

Forum

Covert orienting: the dark matter of social attention

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Covert visual attention is often seen as a lab phenomenon. Yet, in real-life, people routinely shift their attention to others without moving their eyes, a fact overlooked in most research. To truly understand natural behaviour, we must look beyond the eyes and illuminate this dark matter of social attention.

Standard lab-based attention paradigms instruct observers to keep their eyes fixated on a central point while shifting visual attention peripherally, moving a ‘mental spotlight’ known as covert attention. The instruction to maintain fixation is vital because, without it, the natural tendency is to attend with the eyes, which confounds the physical act of foveation with the cognitive act of shifting attention. This artificial nature of covert orienting is one reason why some researchers have expressed persistent doubts about the utility of using the term ‘attention’ itself. Can the concept of covert attention be abandoned in complex, real-world situations? We argue that it cannot. Far from being dispensable, covert attention is the cognitive ‘dark matter’ of dynamic, socially rich environments: invisible yet essential, shaping gaze, and guiding social interactions. Bringing this hidden force to light is crucial for understanding everyday behaviour.

The eye–mind assumption

If people naturally look at what interests them and what they need to focus on, it makes sense to use eye movements as a direct measure of attention in the real world. By capturing where people look,

mobile eye-tracking provides insights into decision-making, goal-directed actions, and social interactions in everyday environments. Eye (and head) direction also has a key role in modern virtual reality (VR) and augmented reality (AR) devices, which are becoming increasingly prevalent. Yet, embedded in nearly all eye-tracking studies is a foundational assumption: that what we gaze at is what we attend to, an idea known as the ‘eye–mind hypothesis’ [1].

Cognitive scientists induce and study covert attention in the lab, making the eye–mind assumption falsifiable. By contrast, with active visual tasks where people move and behave naturally, covert attention is rarely mentioned. Across fields as diverse as psychology, medicine, sports, and marketing, gaze data are crucial for models of information processing. As eye-trackers become more advanced, affordable, and accessible, fixations are increasingly used to understand people's thoughts and actions in social interactions and real-world tasks [2]. In all such cases, whether implicitly or explicitly, researchers rely on the eye–mind assumption, that is, the idea that what a person looks at is what they are paying attention to. As we show in the following section, this assumption breaks down in social situations.

The dark matter of social attention

In studying natural orienting with eye tracking, researchers uncovered something major about social situations: looking is not only about perception, it is also a form of communication. Our eyes send social signals, and the presence of others shapes how and where we direct our gaze (Box 1). For instance, observers may deliberately avoid looking at what interests them, practicing ‘civil inattention’ by suppressing behaviours such as staring or excessive looking, which could be interpreted as signalling interest.

However, covert attention, precisely because it is concealed and separable from

gaze, can be shifted without signalling interest. A recent study indicated that people voluntarily separate covert and overt attention in social situations [3]. When tasked with observing a live stranger nearby, participants spontaneously relied on covert monitoring rather than direct gaze. However, when viewing a video of a stranger, they looked directly at them. This indicates that, in live situations, where the eyes signal information, people may naturally avert their gaze while covertly tracking others. In this way, covert orienting turns the eye–mind assumption on its head, with the eyes effectively sending a false signal as to where attention is directed.

This covert aspect of attention is what we call the ‘dark matter of social attention’. It is invisible and generally overlooked when researching complex, realistic situations; yet, it is crucial for understanding everyday behaviour. Two studies are particularly instructive on this point, illustrating that covert attention is drawn to social stimuli independent of gaze. One investigation examined how pedestrians walking with their heads lowered responded to a confederate's social gestures, either raising a hand to speak into a phone (a private action) or raising an empty hand in greeting (a public action) [4]. While the phone gesture did not attract looks, the greeting gesture caused most pedestrians to look at the confederate. This suggests that covert attention first detects social signals, in this case, the raised confederate hand, allowing individuals to assess whether an action is directed at them before overtly shifting their gaze.

Using a card trick, another study highlighted the reflexive nature of these covert shifts [5]. When a magician diverted participants' gaze with a social action, they failed to detect the trick, indicating that their attention had been shifted with their gaze. However, even when instructed to keep their eyes on the cards, participants still missed the trick when it was combined with a social action, demonstrating that

Box 1. The dual function of the eyes

Laboratory studies often use images of people instead of real individuals. Findings show that people prefer to look at images of people over objects, and even follow the gaze of pictured individuals. However, when a real person replaces an image, looking behaviour changes dramatically: people often avoid moving their head and eyes to look at a real person or follow their gaze. This change occurs because the eyes serve two functions: they gather information and signal it to others [6]. With images, observers do not worry about what their gaze may communicate. However, when engaging with real people, they must balance acquiring information with the messages their gaze conveys. This signalling function is so powerful that it can be triggered by simply believing that one's gaze can be observed, such as in a CCTV recording [7,8]. Crucially, this signalling applies only to overt gaze shifts. Covert attention, because it remains hidden, allows individuals to monitor others without revealing their focus. This invisible process is what we refer to as the 'dark matter of social attention'.

their covert attention was drawn to the magician regardless of overt gaze being focussed elsewhere.

