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SENTIENCE AND EXPERIENTIAL LEARNING
THE ROLE OF THE SENSES IN LEARNING

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SENTIENCE AND EXPERIENTIAL LEARNING: THE ROLE OF THE SENSES IN LEARNING

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Experience Based Learning Systems

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ABSTRACT

This paper explores the role of sentience, the capacity for subjective experience and sensory engagement, in sensory experience in learning, with a focus on the integration of sensory and conceptual processes in Experiential Learning Theory (ELT). The work explores the underlying philosophical foundations and provides contemporary empirical data of the ideas explored. Sentience, as defined in this context, involves the continuous perceptual stream of consciousness, encompassing both external sensory inputs and internal awareness. The study examines the interplay of eight senses grouped into distal (vision and hearing), proximal (touch, taste, and smell), and embodied (intuition, kinesthetic movement, and body awareness) categories to understand their individual and combined contributions to the holistic perceptual experience.

Findings reveal that the proximal and embodied senses form a dominant, interconnected haptic network crucial for immersive engagement, while the distal senses operate within a visual-hearing network oriented toward cognitive exploration. The "Experiencing Self," driven by proximal and embodied senses, contrasts with the "Thinking Self," which is guided by distal senses. Natural environments were found to foster greater presence and sensory engagement compared to “constructed” settings.

The study also highlights the relationship between mindfulness and deliberate sensing, emphasizing the potential for individuals to enhance their sensory engagement through practice. Educational systems, currently biased toward conceptual knowledge, are urged to balance perceptual and cognitive approaches to nurture creativity, empathy, and deeper understanding. These findings underscore the importance of fostering sentience to counterbalance the accelerating influence of artificial intelligence and ensure the preservation of human moral and social capacities.

This work contributes to the fields of experiential learning, sensory perception, and holistic education, advocating for a renewed focus on sentience to enrich individual and collective learning experiences. Sentience has often been overlooked in these areas, however, it appears to be a critical aspect for the future when thinking about machine learning and artificial intelligence.

Keywords: sentience, sensory experience, experiential learning theory (ELT), distal senses, proximal senses, embodied senses, haptic network, holistic education, artificial intelligence (AI)

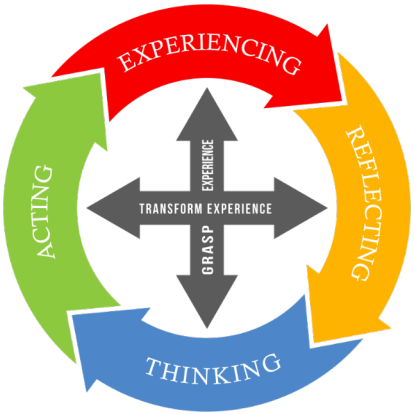
INTRODUCTION

On October 11, 2023, the New York Times Word of the Day was "sentience" chosen because the word had appeared in 22 NYT articles that year. Many of the articles were about artificial intelligence (AI) and whether AI could go beyond the ability to think, to feel the way human's feel, i.e. to achieve human sentience. It is ironic that this greatest human capability, subjective experiencing, is only now getting the attention it deserves to enable the fullest expression of our humanity and to cope with the consequences of its neglect in education.

The Times article defined sentience as:

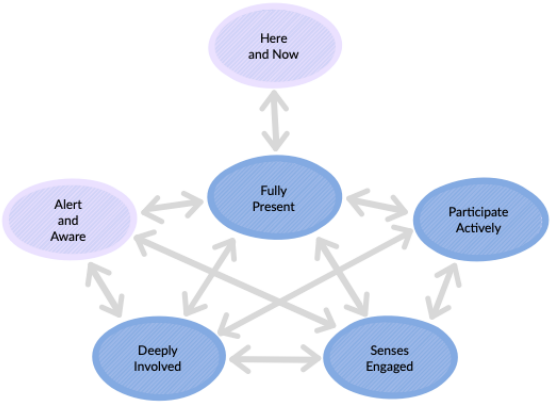
"· sentience \ ˈsen-tr̓-ən (t)s \ noun. 1. state of having consciousness. 2. the readiness to perceive sensations; the ability to feel and sense. 3. the faculty through which the external world is apprehended."

In Experiential Learning Theory (ELT) sentience refers to the process of subjective experiencing, the ongoing perceptual stream of consciousness. It is one pole of William James' dual knowing theory of experience (DKTE) which he called apprehension. The other pole is thinking, called comprehension. ELT defines the learning cycle as a process of experiencing, reflecting, thinking, and acting that is driven by two dialectics—experiencing vs. thinking and reflecting vs. acting. Of these, the experiencing vs. thinking dialectic is primary describing opposite ways of knowing reality that are reconciled by the secondary dialectic— reflecting vs. acting.



Most models of learning and development have focused on the thinking pole of the dialectic, e.g. Bloom's taxonomy of educational objectives or Piaget's theory of cognitive development. The process of subjective experiencing has received less attention. In this study we seek to explore the connection between sentience and experiencing (S=Ex) in the significant lived experiences of our study participants. We explore the role that each of the senses played in these significant lived-experiences and examine the structure of how they interrelate to create the holistic experience of sentience, our everyday conscious awareness.

In a series of investigations, we have sought to understand the experiencing process by examining four contemporary theories of the experiencing process—focusing, flow, adsorption, and mindfulness in a search for communalities among them. [1] Our latest study[2] identified a predominant network of ideas shared by these theoretical traditions called the Presence Network. The core of the presence network is an attention guided, recursive cycle of sensing and acting that deepens involvement and sustains presence in a flow state. This recurring virtuous cycle leads to deeper and deeper levels of sensory motor experiencing and acting. In this highly interconnected network, sense engagement and active participation stand out, along with deep involvement. They show the strongest connections with presence. The remaining two items in the network, "being in the here-and-now" and "being alert and aware" are less correlated with being fully present and suggest conditions for presence to arise.



From these studies, we are led to conclude that the essence of the experiencing mode of the learning cycle is being fully present and involved in the here-and-now through engagement in a recurring cycle of sense engagement and active participation. In this study we seek to explore more fully the role of the various specific senses in learning through the lens of sentience—the ongoing perceptual stream of consciousness.

[1] Stock, K. L. & Kolb, D. A. (2021), The experiencing scale: an experiential learning gauge of engagement in learning. Experiential Learning & Teaching in Higher Education, Vol. 4, No. 1, Article 6, p. 3-21.

