International Journal of Intelligence Science, 2026, 16(2), 202-215
https://www.scirp.org/journal/ijis
ISSN Online: 2163-0356
ISSN Print: 2163-0283

Non-Verbal Signals, Social Media and Artificial Intelligence: Are Emotional Processes Becoming Simpler or More Sophisticated?

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How to cite this paper: Chafi, A. (2026) Non-Verbal Signals, Social Media and Artificial Intelligence: Are Emotional Processes Becoming Simpler or More Sophisticated? *International Journal of Intelligence Science*, **16**, 202-215.
https://doi.org/10.4236/ijis.2026.162010

Received: March 3, 2026
Accepted: April 18, 2026
Published: April 21, 2026

Abstract

Cognitive scientists have long attempted to explain emotional processes using models that vary in complexity. These span very simplistic views such as the ones from James and Lange (*i.e.*, physiological arousal), or Cannon (*i.e.*, homeostasis) to much more elaborated ones. The best example of this elaboration is Scherer's component process model of emotion. Digital environments are sophisticated and complex though they appear to trigger extremely archaic emotional routes. These phylogenetically ancient mechanisms might explain the strength of humans' addiction to digital devices like smartphones. The present research paper aims to understand the interactions between technologically advanced processes and primary, archaic mechanisms in humans. The underlying question being the following: are emotional processes becoming simpler or more sophisticated?

Keywords

Emotion, Cognition, Non-Verbal, Social Media, Artificial Intelligence

1. Introduction: The Paradox of Emotional Sophistication

Today's technologies, such as social media, rely on heavily sophisticated mechanisms and computer networks [1]. Another example of that complexity of information is Large Language Models (LLMs), the most widely used form of Artificial Intelligence (AI). These models have lately been shown to help diagnostic and decision-making processes for complex medical cases [2]. Furthermore, these processes were way faster than the same processes performed by human doctors. Despite unprecedented computational sophistication, the affective mechanisms sustaining user engagement appear strikingly primitive. For example, researchers [3] showed that basic primary emotions such as Lust, Happiness and Sadness had a strong impact on people, even when these emotions were conveyed by virtual agents. Even at a lower level of consciousness, very plain aspects of an image such as a simple disk moving through elementary trajectories were shown to interfere with cognitive and emotional processes [4]-[9]. In the same vein, other scientists [10] showed that micro-interactions in smartphone apps reduce cognitive burden, enhance the sense of direct manipulation, imply positive emotions related to a brand and impact the user's subsequent actions. Similar effects on emotions have been shown concerning facial emojis in messages [11]. Effectively, these authors showed that facial emojis affected how a sender's mental state was perceived from their text message. They also demonstrated that emojis impacted text processing by measuring event-related potentials, and that emoji valence (*i.e.*, positive *vs.* negative) impacted text processing differentially. Another aspect of modern technology is scrolling. This behaviour also seems related to emotional operations. Effectively, difficulties in emotion regulation predicted the occurrence of passive scrolling and surveillance of others according to a 2026 study [12]. AI should also be taken into account. Effectively, another recent study [13] has shown that being exposed to AI's ability to generate meaningful texts both elicited negative emotions and favoured a greater perception of threat involved by AI. Although much of the present paper focuses on non-verbal signals, interactions with AI systems may similarly engage rapid emotional mechanisms. In particular, the ambiguity of agency and the uncertainty associated with AI-generated content may activate fast evaluative processes related to threat detection and social inference, thereby extending the relevance of the present framework beyond strictly non-verbal domains.

Therefore, most elements implied in modern technology are bound to emotions. Most of these emotions seem quite basic (e.g. fear, lust, threat). Yet, most theories of emotions involve complex cognitive appraisals. One of the best examples to illustrate this is the appraisal model of emotions developed by Scherer and his collaborators [14]. Are these models adapted to environments which solicit fast, automatic and near-subliminal responses? This paper argues that emotional engagement in digital environments increasingly relies on phylogenetically ancient rapid-response mechanisms rather than deliberative appraisal processes, thereby challenging dominant appraisal-based models of emotion.

