



Augmentation and Dissociation: Exploring Brain's Associations Across Real and Virtual Realities

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Abstract:

This paper explores the malleable nature of perceived reality and bodily ownership as demonstrated through multisensory illusions like the rubber hand experiment. Research shows that precisely matching what someone sees and feels can recalibrate neural processing to incorporate fake limbs into one's sense of bodily boundaries and agency. This means an individual's feelings of having a body and self-come from the brain continually tweaking itself based on intercessory correlations. Meanwhile, extensive trauma research reveals significant disruptions when overwhelming experiences prevent smooth processing, storage and understanding in an individual. This manifests in dissociated fragments and dysfunctional encodings splitting from explicit memory and ownership, recreating persisting struggles without awareness. However, early therapeutic approaches using coordinated sensory stimulation suggest the potential for compassionately reshaping rigid implicit perceptions that complicate trauma recovery by tapping into neuroplasticity. Research on bodily illusions, the complexities of trauma, and sensory-based treatments shows that trauma can be framed as a disruption in aligning expectations with sensory input to create a more unified experience. There exists potential for tailored therapeutic exposures through custom sensory feedback to rewrite rigid encodings towards post-traumatic growth. Future research should thoughtfully explore these avenues into practical methods that respect survivors' agency and dignity. Overall these themes reveal one's perception of reality as fluid, constructed by the brain continuously adjusting its predictions and interpretations to match the incoming flow of sensory information from sight, sound, touch, etc. Trauma strains the integrative system underlying a coherent experience. Therapies strategically recalibrating the senses can help realign stuck implicit perceptions of trauma. Through controlled and empowering sensory exposures, these therapies assimilate past overwhelming impressions into narratives that affirm bodily wholeness and resilience.

Keywords: Perceived Reality · Rubber Hand · Experiment · Multisensory Illusions · Therapeutic Exposures.

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The nature of reality, the workings of the mind, and the impact of trauma have captivated thinkers and researchers for centuries. Yet, some of the most profound mysteries still

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Elude complete understanding. The subjective experience of reality, the mental complexities of trauma, and strategic interventions targeting mental recovery represent critical frontiers that are still being explored (Lanius et al., 2015). Intriguing experiments involving bodily illusions highlight the brain's malleable perception of reality and self, shaped by coordinated sensory inputs. The rubber hand illusion stands out for demonstrating how synchronous visuo-tactile stimulation enables the embodiment of a fake arm, fundamentally altering one's bodily boundaries (Botvinick & Cohen, 1998). This deception of reality by synchronising multiple senses has profound implications for trauma and recovery. It hints at potential pathways for creatively and strategically reshaping trauma's imprint. This involves deliberately altering inputs that feed into the brain's perception of reality that apparently may be susceptible to manipulation.

The rubber hand illusion paradigm developed by Botvinick and Cohen (1998) demonstrated the effect of synchronised multisensory inputs on bodily perception and ownership. Through methodical visuo-tactile stimulation achieved by brushing a participant's hidden real hand and visible fake hand synchronously, researchers elicited sensations of the rubber arm becoming part of one's body. This impact persisted even after the inputs ceased, indicating a fundamental recalibration of bodily boundaries based on coordinated sensory cues. Analysing points of subjective transition in perceiving the fake arm as one's own limb highlighted the critical role of spatio-temporal congruence in driving embodiment (Tsakiris, 2010). This synchronicity enabled external signals to get integrated into mental representations defining one's physical self (Ehrsson et al., 2004). This startling impact reveals body ownership as a fluid and personally defined construct, reliant on the coherence of sensory evidence. The mind reconciles inputs from various sources to construct its best approximation of reality and self.

These insights take on substantial meaning when considered in light of trauma's extensive impact on mental well-being and recovery. Trauma, rooted in experiencing actual or threatened harm, has extensive physiological and psychological effects (Bremner, 2006). Its imprint on mental health is extensive, with trauma strongly linked to conditions like PTSD, Depression and Anxiety (Bisson et al., 2015). Trauma's psychological and emotional consequences are complex, involving altered information processing, fractured narratives and embedded emotional disarray (Lanius et al., 2014). The need for research and interventions targeting this intricate mental sphere has been emphasised in trauma literature (Lanius et al., 2015). Strategic mental approaches may hold unique potential for transforming trauma's imprint.

