (as checking), rather than automatic cue-driven reflexive behaviors, which is more the nature of impulsivity.

Covert social curiosity showed a small positive association with problematic media use, but no relevant ties to other dimensions. A potential reason could be that social media platforms, which allow anonymous observation of others, create an ideal environment for this form of curiosity to thrive. This may include behaviors such as discreetly browsing others' profiles, reading comments on posts, or monitoring online activity patterns. These platforms facilitate information seeking and offer rewards thanks to access to such sought after content, which can reinforce repetitive engagement. Over time, this reward-driven behavior may contribute to maladaptive use patterns, potentially leading to cyberaddiction. From this perspective, problematic media use could be viewed as a learned, reward-driven disorder (Sun & Zhang, 2021; Wang, 2019)). However, such link was relatively weak and previously discussed ties between problematic media use and stress tolerance or impulsivity-thrill-seeking appeared stronger.

Overt social curiosity appeared to be unrelated to anxiety-depression and problematic media use, which in a way reflects its definition as an outward tendency motivated by learning more about others (their culture, story) and to entertain a social circle. However, the lack of a direct link might be due to its negative association with stress tolerance, even if very small. Similarly, Kashdan et al. (2018) did not find significant associations with anxiety or depression, but they also reported a negative correlation with stress tolerance. We can suppose that part of this willingness to learn about others is driven by the need to feel part of a group, be accepted, and learn or adhere to social norms; these needs could generate stress, which is then alleviated by acquiring more information about others. The additional small positive link we found with compulsion could reflect a similar need for belonging and connection, fulfilled through repetitive checking of what others think or feel, much like reassurance-seeking, offering temporary relief from social uncertainty.

Expectedly, joyous exploration didn't show any relevant ties to anxiety-depression, compulsion and impulsivity. This seems consistent with its tendency to actively seek knowledge and

experiences for the pleasure of learning, which entails the capacity of seeing challenges, and their inherent uncertainty, as a potential of personal growth. Such resilient attitude naturally predisposes individuals to higher coping potential, confidence in their ability to face adversity, trust in the world as being a nurturing place and the view of the future as an opportunity for personal growth - hence, protecting them from these mental health conditions. Joyous exploration only had a negative tie to problematic media use, which echoes Mahama et al.'s (2024) results showing that joyous exploration appears to mitigate the risk of developing internet addiction. This may suggest that when online media is used as a platform for exploration and personal growth, as discovering recipes, travel destinations or fun facts, its consumption doesn't necessarily lead to cyberaddiction - on the contrary, can protect from it.

Complementary observations

The richness of the network structure allows for complementary observations beyond our research question, particularly regarding the organization of the curiosity construct and the relationships among mental health dimensions.

On the organization of the curiosity construct

When considering the structure of the curiosity construct, we found the various facets to represent different but connected motivational aspects of exploratory behavior. When examining their interplay, two distinct subsystems emerged. The first comprised a cohesive, positively interconnected cluster of facets including joyous exploration, deprivation sensitivity, and both overt and covert social curiosity - representing a more *cognitive-driven*, interpersonally and intellectually motivated exploration profile. The second subset centered on thrill-seeking. This represents a more *sensation-driven* form of exploration that is only lightly connected to the rest of the curiosity system. Our data structure seems to align with recent work by Reio (2024), where these same subsets are described as the two main types of curiosity commonly identified in research. They were labeled the "cognitive" type - driven by a willingness to gather information and learn - and the "sensory" type, which is driven by the pursuit of new sensations and may incidentally lead to learning as a byproduct of engaging in novel experiences (p. 43). In a way, although not totally overlapping, these two sides of curiosity could recall Berlyne's (1966) described types of epistemic curiosity (in their relation to gathering information) and perceptual (in their relation to sensation).

Be it to know more or for the feeling it brings, exploration implies exposure to novelty and uncertainty, which in turn, requires the capacity to tolerate the potential risks associated with this exposure - such as getting expensive tickets for a theater play that turns out to be disappointing or being injured when climbing an active volcano. In line with this narrative, our findings show that both curiosity subsets are linked to stress tolerance, suggesting that the ability to manage the emotional distress associated with uncertainty and risk exposure plays a critical role in exploration - though each subset is differentially connected to stress tolerance.