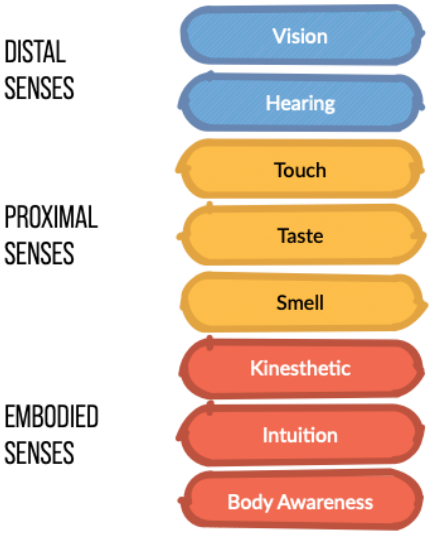
[2] Stock, K., Cola, P., & Kolb, D. (2024), Educational experiences become experiential when the learner is fully present. Experiential Learning and Teaching in Higher Education, Vol. 7. No. 1, pp. 82-96.

THE SENSES

Human beings are equipped with an exquisite system of senses that provide continuous data about the immediate state of our relationship to the environment and about our internal state. We are all familiar with the basic five senses—seeing, hearing, touching, tasting, and smelling—but in addition there are many other senses that contribute to our perception of the world and our place in it. There are lists that include 12, 19 and 65 senses including intuition, often described as the sixth sense, along with kinesthetic movement, pain, temperature, body awareness and so on. Embodiment is the name for many internal sensors that regulate body functions, including interoception (emotion) and proprioception (muscle and joint awareness.)

For the current study we chose the five senses plus intuition, kinesthetic movement, and body awareness. We group the 8 senses into Distal, Proximal and Embodied senses. Distal senses including vision and hearing are attuned to the world out there. Proximal senses including touch, taste, and smell, sense events through direct contact with the body. Embodied senses including kinesthetic movement, body awareness, and intuition are focused on sensations from within the body. The distal senses are subject to pre-attentional and post-attentional cognitive control and direction, while proximal senses are less so. Embodied senses seem to operate outside of conscious awareness and less is known for sure about how they operate cognitively or perceptually.

In this we follow Humphrey, "Of our five senses, vision is often considered the loftiest, followed by hearing, smell, taste, and touch. Plato ranked the senses according to how far their reach goes beyond our bodies. Vision can tell us about the stars, touch can tell us only about what's in contact with our skin. Vision is therefore the least sullied by our animal nature. Position sense, or proprioception, uses information picked up by sensors in joints and muscles to enable you to perceive the spatial location of your body parts. However, what's notable about position sense compared to senses such as vision and hearing is that you don't have any accompanying sensation."[3]



[3] Humphrey, Nicholas. (2023), *Sentience: The Invention of Consciousness*. p. 161 MIT Press. Kindle Edition

PERCEPTION AND SENSATION

"The words Sensation and Perception do not carry very definitely discriminated meanings in popular speech, and in Psychology also their meanings run into each other. Both of them name processes in which we cognize an objective world; both (under normal conditions) need the stimulation of incoming nerves ere they can occur; Perception always involves Sensation as a portion of itself; and Sensation in turn never takes place in adult life without Perception also being there. They are therefore names for different cognitive functions, not for different sorts of mental fact. The nearer the object cognized comes to being a simple quality like 'hot,' 'cold,' 'red,' 'noise,' 'pain,' apprehended irrelatively to other things, the more the state of mind approaches pure experience. Sensation, then, so long as we take the analytic point of view, differs from Perception only in the extreme simplicity of its object or content. Its function is that of mere acquaintance with a fact. Perception's function, on the other hand, is knowledge about a fact; and this knowledge admits of numberless degrees of complication. But in both sensation and perception we perceive the fact as an immediately present outward reality, and this makes them differ from 'thought' and 'conception,' whose objects do not appear present in this immediate physical way. From the physiological point of view both sensations and perceptions differ from 'thoughts' (in the narrower sense of the word) in the fact that nerve-currents coming in from the periphery are involved in their production. In perception these nerve-currents arouse voluminous associative or reproductive processes in the cortex; but when sensation occurs alone, or with a minimum of perception, the accompanying reproductive processes are at a minimum too."

William James, The Principles of Psychology

Perception is created by sensations produced by sense organs in the body, some of which are focused on representation of the external world and some on the internal world of feeling and emotion. Combined they represent the external world and our feelings about it in the miraculous unfolding of the perceptual stream of consciousness. These senses do not deliver individual readouts to a central "mission control", but instead act cooperatively, validating, assisting, and contributing their information to deliver an integrated experience of the beautiful world of lived experience. We hear the world with our ears, see the world with our eyes and touch the world with our hands and feet. At the same time, we have feelings and emotions about what we are experiencing. These and all the other senses magically deliver to our consciousness, not a series of reports, but a unified perceptual stream of consciousness, unfolding a portrait of reality that allows us to situate ourselves in the world and act in it.

Integrated Information Theory[4] proposes that consciousness arises from the ability of a system to integrate information. In evolutionary biology a species achieves consciousness when information from the senses is integrated, the more integrated the information, the richer the experience of consciousness. Integrated Information Theory proposes that consciousness arises from the ability of a systemto integrate information. In evolutionary biology a species achieves consciousness when information from the senses is integrated, the more integrated the information, the richer the experience of consciousness. For we humans Tononi says:

> *The brain is built its way according to its laws, which rule the integration and the differentiation of its parts; due to the world it encountered, evolving through the seasons of the species, growing through its own development, learning through its own experience. The world is known not as reflected through a mirror. No, but by the shape to which the brain was hewed by the harsh hatchet of life—until its shape was such that its internal mechanisms could run in harmony with those external. Every perception is an act of memory, memory of the law, memory of history, and memory of experience……knowledge is the adjustment of inner to outer relations—a matching of unequals. That when we face the world, the more we know and understand, the more Φ grows and breathes, inner relations flourish, when they match outer ones...Consciousness is maximally irreducible, and it is unique; consciousness is the shape of understanding, the only shape that's really real—the most real thing there is; consciousness is a model of how the world might be, a model original and proud, built over millions of years, with sacrifice immense, at the expense of innumerable losses, born on the life and death of countless ancestors, paid for by endless wars, won by the sweat of slaves, mended by wearing lessons, polished by civilizations, schools, and learned arguments… (pp. 348-349).*

This integrated experiencing of the perceptual world to which all our senses contribute is called "sentience" and in Experiential Learning Theory it is called "experiencing".

[4] Tononi, G. (2012). *Phi: A Voyage from the Brain to the Soul*. New York: Pantheon Books.