The rubber hand illusion and related bodily deception paradigms strategically manipulate sensory inputs to influence mental representations of both: reality and self. The impact reveals a pathway for creatively altering trauma's mental entanglement at its roots – the very sensory informational strands that feed into perceptions of reality. Just as synchronised visuo-tactile inputs embed an artificial limb into one's body schema, therapeutic approaches such as synchronising emotional, somatic and narrative inputs could help transform trauma. Research hints at mirror therapy's promise for trauma recovery by activating neuronal networks linked to positive bodily ownership and control (Scholl et al., 2023). Mirror visual feedback of moving one's trauma-affected limb has the potential to reconstruct sensorimotor. Synchronicity that was disrupted during the original incident. This forces an update in mental representations of the body and associated emotional landscape. The mirror illusion paradigm strategically taps into the mind's reconciliatory.

process for resolving disparate signals into a coherent sense of self and reality. By coordinating therapeutic inputs, existing frameworks could potentially be updated to better support mental well-being.

The brain's perception of reality and self-evades simplistic explanations. Trauma further obscures the landscape with its delicate mental fingerprints. Making progress requires leaning into this uncertainty and complexity with fresh perspectives and radical openness. The rubber hand illusion and its variants highlight the extraordinary malleability of our inner worlds in response to external stimuli. Trauma's ultimately personal nature demands interventions embracing subjectivity and the limitless permutations of sensory, memory, narrative and emotional inputs feeding one's inner ecology. While logical constructs undoubtedly have value for decoding trauma's patterns, lasting transformation may hinge just as critically on creatively and compassionately coordinating therapeutic inputs targeting root perceptions of self and reality.

Analysis of the rubber hand illusion methodology offers clues towards sensory manipulation techniques. These techniques may help update trauma's restrictive mindsets by integrating fragmented emotions and narratives into renewed perspectives of grounded, resilient identity in the here and now. Mirror therapy builds on these principles, hinting at potential pathways for creatively rewriting trauma's root sensory codes through compassionate guidance reconciling bodily awareness with affirmations of belonging.

This paper aims to explore the mechanisms facilitating bodily ownership illusions through precise sensory alignments. It will examine relevant trauma research revealing key target areas for sensory intervention strategies, and details on embodied therapeutic modalities highlighting

routes for compassionately updating trauma's imprint by restructuring sensory inputs feeding perception.

Literature Review

The intriguing intersection of bodily illusions, trauma's mental impacts, and sensory-based interventions for healing, builds upon rich interdisciplinary literature. Core references elucidate key themes around the malleable nature of perception and ownership constructs, trauma's disruptive effects on information processing, and strategic clinical approaches targeting these areas.

Bodily Illusions and Perceptual Manipulation

Seminal bodily illusion experiments by Botvinick and Cohen (1998) on the rubber hand paradigm elegantly demonstrate the impact of synchronised multisensory visuo-tactile inputs on fundamental bodily ownership perceptions. Through brushing a participant's real hidden hand paired with brushing a visible fake rubber hand, the illusion of incorporating the artificial limb into one's body schema is elicited. This reveals the extraordinary plasticity of mental representations of bodily boundaries and belonging based on contextual sensory evidence.

Related literature builds upon these core findings on ownership manipulability. Tsakiris (2010) specifically analyses the subjective points of transition during the rubber hand illusion, emphasising the critical role of spatiotemporal congruence in driving embodiment. Ehrsson et al. (2004) assess associated neural activity, finding correlated premotor and intraparietal cortex activation during the illusion, supporting the view that bodily awareness relies profoundly on multi-sensory integration processes. Additional sources cover technological extensions of these principles using immersive augmented reality settings to

replace real-body sensory channels with programmed virtual embodiments (Slater & Sanchez-Vives, 2015).

Supporting multisensory integration theories and predictive processing models elucidate the mechanisms behind bodily illusions. Leading models propose that hierarchical Bayesian calculations in our brains drive perceptions about our body and self (Rohe & Noppeney, 2015). The Bayesian brain model uses priors, likelihoods, and evidence to make probabilistic inferences about perceptions of our body and self. Specifically, it combines existing expectations and beliefs as priors with the likelihoods of new sensory input to calculate updated beliefs. At the same time, complementary models stress the role of prediction errors, weighted by precision, in updating perceptions as sensory input is received (Apps & Tsakiris, 2014; Friston 2010). These support experimentally observed malleability and hint at potential clinical translation.