An intuitive link is the positive association between stress tolerance and joyous exploration. If exploring the unknown entails novelty and uncertainty, it seems only natural that the ability to manage distress would facilitate experiencing the excitement and wonder of discovery. This positive link is particularly evident when examining the curiosity profiles identified by Kashdan et al. (2018). The authors clustered participants into groups, finding that “The Fascinated”, individuals high on joyous exploration, also score high on stress tolerance, whereas those low on both were categorized as “The Avoiders.” Adding nuance to these profiles, *The Fascinated* are described as having “inquisitive minds” and a “joie de vivre” (p. 145), they are enthusiastic, adventurous individuals who *take pleasure in unpredictability*. In contrast, *The Avoiders* tend to “shy away from things they don’t know or don’t understand” (p. 145), report higher stress, feel incapable of handling difficult situations, and demonstrate poorer emotional awareness. These descriptions illustrate how differing appreciations of uncertainty shape emotional pattern and behavioral tendencies and seem to support both the positive link we found to joyous exploration and the ties of stress tolerance to mental health dimensions.

The negative association between stress tolerance and deprivation sensitivity may suggest that a greater capacity to regulate distress is linked to lower sensitivity to information gaps, and vice versa. Hence, higher stress tolerance may imply lower frustration in front of not knowing, while feeling frustrated in front of an information gap hints to lower stress tolerance.

A closer look at the triadic relationship among stress tolerance, joyous exploration, and deprivation sensitivity reveals an interesting dynamic; indeed, we found a strong positive link between joyous exploration and deprivation sensitivity. On one hand this challenges the traditional view of curiosity as a binary experience: either a distressing state arising from the awareness of an information gap - where exploration is driven by the urge to reduce discomfort - or a purely positive emotional experience aiming discovery and growth; instead, these findings support a more nuanced perspective, indicating that curiosity does not operate in an "either/or"

fashion, but rather that both facets can coexist, as already proposed by Litman and Silvia (2006). On the other hand, this positive link suggests that detecting a knowledge gap and experiencing some degree of urgency in filling it can still be lived as a positive experience when distress is well tolerated. However, the same gap may also be perceived as an intolerable sense of lack when coupled with lower distress tolerance. From this perspective, it is not the detection of an information gap that leads to distress or compulsion, but rather the inability to regulate the emotional response to that gap. When well-regulated (thanks to stress tolerance), the same situation can instead foster a pleasurable and enriching sense of discovery.

To a lesser degree, stress tolerance showed a small positive direct link to thrill-seeking as well; the mechanism behind may be the one described by McCay et al. (2018), who found that sensation-seeking (including thrill-seeking) increases stress tolerance by modulating the appraisal of stressful situations on one hand - seeing them as *opportunities* for growth rather than mere threats - and by enhancing perceived coping abilities on the other, such as having confidence in one's problem-solving strategies. This dual effect could make stressors appear more manageable, hence more tolerable. These findings suggest that thrill-seeking is not inherently negative and can fuel enthusiasm in learning - in fact we found a (small) positive link to joyous exploration. Yet, the likelihood of thrill-seeking tendencies to come with impulsivity - and therefore trigger maladaptive behaviors - appears to be quite strong, as previously described.

Overt social curiosity and joyous exploration showed a strong positive association, which may be explained by their shared core of intrinsic motivation in acquiring new knowledge - joyous exploration for understanding oneself and the world, and overt social curiosity for understanding others and their behaviors.

On the associations among the different mental health dimensions

Anxiety-depression was positively linked to problematic media use and, to a lesser extent, to compulsion, while problematic media use and compulsion shared a rather small positive tie. These reciprocal links suggest that these nodes are related and may mutually reinforce one another when one is activated. However, since these dimensions were extracted as latent factors from the factor analysis, their connections may reflect not only statistical associations but also the cross-loadings observed in the EFA. For instance, the anxiety-depression factor captured a

group of internalizing scales (STICSA-T, PSS, DASS-21, CES-D, IUS) but also showed a relevant loading from the OCIR-obsession subscale. Conversely, the compulsion factor was primarily defined by compulsivity-related scales (OCIR-checking, OCIR-obsessing, etc.), yet smaller loadings were also observed from anxiety and intolerance of uncertainty scales (STICSA-T and IUS). In the network, each mental health dimension is linked based on shared variance; because certain scales contributed to multiple factors through these cross-loadings, this may have created an overlap or shared variance between the factors, increasing the likelihood that they would appear connected in the network analysis. As a result, the edge observed between the anxiety-depression and compulsion nodes may, at least in part, reflect these overlapping contributions at the factor level. Such effect appears however to be minimal when comparing loadings between anxiety-depression and problematic media use, or between compulsion and problematic media use.