For the purposes of this paper, several key terms require clarification. "Simpler" emotional processes refer to fast, automatic, and low-dimensional affective responses which rely on limited cognitive integration. In contrast, "more sophisticated" emotional processes involve multi-stage appraisal, contextual interpretation, and reflective evaluation. The concept of "Primary Emotional Loops" introduced in this paper refers to rapid, self-reinforcing cycles of stimulus detection, affective activation, and behavioural response that operate with minimal cognitive mediation. At last, "minimal cognitive mediation" denotes processing that occurs without extended, conscious, or deliberative appraisal, although it may still involve fast and automatic evaluative mechanisms.

The paper is structured as follows. First, classical models of emotion and their emphasis on cognitive appraisal are reviewed. Second, empirical evidence supporting rapid and early emotional processing is presented. Third, the role of non-verbal signals in digital environments is examined. Finally, the concept of Primary Emotional Loops is introduced and discussed in relation to contemporary technological contexts.

2. Methodological Approach

This paper adopts a narrative and conceptual review approach. The objective is not to provide an exhaustive or systematic review of the literature, but rather to integrate findings from multiple domains, including emotion theory, neuroscience, behavioural research, and human-computer interaction, in order to develop a coherent theoretical perspective. The studies discussed were selected based on their relevance to rapid emotional processing, non-verbal signal perception, and digital interaction contexts. Priority was given to empirical findings that illustrate the existence of fast, automatic affective mechanisms, as well as their potential modulation in technologically mediated environments. As such, the present work should be understood as a hypothesis-generating and theory-building contribution rather than a comprehensive meta-analytic review.

3. Classical Models of Emotion and Their Cognitive Bias

Over the past sixty years, dominant theories of emotion have converged on the idea that emotion is composed of two main components: a physiological component and a subjective component. During the twentieth century, the first to develop an in-depth account of the subjective component was the American psychologist Magda Arnold [15], although she was preceded at a shallower level by Wundt and James in the nineteenth century. Arnold focused on the process through which meaning is attributed to an event, which she termed appraisal, or cognitive evaluation. A few years later, Lazarus [16] extended this framework by introducing the notion of cognitive reappraisal. He also distinguished between two types of appraisal: 1) primary appraisal, which evaluates an event in terms of its pleasantness and goal relevance, and 2) secondary appraisal, which assesses the individual's perceived ability to cope with the situation. According to Lazarus, it is the combined outcome of these two forms of appraisal that differentiates emotions. Alongside the work of Arnold and Lazarus, Schachter and Singer [17] proposed the Two-Factor Theory of Emotion. This theory posits that both a non-specific physiological activation and a cognitive interpretation of the situation are necessary for an emotion to occur. In other words, the first factor corresponds to arousal, and the second to appraisal. One of the major contributions of Schachter and Singer's model was to emphasize the role of social influences in shaping emotional experience. In sum, appraisal theories assume the existence of a physiological activation whose qualitative differences were not thoroughly investigated by their proponents. This activation is then assumed to lead to distinct emotions, with cognitive appraisal being the main mechanism accounting for emotional differentiation. Likewise, component process models of emotion, most notably Scherer's model [18], propose that emotions emerge from the coordinated and dynamic interplay of multiple subsystems, including cognitive appraisal, neurophysiological responses, action tendencies, expressive behaviour, and subjective feeling. In this framework, appraisal is conceived as a multi-stage evaluative process that continuously monitors the relevance, implications, and coping potential of events, thereby driving the differentiation and unfolding of emotional episodes over time. Emotions are thus not viewed as unitary states, but as complex, multi-component processes resulting from ongoing appraisals operating at different levels of processing. Importantly, the present framework distinguishes between extended, deliberative appraisal processes and rapid, automatic evaluations that may occur at pre-reflective levels. While some theoretical models consider early evaluations as forms of appraisal, the present paper treats them as functionally distinct from the multi-stage, cognitively elaborated appraisal processes described in classical theories. This distinction is central to the argument that emotional responses in digital environments may rely less on extended appraisal and more on rapid evaluative mechanisms.