Trauma and Information Processing Disruptions

In contrast to the integrative processes underlying bodily ownership, trauma literature reveals profound disruptions in smoothly predicting, consolidating and contextualizing adverse experiences. Ehlers and Clark (2000) provide foundational cognitive models elucidating trauma memory's fragmented encoding within sensory and emotional neural systems, lacking higher-order linkages into cohesive narratives. Additional studies detail dissociation's detrimental influence wherein overwhelming memories get partitioned from conscious access and context (Lanius et al., 2012).

Key sources emphasise deep physiological impacts on emotional regulation and information flow underpinning trauma's extensive psychiatric fallouts (Lanius et al., 2010). While initially protective for functioning, chronic dissociative

detachment from past events that resist full cognitive and emotional processing contributes to persisting struggles in the long run. Related research details trauma's alteration of predictive perceptions around safety and belonging that require updating to restore functioning (Herman, 2015).

Clinical Sensory Manipulation Interventions

Contrasted with trauma's information processing disruptions, promising clinical advances reveal routes for strategically recalibrating dysfunctional encodings and perceptions using controlled sensory cue alignments. Mirror visual feedback for phantom pain stands out for its elegant manipulation of visual input related to missing limbs to restore sensorimotor coherence and alleviate suffering (Ramachandran & Rogers-Ramachandran, 1996). The induced matching or synchronisation between what one sees and what one feels in terms of body position and movement drives an overall recalibration of the brain's predictions about bodily ownership. Specifically, the realignment between one's sense of proprioception (the body's awareness of its position and movement) and one's visual input allows for a systemic update of the assumptions the brain makes about what is considered part of one's body. By coordinating what is seen and felt, the boundaries of bodily selfhood are reshaped.

Eye movement desensitisation (EMDR) extends these principles using alternating bilateral hemispheric stimulation to purportedly catalyse blocked trauma memory consolidation processes towards more integrated autobiographical formats (Shapiro & Laliotis, 2011). While debates continue over the specific mechanisms underlying EMDR While debates continue over the specific mechanisms underlying EMDR, clinical literature endorses its effectiveness. EMDR allows for an adaptive update of prior dysfunctional encodings

that drive post-traumatic symptoms following strategically guided reactivation of trauma memories (Leer et al. 2014).

Both modalities reveal themes of leveraging sensory cues targeting bodily and memory systems to drive larger network-wide updates. This aligns with literature on memory reconsolidation dynamics, showing that when memories are recalled, they become flexible and open to integrating new important information (Nader & Hardt, 2009). It points to the potential for customised protocols sequentially exposing clients to sensory inputs designed to facilitate the assimilation of dissociated content into present narratives of empowered coping.

Key Insights

Several cross-cutting insights emerge across the analysis of these sources at the intersection of rubber hand illusions, trauma fragmentation, and sensory therapies. Lab-induced illusions highlight bodily ownership constructs as continually constructed based on ongoing intersensory correlations (Tsakiris, 2010). Reorienting these input patterns produces systemic recalibrations as the brain dynamically models reality (Rohe & Noppeney, 2015). Strategic sensory manipulation can thus catalyse targeted subjective states (Slater & Sanchez-Vives, 2015). In contrast, trauma chronically strains integrative functioning, blocking unified understanding across dissociated painful past and fearful present (Ehlers & Clark, 2000). Yet, mirror therapy and EMDR paradigms creatively transduce sensory cues into global cognitive-emotional shifts rewriting dysregulated scripts (Ramachandran & Rogers-Ramachandran, 1996). It suggests the immense latent potential for carefully designed holistic interventions that compassionately harness the mind's drive to weave coherent meaning across the embodied experience.