SENTIENCE

In their massive and comprehensive 2019 study of the history of consciousness, *The Evolution of the Sensitive Soul: Learning and the Origins of Consciousness*, Israeli evolutionary biologists and philosophers of mind Simona Ginsburg, and Eva Jablonka trace the evolution of thought about consciousness from Aristotle's "sensitive soul", the term he used to describe sentience, to present day descriptions that equate sentience and subjective experiencing. In it they articulate the fundamental proposition made in this article that sentience and subjective experiencing are identical. We use S=Ex to signify that sentience equals subjective experiencing:

"One of the major arguments in this book is that subjective experiencing is an aspect of open-ended associative learning and that the evolution of open-ended associative learning led to the emergence of consciousness." People often refer to humans and animals who subjectively experience as "sentient," and that is how we use the words "sentient" and "sentience" here. In addition to the intuitive appeal of "subjective experiencing," we like the term because "experiencing" is a verbal noun, so the dynamic nature of the processes involved is explicit…We see subjective experiencing as a mode of being that involves activities that generate temporally persistent, dynamic, integrated, and embodied neurophysiological states that ascribe values to complex stimuli emanating from the external world, from the body, and from bodily actions." [5]

[5] Ginsburg, Simona; Jablonka, Eva. The Evolution of the Sensitive Soul: Learning and the Origins of Consciousness p. 609. MIT Press. Kindle Edition.

They begin their book with the idea of teleological, goal-directed systems and Aristotle's three 'modes of being', each of which has a unique purpose: life (survival/reproduction), sentience (value ascription to stimuli), and rationality (value ascription to concepts). The focus of this book is the second of these—the "sensitive soul". Rather than a trait, such as vision, Ginsberg and Jablonka see consciousness as a mode of being, in the same way as the emergence of life and rational thought also constitute new modes of being.

In the contemporary philosophy of mind literature consciousness and its origins are hot topics. There is much confusion about the definition of sentience. David Chalmers, a philosopher and cognitive scientist who was skeptical that science would be able to build explanatory bridges between neural correlates in the brain and the subjective experiencing, famously called consciousness the "hard problem"—how can non-physical subjective experiencing arise from the physical structure of the brain. He believed the hard problem was sufficiently challenging to keep any explanation of consciousness at bay for a long time. Software programs like ChatGPT have convinced some observers that machine consciousness is imminent. Others disagree, "Artificially intelligent machines are all perception, no sensation; they'll never be sentient so long as they only process information."[6] Most scientists consider the explanation of conscious awareness to be beyond scientific explanation currently. More poetic writers like Steven Pinker agree: "In the study of mind, sentience floats in its own plane, high above the causal chains of physiology and neuroscience…. we cannot banish sentience from our discourse or reduce it to information access, because moral reasoning depends on it."[7]

17th century Renaissance philosophers created the term "sentience" to contrast the ability to feel with the senses with the ability to think rationally about concepts. They sought to balance the Enlightenment Project of human emancipation through reason with an emphasis on the sensibilities of the arts and literature. The sentience movement reached its peak in the early 19th century emphasizing reverence for nature, fascination with the mysterious, and a celebration of the heroic and sublime. A leader of the romantic movement, W.B. Yeats said "The world is full of magic things, patiently waiting for our senses to grow sharper". Romanticists rejected the social conventions of their time in favor of individualism, arguing that passion and intuition were crucial for understanding the world. Later in the 19th century the term came to mean "experiencing the world as I do", as animal rights activists focused on the claim that animals were sentient and felt pain just as humans do.

Nicholas Humphrey's theory of sentience. We have been guided in this current investigation by the theory of sentience created by the eminent neuropsychologist Nicholas Humphrey.

[6] Humphrey, Nicholas. (2023), *Sentience: The Invention of Consciousness*. MIT Press. Kindle Edition. p.162.

[7] Kabat-Zinn, Jon. (2010). *Coming to Our Senses: Healing Ourselves and the World Through Mindfulness*. pp. 317-318 Hachette Books. Kindle Edition. EPub Edition.

Sparked by his concern for animal rights in the scientific use of laboratory animals, he examines the question of sentience through the lens of evolutionary biology with such questions as: How did the evolutionary process of natural selection invent consciousness? What is the survival value of conscious awareness? Why did it arise so recently and quickly in evolution time? He argues that the platform for sentience arose with the emergence of warm-blooded animals, mainly birds and mammals some 200 million years ago. A covering of feathers or fur insulated them allowing the internal regulation of body temperature, a wider range of movement and adaptive response, and importantly for sentient consciousness-- more efficient brain functioning."

To explain the rapid discontinuous rise in the evolution of sentience that occurred in homo sapiens some 80 to 100 thousand years ago he invokes a process recognized by Darwin that can bring about rapid stepwise changes:

"It arises when there are two animals in a dyadic relationship, each of whom stands to benefit from the success of a trait exhibited by the other, so that there's the possibility of positive feedback. The example that interested Darwin was the evolution of displays used by animals in sexual courtship such as the peacock's tail. He called it called sexual selection. Start with a female who just happens, for no good reason, to be sexually attracted to a male with an exotic feature such as having an unusually large and gaudy tail. As a result of their sexual union, the propensity for exhibiting this feature is passed to their sons, while the propensity for being attracted to it is passed to their daughters. Thus, in the next generation, there will be more males with large tails and more females that find them sexy. Now, assume that females who find large tails sexy find larger tails sexier still. Then, there will be a cascade of selection for ever larger tails in males and for ever greater attraction to them by females, resulting in the super-tails that exist today. Much of the otherwise inexplicable grandeur and beauty of courtship displays can be attributed to sexual selection. Darwin believed it was responsible for humans' love of music, art, and poetry—traits that seem to be absurdly over the top when it comes to practical returns. Could the same be said of phenomenal consciousness: that it's unnecessarily wonderful? If so, could something like sexual selection, at the level of mind mating, have been responsible for making phenomenal properties the runaway success they have become? [8]

Sentience and presence. We find links between his recursive model of how sentience evolved and the strange attractor it creates to the presence model of subjective experiencing. In Sentience: he describes how the recursive sensing and acting in the presence model,

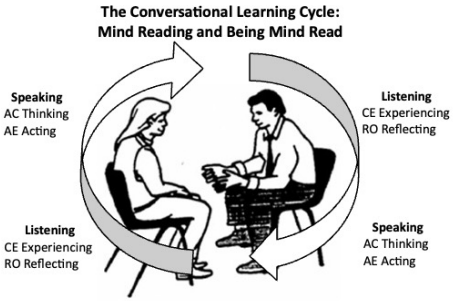
[8] Humphrey (2023), pp. 158-159

"can be drawn out in time, so that the subject, monitoring the outgoing signals, will get the impression that each moment of sensation lasts longer than it really does. Sensations are, as it were, being thickened up. But this is only the beginning of a more elaborate transformation. Once the loop has been established, the circling activity can be channeled and stabilized so that it settles into an 'attractor' state, where a complex pattern repeats itself over and over... The upshot is that sensations come to be experienced as being inalienably private, suffused with distinctive modality-specific qualities, rooted in the thick time of the subjective present, made of immaterial mind stuff." [9]