Moreover, the postulate on which component process models are based would have raised fewer issues had physiological research, particularly in cardiology, not revealed distinct patterns of activation depending on the emotion experienced [19]. These authors showed that joy (elicited through appreciation) and anger (elicited through frustration) are associated with markedly different cardiac dynamics: joy is characterized by a more regular heart rhythm, whereas anger is associated with a more chaotic pattern (see **Figure 1**). This suggests that subjective feelings may stem from a differentiation process that already takes place very early in the emotional sequence. This idea is consistent with Frijda's comprehensive account of action tendencies [20], a concept originally introduced by Arnold.

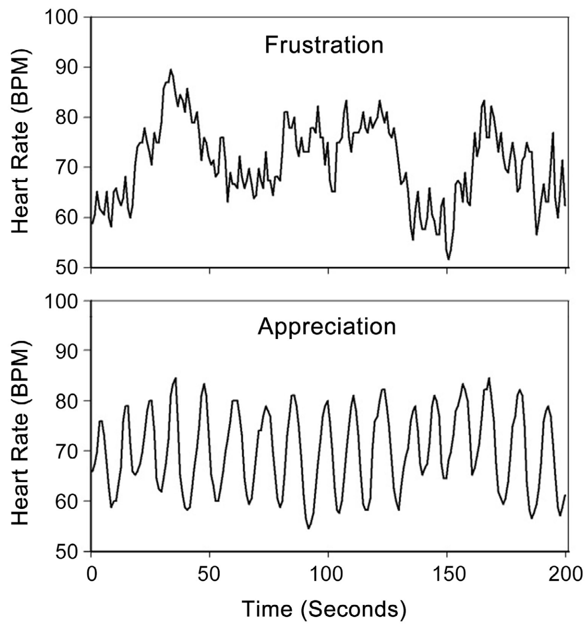

Figure 1. Heart rhythm patterns for Frustration and Appreciation. Source: [19].

For Frijda, action tendencies constitute the link between emotional experience and behaviour. In this perspective, autonomic physiological activation can be seen as the logistical support for certain variables involved in action preparation. Emotional experience would thus be grounded in both appraisal-related awareness and awareness of action tendencies. The main innovation of Frijda's model lies in the integration of action tendencies into the modelling of emotional processes, as well as in the specification of these tendencies. Some authors have even argued that emotion arises from the action performed in response to a stimulus. This is notably the case for James [21] and Lange [22] who reached similar conclusions independently and almost simultaneously. According to them, seeing a bear is in itself a frightening stimulus that elicits fear and/or anxiety responses. However, if the bear is seen in a cage or behind bars in a zoo, it is very likely that the individual will not experience fear. This explanation nonetheless seems insufficient to us. One could reasonably assume that seeing a bear triggers primary physiological reactions (irregular heart rate, altered breathing, increased blood flow to the leg muscles, etc.), which are then counteracted or modulated by the perception of another stimulus, namely the solid bars confining the bear. Indeed, an ecological situation is composed of multiple stimuli. Isolating a single stimulus and observing its effect is precisely the core principle of empirical scientific methodology. Thus, even if seeing a snake in a terrarium does not elicit any unpleasant reaction, it is well established, based on both empirical evidence and genetically grounded learning, that the snake considered in isolation will trigger a visceral fear response in the vast majority of human beings [23] [24].