This selective literature analysis reveals deeply intertwined themes. These themes include constructed realities continuously shaped by reconciling sensory cues, trauma's fragmentation of these dynamic integrative flows along with promising contemporary approaches targeting bodily, memory and network-wide plasticity mechanisms. These approaches update rigid trauma perceptions hindering smooth adaptation and belonging. The themes across these sources highlight avenues for creatively transforming trauma's restrictive imprint through thoughtful sensory-based interventions. However, translating these findings into practical clinical protocols requires further investigation across several domains. The subsequent chapters will explore in greater depth the mechanisms facilitating bodily ownership illusions through precise sensory alignments, which can inform strategies for facilitating trauma memory integration. Relevant trauma research will be covered to reveal key target areas and blockages for sensory intervention strategies to tackle. Details on embodied therapeutic modalities like mirror therapy and EMDR will be explored, highlighting routes for compassionately updating trauma's imprint by restructuring sensory inputs that shape perception. Finally, recommendations will be provided for responsibly developing this sensory manipulation approach focused on empowerment, groundedness and post-traumatic growth. This deeper investigation aims to advance creative therapeutic paradigms centred on harmonising fragmented trauma elements into renewed perspectives affirming wholeness and resilience. By elucidating target areas, change mechanisms and ethical considerations, this exploration intends to further thoughtful, embodied clinical avenues for those weighed down by a mind and body disconnection.

The Brain's Reality Constructs

Our perception of reality relies profoundly on mental processes for interpreting sensory inputs and crafting cohesive inner worlds. While objective reality undoubtedly exists, our subjective experience depends greatly on the mind's reconciliation and integration of external signals and our internal predictive models (Friston, 2010). The brain engages in intricate processes to make sense of the world, moment-to-moment. Sensory signals stream in, conveying the raw sights, sounds, and feels of the outside environment. Meanwhile, internal predictive models - shaped by past experience and emotional tones - predict what inputs to expect. When a loud noise startles someone, for instance, fear-tinged predictions may sound inner alarm bells, priming the body for action before conscious awareness catches up. The brain reconciles the back-and-forth between incoming sensory information from the external world (bottom-up sensory evidence) and internal predictive assumptions and interpretations based on prior knowledge (top-down predictive evaluations), integrating the most relevant details into a unified understanding of each passing moment. Subjective experiences emerge from this dynamic interplay, with emotions determining what stands out as important in each moment. The mind weaves together the most pertinent details from the unceasing flow of sensory input to shape one's unique experience of reality. Trauma severely alters these predictive mechanisms and emotional textures, necessitating interventions targeting root distortions underpinning fractured perceptions of self and reality after adversity.

Foundational research reveals multilayered mental processes continually striving to model the ever-changing world and role within it, as accurately as possible. Friston's (2010) influential predictive processing framework posits intricate neurocognitive dynamics centred around minimising errors in perception and action

planning. The brain's neural architecture is organised hierarchically, with higher levels generating predictions about upcoming sensory inputs. These probabilistic perceptions flow downwards to lower processing regions, preparing the system to receive and interpret the anticipated signals. Incoming sensory information carries signals about errors in the predictions, prompting the brain to update its internal models to better align with the actual inputs for improved accuracy. Thus, perception relies profoundly on generative internal models predicting potential sensations. By continually updating top-down anticipatory perceptions based on bottom-up evidence, the brain resolves conflict and stabilises its representation of reality.

Emotions critically shape which sensory details become salient and how predictions incorporate them into subjective experience. Appraisal theories root emotions in valuations of personal significance, prompting physiological and psychological responses (Moors et al., 2013). Emotions have been found to critically shape predictive perceptions and resultant experiences, steering attention and internal sensations based on cognitive and physical context (Barrett & Simmons, 2015). Positive affective states may open awareness to broader possibilities amidst sensory chaos, whereas negative emotions spot potential threats, overly sensitising predictive systems to align with distressing details. The qualitative varieties of emotions, from joy to anger to sadness, each tune the brain's predictive attunements differently.

Trauma severely alters the landscape of perception by entrenching distortions in prediction interpreting reality. Adversity directs attention excessively to potential harms, narrowing awareness and rigidifying beliefs (Herman, 2015).

Trauma fractures unified sense-making by dissociating overwhelming sensations and emotions from conscious awareness. Yet their uncontrolled imprints continue influencing perceptions and behaviours unconsciously, manifesting in flashbacks, numbing and hypervigilance. Without integrating traumatic memories into cohesive narratives, their lingering shards swirl chaotically through the mind's aborted attempts at prediction and reconciliation.