Human sentience. Humphrey argues that human sentience is a social and biological product that is formed by a similar virtuous cycle of mind reading and being mind read:

As your life unfolds, it becomes ever more apparent to you how your understanding of yourself helps you understand other people—and, for that matter, how it helps you to be understood by others. The mutual adjustment and refinement of mental models that flows from this will be a work in progress that continues throughout your individual life... The more phenomenal consciousness helps the mind donor with the task of mindreading, the more it helps the recipient with the task of being mindread. Thus, phenomenal properties could indeed have become self-selecting, leading to their spiraling up into the phenomenosphere, to the heights of strangeness and beauty we enjoy today.[10]

A 2024 Scientific American article by Hare and Woods supports Humphrey's argument for the civilizing effect of phenomenal consciousness generated by mind-reading and being mind-read that began around 80,000 years ago. In their article they summarize archeological evidence suggesting that homo sapiens survived over the rival Neanderthal line by engaging in a process of self-domestication. This self domestication happens through through cooperative communication that "allows us to plug into the minds of others and inherit the knowledge of generations. It is the foundation for all forms of culture and learning."[11]



[9] Humphrey (2023), pp. 109-11. Emphasis added.

[10] Humphrey (2023), p. 124

[11] Hare, B & Woods, V. (2024), Survival of the Friendliest. Scientific American Winter Spring, p. 24

The perceiving "I" in consciousness. A distinctive characteristic of sentient consciousness, which he calls phenomenal consciousness is that there is an "I" doing the perceiving.

Sensations that started out far back in history as a way of tracking your interaction with the physical world have, during evolution, come to play a subversive double role. While still connecting you to the physical environment, they now serve also to distance you from it. They give you the feeling that there is an essential non-physical dimension to your life. They fix your sense of self as a bubble of mind stuff floating above the world of matter. Sensations have become a work that captures the paradoxical nature of what it is to be you.[12]

Every conscious perception has a bit of your self involved:

"Imagine that your sensations form a sequence of paintings that hang in a long picture gallery stretching back into your past. Their subject matter is what's been happening at your sense organs and how you've felt about it at successive moments. The style in which they are executed is peculiarly yours. Just as we say paintings by Picasso are all 'Picassos' or those by Cézanne are all 'Cézanne's', these are all 'Yous'. Note that these 'Yous' are not mere copies of the facts of sensory stimulation; rather, they represent your creative take on it."[13]

This gallery of "yous" pictures is consistent with Jerome Bruner's autobiographical model of self, described in Chapter 6 of *Acts of Meaning*, that describes the self as a continuous process of the self-authoring. [14] It also fits with the emerging picture of the brain's default mode network as an after-action review that is activated after completion of a task or experience. Barrett describes the dynamics of the default mode:

"My key hypothesis is that the dynamics of the default mode, salience and frontoparietal control networks form the computational core of a brain's dynamic internal working model of the body in the world, entraining sensory and motor systems to create multi-sensory representations of the world at various time scales… the simulations initiated within this network cascade to create concepts that eventually categorize sensory inputs and guide movements…So, your brain is faced with a problem of reverse inference: any given sensation—a flash of light or a sound or an ache or cramp—can have many different causes. In addition, the sensory information is dynamically changing, noisy, and ambiguous. Your brain solves this puzzle by using the only other source of information available to it—past experiences—to create simulations that predict incoming sensory events before their consequences arrive to the brain. In this way, your brain efficiently uses the statistical regularities from its past to anticipate future events that must be dealt with."[15]

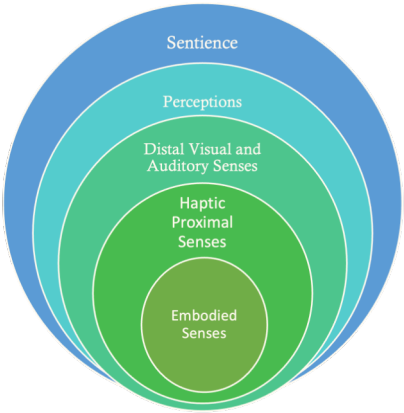
[12] Humphrey (2023), pp. 117-118

[13] Humphrey (2023), p. 116

[14] Bruner, J. (1990), *Acts of Meaning* Harvard University Press

[15] Barrett, L. F. (2017), The theory of constructed emotion: an active inference account of interoception and categorization. *Social Cognitive and Affective Neuroscience*, 2017, p.16

The nested hierarchy described below depicts sentience as a series of "nests", each of which incorporates the lower nest and adds something. Embodied senses operate outside of our consciousness. They include many sensory operations that regulate the body's systems and activity, e.g. body awareness and kinesthetic movement. The haptic proximal senses add a self that is perceiving the sensation. I feel pain. I feel your touch. The addition of the distal senses of vision and hearing is explore novelty and uncertainty. Finally in the inclusive Sentience nest there is the addition of interpersonal and cultural conversation, mind-reading and being mind read.



In this study we explore:

The Structure of Sentience. We examine the role of subjective experiencing in learning more closely, seeking to understand the structure of sentience and the specialized information that each sense contributes to create the holistic perceptual stream of consciousness. How do the distal senses specialized for novelty seeking and intentional cognitive exploration of the environment, the proximal senses that bring us into direct conscious contact with the immediate context, and the silent embodied senses that operate outside conscious awareness co-operate in the production of sentient awareness?

Deliberate sensing and mindfulness. We assess the capability for deliberately increasing subjective experiencing and test its relationship to mindfulness. In *Coming to our Senses*, Jon Kabat Zinn, a leading mindfulness scholar, gives a wonderful description of sentience and the invaluable role it plays in enriching our lives. He argues the practice of mindfulness is a process of attending to the senses, releasing sentience from bounds of cognitive control—e.g. doing jobs or tasks automatically, without being aware of what I'm doing, getting so focused on the goal I want to achieve that I lose touch with what I'm doing, or rushing through activities without being attentive to them.

Educational consequences. Finally, we explore some of the many consequences that flow from the neglect of sentient perception and the celebration of conceptual knowledge that can be seen in educational systems that emphasize, esteem and reward conceptual "knowledge about", treating perceptual "knowledge of acquaintance" as secondary. We also find that there is a great need and opportunity for a rebirth of sentience, a Coming to our Senses. As individuals we have the capacity to deliberately develop sentience. Cultures and organizations can foster sentience by attending to the sense spaces they create.