It is noteworthy that balance is one of the most important factors in our understanding of the world. According to Cannon [25], a disruption of homeostatic balance lies at the origin of emotional episodes. For this American physiologist, the healthy state of an organism is defined within homeostatic limits. When this homeostasis is disrupted, the body triggers an alarm response, leading to a cascade of reactions culminating in stress. From that point onward, the individual's behaviour is oriented toward restoring the initial equilibrium. Cannon's theory seems to address a substantial gap in other theoretical accounts. Although contemporary models of emotion allow for a fine-grained description of affective processes and can be useful in therapeutic contexts [26], these multi-level models (like in [27]) fail to address nowadays swift and meaningless processes at stake when using modern digital technology. Effectively, these models were conceived for stable environments which are rich in symbolic meaning (e.g. thinking of an issue in the office of a psychiatrist or a psychologist). Therefore, a legitimate question arises: do empirical data support Cannon's view? In other words, are there stimuli capable of eliciting emotional responses without any prior cognitive appraisal?

4. Empirical Evidence of Early and Primary Emotional Processing beyond Appraisal

By observing escape behaviours in birds or fish when confronted with a predator, one can account for emotion as being, at least partly, genetically encoded in order to prepare the organism for specific types of stimuli. In such cases, birds and fish appear to merely follow a genetic program when displaying escape behaviours that are repeated in an invariant manner in response to the same stimulus, namely the predator. The detection of motion may thus be sufficient to trigger a cascade of emotionally driven behavioural processes. This was famously illustrated by an Austrian zoologist [28], who elicited panic reactions in newly hatched ducklings when a shape resembling a bird moved toward them, thereby evoking the silhouette of a bird of prey. Conversely, when the same shape moved in the opposite direction, the freshly hatched ducklings followed it as if it were their mother. Numerous other examples can be found in the animal literature, but the present discussion will focus on human beings. A clear human example concerns genetically influenced preferences for odours and tastes. For instance, a study conducted on three-day-old newborns showed that butyric acid (which has a rather unpleasant odour) elicited more facial markers of disgust than vanillin, which is generally perceived as pleasant [29]. Preferences for sweet tastes throughout the lifespan also appear to be partly genetically determined [30]. Taken together with other findings [31], these results support the existence of biologically predisposed olfactory and gustatory preferences. Also, neuroscientists [32] showed that distinct basic emotions are associated with different temporal patterns of evoked potentials. Specifically, disgust appears to be the first emotion linked to specific neural processing, emerging shortly after 140 ms, followed by joy and sadness, which differ at frontal and central levels after approximately 160 ms. Studies in newborns further converge with this view by showing early preferences for certain types of stimuli, notably facial expressions of joy [33] or specific motion patterns, as reported by other researchers [34]. In the latter study, newborns visually preferred non-biological motion, which suggests that they were able to recognize biological motion early on and quickly lost interest in it after minimal exposure. More recent studies on visual processing of non-biological motion in both adults and children indicate that certain types of motion (*i.e.*, wave-like, parabolic, and translational) can elicit an initial emotional response capable of modulating the processing of affective stimuli [4] [6] [7] [9]. The same authors also showed that exposure to these motion patterns can either enhance or impair mnemonic and psychomotor performance [5] [8]. Across all the studies reviewed above, no conscious evaluation of the situation was required. If such primary mechanisms are sufficient to modulate perception, memory, and behaviour in controlled laboratory settings, it becomes legitimate to ask how massively repeated exposure to similar low-level signals may operate within digital environments. This raises important questions about the role of appraisal and its definition in contemporary models of emotion as well.

While the evidence reviewed in this section is largely derived from animal studies, developmental research, and controlled laboratory experiments, it provides a foundational understanding of rapid emotional processing mechanisms. The following section examines how similar mechanisms may be engaged in contemporary digital environments, where such processes are not merely observed but actively exploited and amplified.