Trauma's alterations manifest physiologically as well, with lower prefrontal and higher amygdala activation indicating overwhelmed emotional processing (Lanius et al., 2010). Dysfunctional alarm systems spur false threat signals, reinforcing fear-based predictive patterns while suppressing incongruent details that fail to validate engrained insecure mental models. Fixating on potential harms while split from integrated self-awareness, trauma severely constricts perception's scope. Rigid worldviews resist updating, perpetuating fractures between reality and the mind's framework for anticipating and incorporating sensations.

While trauma etches dysfunctional patterns into perception's blueprint, strategic interventions may help rewrite these root codes. By interweaving bottom-up sensations grounding the body in present safety with top-down affirmations of belonging, space may open for integrating overwhelming emotional memories into coherent narratives. This compassionate synchronisation of sensory, cognitive and interoceptive inputs aligns with research on supporting emotional processing and healthy reality perceptions (Lanius et al., 2014).

The brain continually constructs reality by reconciling sensory signals with predictive models, integrating salient details into coherent narratives. Emotions highlight what matters for updating perception's ever-evolving approximation of each passing moment. Trauma freezes this dance, entrenching restrictive mindsets reinforced

unconsciously by lingering emotional shards split from awareness. Transforming these fundamental codes requires compassionately realigning perception and prediction amidst interoceptive, narrative and environmental cues communicating fundamental human worth and interconnection.

Virtual Input Manipulates Ownership

Advances in technology have enabled the extension of bodily illusions like the rubber hand experiment into immersive virtual settings through augmented reality. By replacing real-body sensory signals with carefully coordinated virtual visual and tactile inputs, compelling sensations of owning a virtual body can be elicited. This exploits innate multisensory integrative processes to facilitate ownership illusions, altering functional connections between brain regions processing bodily stimuli.

The rubber hand experiment is an effective demonstration of this manipulability by aligning seen and felt evidence of an artificial hand (Botvinick & Cohen, 1998). Brushing a participant's real out-of-sight hand while simultaneously brushing the visible rubber counterpart triggered sensations of the prosthetic hand becoming part of one's body. The brain fused congruent visual and tactile patterns into a unified perception of embodied ownership. Augmented reality expands on these findings by wholly replacing natural sights and feels with programmed virtual bodily inputs.

Researchers have immersed participants in virtual settings where a realistic virtual body replaces their own, seen from a first-person perspective (Slater & Sanchez-Vives, 2015). Deliberately synchronising the virtual hands' motions and animations with the Individual's real movements and tactile feedback facilitates sensations of owning and controlling the digital body. Such interplay between dynamic virtual visual-motor signals and responsive multisensory stimulation has successfully

manipulated subjective experience across diverse illusory embodiments.

These compelling impacts stem from the brain continually seeking to resolve coordinated cross-modal evidence into unified representations of bodily state and environment (Seth, 2013). Augmented reality technology strategically exploits these integrative sensorimotor processes by aligning virtual visual feedback with tactile and proprioceptive cues. Supporting predictive models suggest top-down perceptual inferences about bodily actions get reinforced by concordant bottom-up confirmation from several senses simultaneously, leading to an update of mental schema around ownership and agency (Apps & Tsakiris, 2014).

Neuroimaging studies reveal the rubber hand illusion modulates activity across sensorimotor brain regions (Gentile et al., 2013). Functional MRI scans show altered connectivity between the visual cortex processing the sight of the fake hand, and somatosensory areas mapping the tactile brushing sensations. This strengthening of reciprocal pathways between visual and tactile regions highlights the brain's drive to resolve congruent multisensory inputs into unified perceptions of bodily ownership. Augmented limb ownership strengthens reciprocal visual-tactile pathways to resolve the programmed congruence. This reveals the heavy weighting given to coordinating multisensory evidence when constructing representations even of one's own body. By aligning virtual visual and physical tactile-proprioceptive patterns, awareness gets steered into targeted subjective embodiments.