Only problematic media use was directly connected to impulsivity, while no direct links were found with either compulsion or anxiety-depression. The connection between impulsivity and problematic media use was already hinted at in the factor analysis, with impulsivity-related scales - particularly positive and negative urgency and lack of perseverance - loading moderately on the problematic media use factor. It therefore remains unclear to what extent the positive association observed in the network analysis is driven by shared variance due to overlapping loadings, and to what extent it reflects a distinct relationship between the constructs.

The absence of a connection between impulsivity and compulsion may suggest that, although these behaviors can appear similar in their hard-to-stop nature - as immediately checking when notifications appear on one's phone versus repeatedly checking whether the stove is off - they may be driven by distinct psychological mechanisms. For example, the Creature of Habit Scale (COHS) loading patterns revealed that impulsivity was positively associated with automaticity (the tendency to act without conscious thought, often as a reflexive response to cues) and negatively associated with routine (the preference for routine, stability and repeated actions). In contrast, routine showed a positive loading on compulsion, reflecting its rigid and repetitive nature; this pattern is consistent with previous findings by Wuensch et al. (2025), who also observed that compulsivity tends to associate with routine, while impulsivity is more closely tied to automaticity, with automaticity itself being linked to reward-seeking behaviors. This may provide some evidence that impulsive behaviors could be reflexive and driven by reward-

seeking, whereas compulsions are more structured and rigid, serving an anxiety-reducing function - supporting the lack of association we observed.

Limitations

Several limitations should be acknowledged. First, the data was collected through self-reported measures, which are inherently subject to various biases, such as social desirability and limitations in introspective ability and accuracy. Second, although the network analysis enabled the identification of associations between variables and the generation of hypotheses regarding underlying mechanisms, it does not allow for causal inference. Experimental designs would be necessary to test our hypothesized interpretations. Finally, the selection of regularization parameters, in our case a conservative 0.5, can influence edge detection as GLASSO may introduce "false negatives" ("true" edges reduced to zero) that might have been present had we chosen another parameter; this might be especially true for psychological constructs, where many variables are intercorrelated and may not have been fully captured in our network, potentially limiting the accuracy of our interpretations. As a result, our findings should be interpreted with caution and ideally replicated.

7 CONCLUSION

Our study aimed at understanding how different facets of curiosity relate to mental health. The key role of stress tolerance, serving almost as a bridge between other curiosity facets and mental health dimensions, suggests that how well individuals manage (di)stress in the face of an information gap and the accompanying uncertainty may function as either a protective or risk factor. In other words, it may determine whether the lack of knowledge is experienced as a potential source of growth or be associated with mental health difficulties. In this regard, our study suggests that it is not the detection of an information gap itself that is problematic, but rather the inability to manage the distress associated with not knowing. To a lesser extent, thrill-seeking may also become problematic - indeed, if such fuel for exploration and experiencing may be a powerful force of learning and growth, it may as well lead to problematic media use when coupled with impulsivity. As for the other curiosity facets, they were only loosely connected to mental distress dimension: deprivation sensitivity and overt social curiosity were weakly tied to compulsion and covert social curiosity to problematic media use. Joyous

exploration seems to play a protective role, being only inversely connected to problematic media use.

Overall, our study suggest that curiosity can be a fulfilling source of learning and growth, but it comes with a catch: it requires both the ability to tolerate stress and to channel thrill-seeking constructively; otherwise, it may instead be associated with negative mental states.

Our findings may help shift the research focus from asking whether being curious is good or bad for mental health to understanding which facets of curiosity appear to foster personal growth and well-being, which may hinder it, and how these facets are interconnected. They may also potentially prompt future research in the development of personalized clinical interventions, aiming at enhancing stress tolerance and channel thrill-seeking, while boosting the more adaptive ones, such as joyous exploration. In doing so, curiosity could be leveraged as a constructive force for personal development and well-being.

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