THE STUDY PARTICIPANTS AND THEIR SIGNIFICANT EXPERIENCES

The ES2 was administered via Mechanical Turk to a broad international sample of 330 individuals ranging in age from 21-78. They were asked to focus their answers to an online survey based upon recollection of "a significant experience you have had that stands out for you" with the guideline that the experience could be something recent or a more distant memory that can be easily recalled. Many of the experiences described by participants were somewhat expected as they recalled a favorite vacation, the birth of a child, or the loss of a loved one. However, we were intrigued by some unexpected responses. For example, one person vividly described the moment a life-altering decision was made when choosing a career path—an excerpt of which follows:

I was a cadet at the Air Force Academy in my senior year and was to select my requested career path… I was to rank and stack my choices in order of preference, which was then sent to the greater career selection committee to assign careers based on class standing… I had wanted to fly for the Air Force since 6th grade. I sat down at my computer to select "rated" and got an immediate and debilitating headache. It started in the back of my head and wrapped around the front. It was sudden and shocking. I decided I would deal with my career selection at a later time. The next day, I sat down to make my career selection and the same intense headache returned. As a person who does not get headaches often, I knew my body was telling me something and I needed to listen. I joke that it was God hitting me over the head with a 2x4 board to get my attention. Flying was my world...I had been taking flight lessons since I was 9 years old and had wanted to fly for the Air Force for almost half my life. Now, I was at a decision point that would completely change the direction of my future. I did not have a vision of who I was apart from flying… I was deeply conflicted and confused. Ultimately, I decided not to fly. I'm grateful for the path I have had but will always wonder "what if." Since that experience, I have never had headaches like the ones mentioned.

For another individual, an incident from early childhood stands out, even though many years have passed since that time. It is described as follows:

Brazil. 1989. I'm 3 years old. I'm facing my sister. She's 9 years old. I've eaten the meat on my plate. I want hers. She's cutting small pieces at a time with a fork and knife. I suddenly lunge at the remaining meat on her plate and shove it into my mouth. She wants to kill me, but my mom is there to protect me.

HYPOTHESES AND RESULTS

Hypothesis 1a. Exploratory factor analysis of participant's rating of sensory involvement in their significant experience will identify proximal, distal, and embodied groupings.

Factor analysis of the 8 senses produced two factors. Factor 1 explains 44% of the variance with the strongest factor loadings for the proximal and embodied senses. Factor 2 explains 13% and is characterized by positive loading on the distal senses of vision and hearing and negative loading on taste and smell.

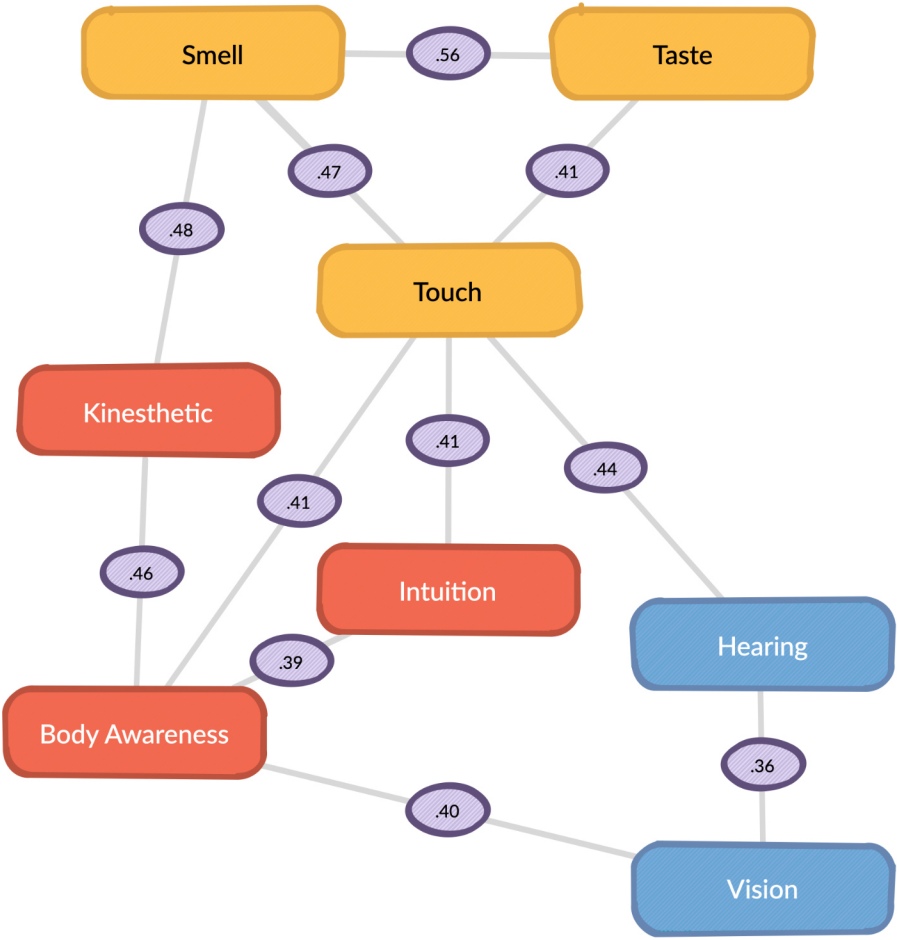
Extraction Method: Principal Component Analysis.	1	2
1 vision	.547	.438
2 hearing	.624	.480
3 touch	.742	.009
4 taste	.611	-.632
5 smell	.720	-.429
6 kinesthetic	.708	-.033
7 intuition	.627	.105
8 body awareness	.684	.157

Hypothesis 1b. non-parametric factor analysis

Here we use the non-parametric factor analysis method that our previous study used to identify the presence network. When applied to a holistic universe of variables, such as the way that the breadth and depth of the 8 senses combine to produce sentience, the intercorrelations among this holistic scheme of senses suggest clues about the organization and structure of sentience. We used non-parametric factor analysis to identify sensory interrelationships, starting with the highest correlations pairs and building a hierarchy from there. This analysis of participants' ratings of how much each of the 8 senses were involved in the significant lived-experience they chose to examine, revealed a two-factor hierarchy where the distal, vision and hearing, senses are subordinate to an interconnected network of the proximal and embedded senses of smell, taste, touch, kinesthetic movement, body awareness and intuition.