Strategic Interventions for Alternate Realities

Clinical advances reveal creative paradigms strategically manipulating sensory cues and information flows to access alternate subjective realities, with promising implications for trauma

recovery. Mirror visual feedback for phantom pain and eye movement desensitisation and reprocessing (EMDR) demonstrate sophisticated leveraging of bodily illusions and memory remodelling techniques towards transformative outcomes. Integrating multiple sensory channels with mindset interventions, these protocols tap into the brain's innate neuroplasticity for recalibrating dysfunctional representations. This complicates healing after adversity.

Spurred by curious observations of phantom limb pain alleviation when patients visually occupy the space where the missing arm would be, mirror visual feedback emerged as an elegant treatment paradigm (Ramachandran & Rogers-Ramachandran, 1996). In this augmented reality intervention, amputees place their intact arm on one side of a parasagittal mirror that is aligned vertically with the plane that divides the body into left and right halves, while viewing the mirror image superimposed over the contralateral space where the amputated arm would have been. When they move their intact hand, amputees experience vivid sensations of controlling and exercising the 'phantom limb' resolving its painful contraction. This visually guided motor imagery powerfully recalibrates disrupted bodily representation circuits towards more integrated functioning.

Mirror visual feedback alleviates phantom pain by strategically aligning virtual visual inputs with retained sensorimotor networks (Chan et al., 2007). Functional imaging reveals that executing mirrored movements intensely activates premotor and parietal areas involved in motor planning and coordination. This reengages residual motor representations of the amputated hand to resolve incongruence with visual feedback expected from previous bodily experience. The illusion of seeing and controlling the missing hand restores coherence within disrupted sensorimotor loops,

functionally overriding signals misinterpreted as painful. Selective stimulation of relevant visual-proprioceptive-motor pathways drives cortex changes recalibrating virtual and actual experience.

Eye movement desensitisation and reprocessing (EMDR) extends sensory manipulation techniques towards transforming trauma's ingrained maladaptive encodings obstructing recovery (Shapiro & Laliotis, 2011). This structured, 8-phase intervention, first builds coping capacities before guiding clients to selectively focus on disturbing images, emotions and body sensations while tracking the clinician's lateral finger movements with their eyes. The alternating left-right visual tracking, combined with tuned-in therapeutic presence, purportedly stimulates blocked information processing facilitating adaptive memory reorganisation. EMDR strategically utilises the orienting reflex towards accessing dissociated trauma networks. EMDR theorists propose eye-tracking stimulation mimics innately pre-programmed responses allowing smooth encoding of challenging experiences into manageable memories integrating new understanding.

Though exact mechanisms remain debated, clinical advances support the use of eye-tracking bilateral stimulation to access and update trauma memory imprints, moving towards more empowered alternatives (Leer et al., 2014). Hypotheses around dual attention, hemispheric activation and REM-like effects align with observed therapeutic outcomes. The alternating visual focus indirectly triggers traumatic hotspots while preventing overwhelm, allowing new associations to form. Resurfaced unintegrated sensory traces may become amenable to re-encoding in more consolidated formats integrated within a broader autobiographical context. Alternating left-right tracking may drive hemispheric shifts facilitating cortical processing supporting these memory organisation phases. EMDR elegantly hijacks

orienting mechanisms to safely access dysfunctional encodings driving persisting distress from overwhelming experiences.

Clinical innovations reveal avenues for strategically tweaking sensory and memory components perpetuating trauma's suffering towards alternate inner landscapes where peace and possibility unfold. Mirror visual feedback uses programmed virtual inputs to update bodily representations distorted by absence. EMDR indirectly targets and transforms fragmented traumatic imprints by incorporating new environmental and interoceptive elements to support altered meaning-making. While exact mechanisms continue being investigated, both modalities reveal latent neuroplasticity available for recalibrating neural networks fixated on pain or helplessness. These advances offer clues towards wider integrative somatic and mindset-centred paradigms. These paradigms resolve root factors complicating healing by compassionately guiding awareness to reconnect with its innate coherence.

Therapeutic Potential

Advances in augmenting multisensory experiences open unique portals for recalibrating neural networks distorted by trauma or physical adversity. Paradigms strategically reinstating protective predictions about identity, control and belonging counter dysfunctional encodings behind persisting struggles. While more research is vital, early intervention insights offer hope for those weighed down by trauma-induced distortions that disconnect their perception from the reality of increasing safety and healing phantom pain relief via mirror visual feedback provides a powerful demonstration of augmenting virtual input to recalibrate disrupted neural bodily representations (Ramachandran & Rogers-Ramachandran, 1996). By aligning real motor intentions with visual feedback tricking amputated sensorimotor networks, the illusion of seeing and moving the missing hand reintegrates its lingering traces.