In sum, covert attention has a critical role in real-world interactions and is deployed both reflexively and volitionally. It allows individuals to monitor their surroundings without revealing their focus, helping regulate overt looking and controlling the social signals they communicate. Understanding this dark matter of social attention opens new avenues for research on attentional control and will deepen our understanding of perception and social interaction.

Illuminating the dark matter of social attention

Laboratory studies have provided many insights into covert attention, including its underlying brain mechanisms, capacity limitations, and variations across sensory systems. The challenge, and opportunity, is to apply this knowledge to illuminate the dark matter of social attention (Box 2). We expect this work will reveal how biology, cognition, culture, and individual differences

interact to shape behaviour in real-world contexts.

For example, little is known about when and how individuals naturally decouple overt and covert attention in the absence of explicit instruction. This separation is likely influenced by environmental factors (e.g., the presence of real people or other surveillance cues, such as CCTV). The choice to select with gaze or covert attention also appears to be related to cultural norms, which, in turn, could suggest that the signalling role of the eyes is a learned skill. This raises important questions about how the overt–covert dynamic develops over the lifespan and its relationship to brain maturation and neurodiversity. The way that people subvert the signalling function of the eyes, to deliberately avoid looking at something while covertly focussing on it instead, is a complex, deceptive act that is ripe for investigation. Understanding when and how attentional decoupling is learned and performed has major implications not only for gaze-based research methodologies, but also for industries such

as advertising, which often equate looking with interest or engagement.

These questions also apply to the cognitive and neural mechanisms underlying attention. It is important to determine whether covert attention to social stimuli operates according to the same principles as nonsocial stimuli. While we have focussed on how social factors encourage separating covert attention from gaze direction, the role of peripheral vision in natural viewing suggests this separation extends beyond social contexts. Non-human primates and other animals use covert orienting to monitor important stimuli, indicating that it may have evolved as a flexible, energy-efficient strategy for attending to the environment without requiring large, overt head or body movements. Understanding how covert orienting interacts with other motor and sensory systems in real-world environments will be key to uncovering the hidden dynamics governing attentional control.

Concluding remarks

Both logic and empirical evidence challenge the eye–mind assumption in a social world. To truly understand human behaviour in real-world settings, we must look beyond where the eyes move and account for the unseen dynamics of covert attention. Recognizing covert attention as the 'dark matter' of social interaction compels us to expand how we measure, interpret, and theorise about attention outside the lab. Doing so will refine models of cognition and enhance applications ranging from human–computer interactions to education, marketing, and clinical assessment. As technology makes it easier to track the head and eyes, the temptation will be to equate gaze with mind, but true insight requires illuminating the invisible mechanisms that guide both. Until we confront this unseen force, our models of behaviour will remain incomplete shadows of the truth.

Box 2. Approaches for understanding the dark matter of social attention

If researchers outside the lab cannot rely on observable eye movements or control when or how covert attention occurs, this presents two key challenges: identifying when covert orienting is likely to take place and developing reliable measures of it. Various approaches can help address these challenges. Naturalistic observation examines covert attention in situations where it is functionally necessary. For example, pedestrians navigating a route while reading on their phone provide an indirect measure of covert attention. Social context manipulations investigate how individuals adjust their gaze behaviour when they believe they may be observed. Comparing gaze patterns in private versus social surveillance settings allows researchers to infer when covert orienting may be a substitute for overt gaze [9]. Deception-based tasks assess participants' ability to hide their true attentional focus, offering insights into orienting strategies [10]. Neurophysiological and eye-tracking measures provide more advanced tools for detecting covert attention. For instance, EEG, pupillometry, and microsaccade dynamics may serve as physiological markers of covert orienting [11,12]. Collectively, these diverse approaches provide a comprehensive toolkit for beginning to uncover the hidden dynamics of social attention and advancing our understanding of covert orienting.

Acknowledgments

This work was supported by both a Natural Sciences and Engineering Research Council (NSERC) of Canada Discovery Grant (RGPIN-2022-03079) and a Royal Society Wolfson Visiting Fellowship (RSWVF \R2\222001) to A.K.

Declaration of interests

None declared by authors.

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<https://doi.org/10.1016/j.tics.2025.05.001>

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