Correlation Matrix	1	2	3.	4.	5	6	7	8
1 vision	1.000	**.363**	.345	.138	.313	.290	.271	.286
2 hearing	**.363**	1.000	**.442**	.173	.266	.378	.305	**.398**
3 touch	.345	**.442**	1.000	**.408**	**.466**	.372	**.409**	**.408**
4 taste	.138	.173	**.408**	1.000	**.565**	.344	.272	.318
5 smell	.313	.266	**.466**	**.565**	1.000	**.479**	.332	.320
6 kinesthetic	.290	.378	.372	.344	**.479**	1.000	.351	**.464**
7 intuition	.271	.305	**.409**	.272	.332	.351	1.000	**.389**
8 body awareness	.286	**.398**	**.408**	.318	.320	**.464**	**.389**	1.000

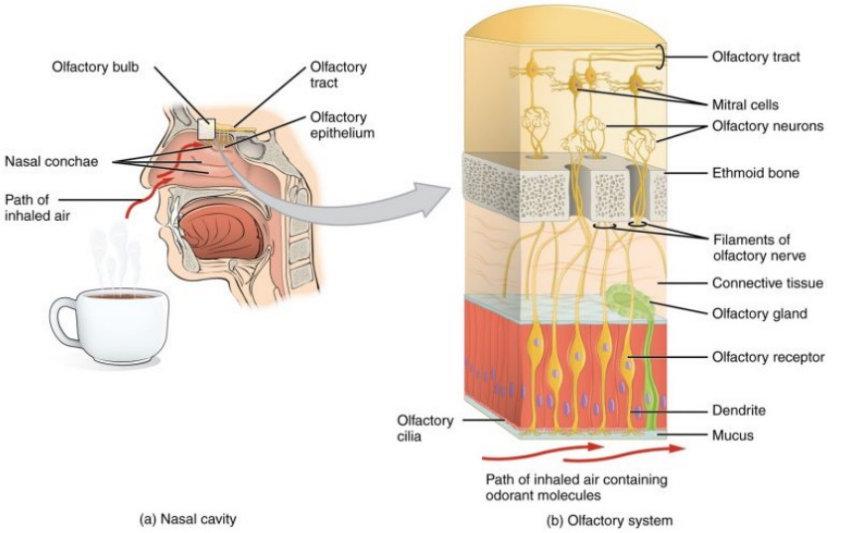
THE STRUCTURE OF SENTIENCE: DISTAL AND PROXIMAL/EMBODIED SENSES



Overall, the Structure of Sentience model shows a distinctive grouping of the distal, proximal and embodied senses. The six proximal and embodied senses form the dominant highly connected haptic touch network. Haptic perception is the process of actively exploring surfaces and objects using the sense of touch, often combining touch and movement to fully manifest the sense. The haptic touch network is thus a combination of the proximal senses and the embodied senses. The distal Vh network of vision and hearing are subordinate to it and connected to it only through hearing.

THE PROXIMAL HAPTIC TOUCH NETWORK

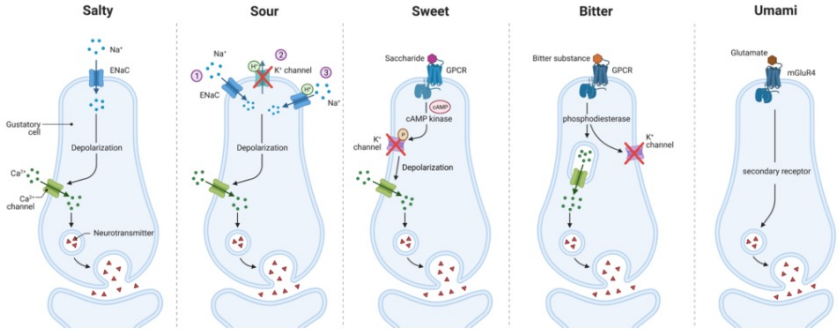
The strongest interconnections are between **smell, taste, and touch.** These are our oldest senses. For millions of years these were our ancient ancestors' primary modes of perception. In the 1990's it was believed that the brain's neo-cortex evolved from olfactory bulbs, "Our cerebral hemispheres were originally buds from the olfactory stalks. We think because we smelled."[16] Subsequent research has shown a more complex picture of the evolution of the neo-cortex, but the fact remains that our human sense of smell has dwindled in favor the cognitive neo-cortex.



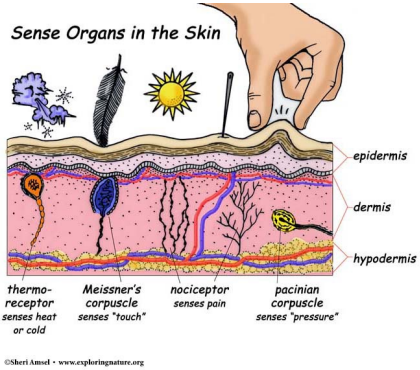
The second strongest set of interconnections adds **kinesthetic movement, body awareness and intuition** to smell, taste, and touch, forming the haptic touch network.

[16] Ackerman, Diane. (1990), *A Natural History of the Senses.* pp. 39-40. Knopf Doubleday Publishing Group. Kindle Edition.

The kinesthetic sense (proprioception) senses the position and movement of the joints, muscles and tendons of the body. Body awareness (the vestibular sense) controls body orientation and balance through the cocculus of the inner ear. The vestibular system is made up of sensors in the inner ear that detect the position and movement of your head. This information is sent to the brain, which then coordinates eye movements, posture, and balance.
Touch is the central sense in the haptic touch network with 5 interconnections to the other senses.



Touch is not only the largest sense organ in the body but the body's largest organ. It has many specific sensors including pain and temperature. The skin has been described as a "social organ," that facilitates social connections. It has receptor cells that tell the brain about pleasurable social touch



Intuition is connected to touch and body awareness bringing some awareness of the silent workings of haptic network. Gary Gress says intuition: "…compresses years of experience and learning into mere seconds. It is manifested partly as emotions because accrued experience reveals itself as having a 'feel' for choosing a course of action…basic intuitive behaviors are possessed by all humans, and they are mainly associated with survival mechanisms…Intuitive processing, though drawing upon experience gained serially and therefore extremely slowly, is parallel in nature and rapidly integrates and organizes complex sets of cues. Conscious deliberation, in contrast, is a 'low capacity' channel and can be quickly overwhelmed by large amounts of information."[17]

[17] Gress, G. (2023), Born to Design: Innate Human Behaviors Involved in Learning and Practicing Engineering Design. p. 7. Learning and Memory - From Molecules and Cells to Mind and Behavior, IntechOpen.