This global bodily resynchronization functionally overrides localization errors that may be misinterpreted as apparently painful. If mirrored movements can ease phantom limb distress, strategically aligned multisensory feedback incorporating trauma-informed perspectives may help survivors reintegrate alienated aspects of identity and past experience. Guided therapeutic exercises blending trauma-sensitive imagery and physical motions with integrated sensory feedback may help update rigid expectation patterns, realigning survivors' worldviews and body perceptions towards greater coherence and wholeness.

However, interventions leveraging bodily illusions risk adverse effects without careful precautions (Madary & Metzinger, 2016). Persistent dissociation often initially protects against overwhelming memories but at the expense of fragmented identity and agency. Augmenting dissociative tendencies through immersive technologies could further destabilise delicate trauma recovery processes or identity formation in youth. Grounding practices checking in on internal states are vital. Technologically facilitating dissociative tendencies without resolving core emotional wounds and relational disruptions, risks compounding underlying trauma. Nonetheless, there exists the potential for thoughtfully designed multisensory interventions to support reintegrating dissociated aspects of self and past if delivered considerately while respecting survivors' bodily boundaries and agency.

Overall, strategically designed augmented sensory input shows immense promise for reshaping rigid trauma perceptions that interfere with healing and a coherent sense of self. However, successfully updating deficits in top-down prediction and bottom-up evidence integration underlying persisting struggles depends greatly on precise alignment with individual trauma profiles and responsively attuned delivery balancing efficacy with ethics. As the precision of augmented

platforms grows, so too must the wisdom guiding their application.

Conclusion

This exploration into bodily illusions, trauma's mental roots, and strategic sensory-based interventions uncovers profound insights into the nature of dynamic reality and the mind-body connection. Challenging experiments around technology-induced virtual bodily ownership powerfully demonstrate the extraordinary malleability of subjective experience. When seamlessly coordinating select sensory channels—aligning visual and tactile sensations - these experiments reveal how our perception of boundaries and belonging can be profoundly altered. Findings on the rubber hand illusion and immersive virtual embodiments reveal that precisely synchronising vision and touch subtly recalibrates neural processing to incorporate fake limbs as felt extensions of self. Such visuo-tactile coherence exploits innate drives for resolving aligned cross-modal evidence into unified representations. This explains bodily ownership and embodiment constructs as continual creations dynamically tuned by intersensory correlations.

Meanwhile, extensive trauma research emphasises profound disruptions in seamlessly predicting, integrating, and consolidating overwhelming impressions—and resultant fractures in constructed identity. Dysfunctional encoding manifests into dissociated sensory fragments splitting from explicit encoding and ownership. However, clinical Advances utilising coordinated sensory flows hint at neuroplasticity being available for transforming such rigid implicit perceptions that recreate persisting struggles. Early therapeutic innovations can creatively rewire trauma's root codes by deliberately exposing patients to controlled multisensory experiences—visual, tactile, kinetic—towards assimilating dissociated fragments into

renewed perspectives seeded with bodily coherence and empowered self-continuity.

These insights reveal themes of fluid realities shaped by the brain's interaction between reconciling top-down predictive models and bottom-up interoceptive evidence into subjective moments. Trauma strains this driven integration underlying experiential coherence and functioning. There is the possibility of tailored therapeutic exposures and integrative mechanisms to re-anchor dysfunctional predictions. The customisation of sensory feedback opens up the possibility of rewriting rigid encodings towards post-traumatic possibilities. Importantly, the brain has an inherent quality of operating in multiple versions of reality and updating based on shifting perceptions. Future directions should thoughtfully research and develop these avenues into practical methods that honour the client's needs. The brain's extraordinary capacity for neuroplastic change, evident in phenomena like bodily illusions, offers hope that with compassion and creativity, even the most rigid implicit trauma perceptions can be reshaped into ones aligning with resilience and a renewed sense of wholeness.

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