5. Non-Verbal Signals as Emotional Triggers in Digital Environments

As previously stated, contemporary digital environments are not emotionally complex because they do not demand deep interpretation. Instead, they are powerful because they repeatedly activate rapid and low-level affective mechanisms [35]. In fact, digital environments rely heavily on fast, repetitive, and pre-cognitive signals. These signals can be listed as follows: micro-movements (e.g. scrolling, swiping), intermittent feedback such as likes and notifications, visual pulses (e.g. red badges, animation effects), and reaction icons (*i.e.*, emojis). When it comes to the latter, a study [36] showed that an emoji-word incongruency had a direct impact on both reaction times and brain activity. More precisely, participants showed longer reaction times when there was an incongruency between the word and the emoji displayed. Also, word + emoji combinations were shown to activate the amygdala, a subcortical structure linked to fast emotional and automatic processes, and therefore survival [24]. Effectively, amygdala-related processes are extremely rapid (<200 ms) and involve the dorsal visual pathway [37] [38]. This pathway can be defined as the cortical highway for emotional processing, especially when this processing is automatic (e.g. processing a football traveling towards you during a match). Other studies showed a link between non-verbal digital signals and fast, automatic operations. For instance, a scientist [39] investigated how dating apps and their typical behaviours, namely swiping and scrolling, modelled brain reactions that involved the prefrontal cortex, the extended amygdala, and the basal ganglia (see **Figure 2**).

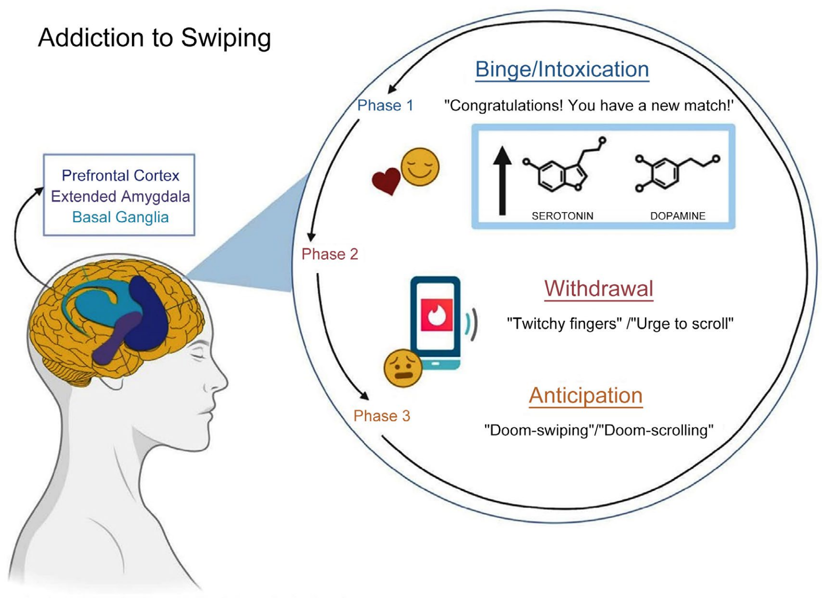

Figure 2. Cortical (prefrontal cortex) and subcortical structures (extended amygdala and basal ganglia) involved in Swiping and Scrolling. Source: [39].

In-lab experimental data showed that motion in an image was itself linked to physiological activation and emotional processing [40]. The same year, other scientists showed that the perception of an object (*i.e.*, a cylinder or a circle) executing a parabolic motion gave rise to animation attribution to this object in adults [41]. Both findings plead for the efficiency of emotional triggering using non-verbal signals in digital environments. Recent research conducted by the present authors also shows relationships between 3 basic motion patterns and emotional perception in different contexts (*i.e.*, emotional faces, movies, memory tasks, consumption products). All their studies led to the same conclusion: some of the most basic trajectories in terms of Physics performed by a single disk were intertwined with positive and negative emotional processes. More precisely, a wave-like motion is widely seen as positive and improves positive qualities of an image [4] while a parabolic motion is widely seen as negative and enhances psychomotor skills [5], making one think that this motion involved threat-related action tendencies. Effectively, it is generally adaptive to display better psychomotor performances when threatened than during a state of relaxation.