THE DISTAL VH NETWORK

The least interconnected senses are **vision and hearing** forming the distal Vh network. vision and hearing are often considered the primordial senses when it comes to experiencing the world. Vision is the least connected sense to the primary proximal senses. Vision is a real paradox here. It contributes the least to the sentience model yet in many ways is the emperor of the senses. 75% of the body's sensory receptors are in the eyes and the largest body of research on the senses is on vision. It is often the final judge (Seeing is believing.) and its cognitively controlled, exploratory nature can override other senses. This Ocular-centrism has been noted by many philosophers including R. W. Emerson and Luce Irigaray a Belgian-born French feminist philosopher (Luce Irigaray 1978). Kevin Pipjers writes of her feminist perspective on ocularity:

> *Investment in the look is not as privileged in women as in men. More than any other sense, the eye objectifies and it masters. It sets at a distance and maintains a distance. In our culture the predominance of the look over smell, taste, touch and hearing has brought about an impoverishment of bodily relations. …Irigaray makes a connection between several things. Firstly, she makes the connection between vision and men, and secondly, between this masculinized vision, and its power to objectify and make distant. Consequently, she calls into question the relation of the objectifying and distancing gaze, with the dominance of the look over the other senses. She thereby contributes a particular sensory dimension to the power of witnessing experimental events…The modern witness favors sight as "master sense of the modern era". Ocular centrism is abound in modern life…Instigated by a Cartesian perspectivism, which bifurcates the gazing subject from the gazed upon object, sight becomes "the noblest of the senses."*[18]

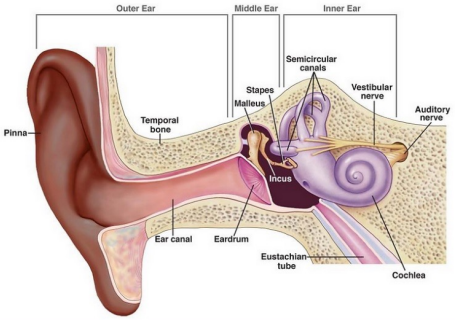
Fredrick Franck in The Zen of Seeing describes how our cognitive labels disrupt perception, "We do a lot of looking: we look through lenses, telescopes, television tubes … Our looking is perfected every day—but we see less and less. Never has it been more urgent to speak of seeing … we are on-lookers, spectators … "subjects" we are, that look at "objects." Quickly we stick labels on all that is, labels that stick once—and for all. By these labels we recognize everything but no longer see anything."[19]

Hearing is the ability to perceive sound by detecting vibrations. It is the sensory foundation for speech, music and hazard perception. Hearing is more linked to the haptic network through touch and body awareness, as sound does have a proximal effect on the body.

[18] Pijpers, Kevin (2017), Haptic Encounters with Archaeological Knowing: Bodily Practices in Excavation. p. 54-56. Doctor of Philosophy at the University of Leicester School of Business.

[19] Cited in Kabat-Zinn, Jon. (2010), *Coming to Our Senses: Healing Ourselves and the World Through Mindfulness*. p. 192. Hachette Books. Kindle Edition.

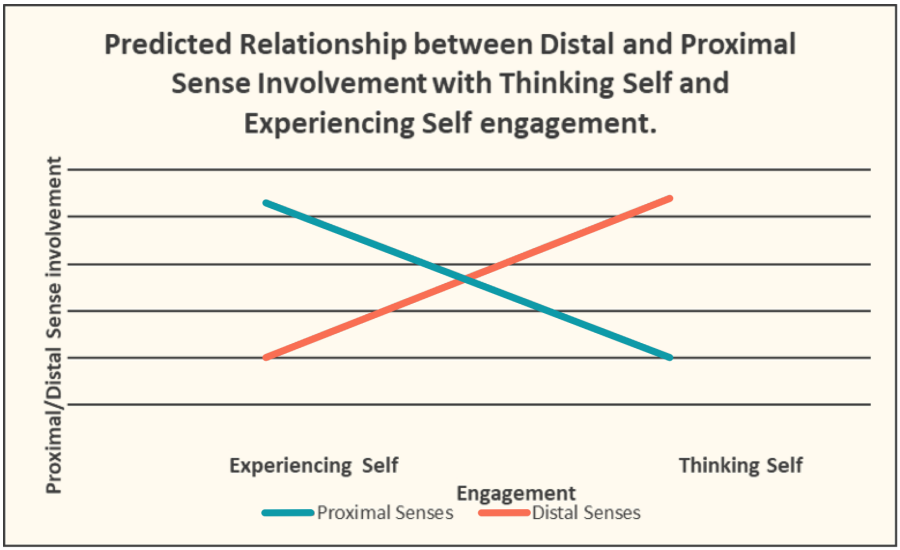
Hearing is often overlooked given the ocularity of human sensing.



Some trace its secondary status to Gutenberg's invention of the printing press which replaced auditory hearing of speech with visual reading of text.

Both vision and hearing are teleceptors, sense organs capable of responding to distant stimuli. In the case of hearing sound waves, through a process of mechanoelectrical transduction convert sound waves into an electric signal' that is carried to the cerebral cortex via the auditory nerve.

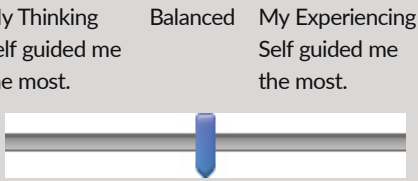
Hypothesis 2. Distal senses are more subject to cognitive control. Proximal senses are guided by subjective experiencing. The prediction is that that individuals who approached their significant experience with their thinking self would have more distal sense involvement, while those who approached the experience with their experiencing self would have more involvement of the proximal senses.



Survey participants were asked the following question:

Nobel Prize winner Daniel Kahneman says we have two selves, an EXPERIENCING SELF, an in the moment, continuing perceiving of the world, and a remembering, THINKING SELF, that makes decisions and plans action. Together both selves guide us in our learning and life choices. What was the balance between the EXPERIENCING SELF and the THINKING SELF in your experience? Move the slider to the appropriate potion.

What was the balance between the EXPERIENCING SELF and the THINKING SELF in your experience? Move the slider to the appropriate potion.



Results of a 1-way Analysis of Variance show that the intensity of distal sense involvement significantly increases with Thinking self engagement. The ANOVA for proximal sense involvement shows a similar significant increase with Experiencing self engagement.[20]
Additionally, when the Experiencing Self was more dominant in the experience, there was a strong relationship with presence (.39 <.001) and experiencing novelty (.30 <.001).
Since the two components of sentience, the distal senses of the Vh network and the proximal/embodied senses of the haptic network, influence the total score for sentient sense involvement in opposite ways the positive Experiencing Self correlations are reduced somewhat by the negative Thinking Self correlations resulting in no relation to overall sentience (.09 <.12).