The same way elementary motion triggers certain emotional patterns, it is clear from research stated in the beginning of the present article that digital animations also put emotions at the centre of attention. Furthermore, modern digital interfaces exploit primary emotional mechanisms rather than complex interpretative processes. These findings suggest that digital environments do not merely communicate emotions symbolically. They structurally engage the same rapid and evolutionarily ancient routes involved in primary emotional processing.

6. Are Emotional Processes Becoming Simpler or More Sophisticated?

The question raised in this paper may appear binary: are emotional processes becoming simpler or more sophisticated? Such a formulation may be misleading. Emotional architecture in humans has not fundamentally changed in the last decades. What has changed is the structure of the environments in which these mechanisms are activated [35]. Indeed, as this researcher stated it: "Until now, all sensory, perceptual, cognitive, affective processes, and behaviours have evolved in a specific spatiotemporal context tied to the locomotion of animals in three dimensions. While physical space is limited and animals can only interact with their immediate surroundings at a given moment, digital space and time are virtually limitless. Individuals can affect locations far more distant than those near their own bodies." (p. 02). The author went on and based on video gaming, clearly showed that not only cognition, but perception itself is affected by digital designs. As a matter of fact, gamers displayed superior visual acuity at higher spatial resolutions and showed resistance to interference from crowding in a study [42]. These observations were replicated in many more research, some involving extremely popular games like Pokémon or Minecraft [43]-[45]. If perception and cognition are impacted by digital environments, it is highly unlikely that emotion remains unaffected by this influence. Effectively, as previously mentioned, the micro-stimulations (*i.e.*, micro-movements, micro-animations, etc.) which happen when somebody uses a smartphone app have multiple effects. These effects have been well described by Beck [39]: attention span decreases, immediacy is favoured, and contextual depth diminishes. Rather than involving deliberate cognitive appraisal, many emotional reactions in digital environments appear to emerge from fast and largely automatic evaluative responses to salient non-verbal signals. Therefore, this paper introduces the concept of Primary Emotional Loops. While the notion of feedback loops is not new, Primary Emotional Loops differ from related concepts such as reward loops, habit loops, or variable reinforcement schedules. These latter frameworks primarily emphasize behavioural repetition driven by reinforcement contingencies. In contrast, Primary Emotional Loops specifically refer to the rapid coupling between perceptual input and affective activation, which can occur independently of explicit reward structures and may operate even in the absence of conscious behavioural reinforcement. One example to illustrate this could be that scrolling involves novelty, which in turn triggers a micro-arousal, and finally leads to another scroll. Another example, this time at the auditive level, would be that a notification will imply an orienting response, which in turn will trigger anticipation leading to another check of one's phone.

In fact, digital environments may not suppress higher-order appraisal, but they may fragment it, therefore preventing sustained emotional elaboration. Appraisal models remain relevant, but their temporal assumptions may require revision. In environments characterized by high stimulus turnover, appraisal may operate in compressed and iterative cycles rather than in stable and context-rich episodes. To sum things up, we are not becoming emotionally simpler beings. Rather, we are increasingly immersed in environments that continuously solicit the most primitive layers of our emotional architecture. Thus, digital sophistication may coexist with emotional minimalism. Understanding this in the age of cognitive warfare [46] is paramount. Effectively, while usual cognitive models of emotion might be useful in therapeutic contexts, they cannot apply to digital environments where processes at stake are much faster and more primary, and the information conveyed mostly uses subcortical circuits. For instance, one study [47] showed that excess social media use (ESMU) in the general population is associated with grey matter volume (GMV) reduction in the bilateral amygdala, a key subcortical structure involved in emotional processing, but not in the prefrontal regions (associated with complex intellectual aspects such as self-control, behavioural inhibition, reasoning, etc.). Reductions in GMV are known to be linked to a reduced activity, therefore reflecting the fact that ESMU leads to habituation conditioning. If that habituation conditioning happens in the amygdala region, and possibly in the striatum, but not in the prefrontal regions, it is because the regions in charge of ESMU-related mechanisms are subcortical structures of the emotional brain. This reinforces the assumption that social media, and by extrapolation digital designs in general, primarily activate fast subcortical routes instead of neocortical areas like the prefrontal ones. In addition, these outcomes have been repeatedly found throughout the literature and scientific research [48].

To be clear, technological systems are increasingly sophisticated, yet the emotional mechanisms they exploit are evolutionarily ancient and structurally simple. In fact, there is a substantial discrepancy between the complexity of a technology like LLMs and the simplicity of archaic circuits involved in the user emotional engagement. A parallel could literally be drawn between the different aspects of digital experience (see **Table 1**).

Table 1. Conceptual comparison between Technological Complexity and Emotional Activation in digital environments.

	Technological Complexity	Emotional Activation
Processing Mode	Computationally intensive	Rapid affective triggering
Circuits	Multi-layered	Predominantly subcortical
Temporal Dynamics	Long computational chains	Sub-second reactions
Awareness Level	Explicit symbolic reasoning	Pre-reflective affective responses
Adaptive Function	Information optimisation	Behavioural readiness
Signal Type	Symbolic information	Non-verbal cues
Behavioural Consequences	Information navigation	Engagement loops

Importantly, increasing technological complexity does not necessarily entail more complex emotional processing, but may instead reinforce reliance on evolutionarily older rapid-response mechanisms. As shown by previously cited authors [47], digital environments may not only activate ancient emotional routes but may also reshape their functional balance relative to slower regulatory processes. While causality remains debated, such findings raise the possibility that repeated engagement with fast-paced digital stimuli may be associated with long-term neuroplastic adaptations within phylogenetically older affective circuits.

7. Conclusions

Being aware of neuropsychological mechanisms at stake when in digital environments holds many important implications. Among them, the fact that regular cognitive models of emotions such as Scherer's may not be well suited to such contexts. Another strong implication lies in the danger of problematic/excess use of digital devices and designs for the human brain. In effect, aside from the behavioural disruptions these excesses may cause, they also clearly change the brain architecture (*i.e.*, reduction of bilateral amygdala's GMV, etc.), especially in subcortical structures and phylogenetically ancient routes. It took millions of years for these routes to evolve, and this contributed to the emergence of humans as apex predators. Thus, impairing these routes comes with a big cost: it may have important consequences for human cognitive and emotional functioning in the long term, especially with the rise of AI and LLMs. Competition with AI on purely rational and cognitive aspects is not relevant as LLMs may outperform humans in certain forms of logical processing. Indeed, the very specificity of Mankind consists in its ability to mix cognitive arguments taken from neocortex areas (such as the prefrontal regions) with emotional information taken from the Mammalian brain/Limbic system. Therefore, the atrophy of Limbic areas and structures would render humans inept and less proficient than AI, in addition to modifying our very nature. Moreover, this atrophy could also explain the emotional desensitization to violence in younger generations who are extremely digitalized [49] [50]. The comprehension of this phenomenon might push Public Policy actors to intervene in order to reduce that velleity towards dangerous behaviours. Another important aspect is that AI interactions trigger anthropomorphism, agency attribution, and uncertainty detection. Hence, interactions with artificial agents may recruit emotional mechanisms originally evolved for social threat detection and agency evaluation, even in the absence of real social agents. Finally, digital ecosystems which amplify fast emotional processing while bypassing slower deliberative reasoning may also increase susceptibility to emotional manipulation. Consequently, the data discussed in this paper are strong evidence of fast emotional mechanisms' importance in misinformation and persuasion, political communication, and strategic information environments.

Rather than making emotional life more sophisticated, digital environments may reveal and amplify the enduring dominance of evolutionarily ancient affective systems in shaping human behaviour.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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