ANOVA: Distal Senses	Sum of Square	df	Mean Square	F	Sig
Between Groups	117.684	10	11.768	2.843	.002
Within Groups	1196.166	289	4.139		
Total	1313.849	299			

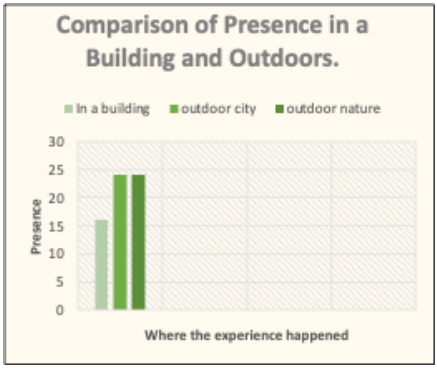
ANOVA: Proximal Senses	Sum of Square	df	Mean Square	F	Sig
Between Groups	2558.973	10	255.897	1.967	.037
Within Groups	37071.013	285	130.074		
Total	39629.986	295			

[20] Expressing the results as correlations, When the Experiencing Self was more dominant in the experience, Proximal/Embedded senses were more engaged (.18<.002). When the Thinking Self was more dominant in the experience, Distal senses were more engaged (-.11<.05)

THE CONTEXT SENSE-SPACE—WHERE AND WHEN THE EXPERIENCE OCCURRED

After participants had chosen their significant experience, they were asked to indicate where and when their experience had happened. Where = Building, city, nature, technology, zoom. When = Recent, Week, Month, Year, Years+. To explore the influence of context the following exploratory hypotheses were tested.

Hypothesis 3a. Where the significant experience happened is unrelated to the level of sentient sense arousal. When the participant's choice of their significant experience happened is unrelated to their level of sentience, i.e. the breadth and depth of sense arousal they reported. The location of the person's experience all had similar levels of sense arousal.



Hypothesis 3b. Where the significant experience happened is related to presence. In the case of presence, location becomes important. Being in a building recorded the lowest levels of presence while being in nature elicited the highest level of presence. This is a suggestive result that raises intriguing avenues for future inquiry. What is it about buildings that inhibits being present? Or what is it about nature that seems to stimulate the presence network? Our current hypothesis is that both processes are at work. Most buildings are built to the Euclidian geometric plan, standardized down to the last bolt and board. They are unchanging and predictable.[21] Nature is always changing and new. Its fractal structure may activate the presence network just as Humphrey's strange attractor does.[22] Karen Stock's finding, in her original experiencing study of equine assisted management development, that being in a natural setting had the biggest impact on subjective experiencing is reinforced by the strong levels of presence in this study.[23] Or is it that being in a building reduces presence as much or more than being in nature increases it.

[21] Ellenberg, Jordan. (2021), *Shape: The Hidden Geometry of Information, Biology, Strategy, Democracy, and Everything Else*. Penguin Publishing Group. Kindle Edition

[22] Florence Williams (2017), *The Nature Fix*. NY: W.W. Norton

[23] Stock, K. L. (2014), Equine-assisted Experiential Learning: Implications for Management Development and Education. Doctoral Dissertation Case Western Reserve University.

Hypothesis 4a. When the significant experience happened is unrelated to the level of sentient sense arousal. When the participant's significant experience occurred is unrelated to their level of sentience they reported, (as was the case for where it occurred). Individuals reported similar levels of sensation from very recent experiences to those that happened years ago.

ANOVA: Sentience	Sum of Square	df	Mean Square	F	Sig
Between Groups	2.421	4	.605	.219	.928
Within Groups	803.735	291	2.762		
Total	806.156	295			

Hypothesis 4b. When the significant experience happened is related to the level of presence. The most striking difference for presence is when the experience chosen is very recent, repeating the pattern of low presence found in experiences inside a building. Does this suggest that recent experiences, though highly sensually experienced, are fleeting and may not last? Presence is an attention guided, recursive cycle of sensing and acting that deepens involvement and sustains presence in a flow state. It stitches sense experiences together into the fabric of conscious awareness and lived experience, recording them in muscle memory, semantic memory, and episodic memory. Without the sustaining engagement of presence sensual stimulation may be "in one ear and out the other."

DELIBERATE SENSING AND MINDFULNESS

Another leading proponent of sentience, in addition to Nickolus Humphrey, is Jon Kabat Zinn, a leading mindfulness scholar who in *Coming to Our Senses*[24], describes how attending to the senses is the key to mindfulness. Mindful practice engages the processes of mindfulness—attention, awareness and an open, curious, accepting, and non-judgmental attitude.

This involves practices such as breathing, eating, walking, yoga, and tai chi in a meditative state. Practitioners are encouraged to allow all experiences to occur naturally and pass without pushing them away, ignoring them, or actively engaging with them.[25]

In Kabat-Zinn[26]it he speaks to the challenges we have and the potential to be gained by developing our sentient powers:

"…our capacity for sentience tends to get covered over by tangles of vines and underbrush and remain weak and undeveloped, in some ways merely a potential. We can become relatively insensate, insensitive, more asleep than awake when it comes to drawing on our ability to know beyond the limitations of self-serving thought…Cultivated and strengthened, sentience lights up our lives and it lights up the world and grants us degrees of freedom we could scarcely imagine...It also grants us a wisdom that, developed, can steer us clear of our tendencies to cause harm, wittingly or unwittingly, and instead, can soothe the wounds and honor the sovereignty and the sanctity of fellow sentient beings everywhere."

[24] Kabat-Zinn, Jon. (2010), *Coming to Our Senses: Healing Ourselves and the World Through Mindfulness*. p. 320. Hachette Books. Kindle Edition.

[25] Tsang EW, Gao J, Lo CN, Trapp NT, Boes AD, Sik H. (2025), Effects of mindfulness meditation on human impulsivity: a systematic review and meta-analysis. p. 1. *Academia Mental Health and Well-Being* 2025;2.

[26] Kabat-Zinn, Jon. (2010), *Coming to Our Senses: Healing Ourselves and the World Through Mindfulness*. p. 320. Hachette Books. Kindle Edition.

Hypothesis 5a. Deliberate sensing is a general capability rather than being sense specific. When we ask our study participants to rate their capability for deliberately attending to each of the eight senses, we found that there were no big differences among the senses. Using exploratory factor analysis, we found that deliberate sensing is a general capability rather than being sense specific. This is shown by a factor analysis with a strong 1 factor solution of eigen value = 3.98 that explains half of the variance.

Component Matrix	Component 1
del vision	.731
del hearing	.743
del touch	.737
del taste	.690
del smell	.712
del move	.745
del intuit	.615
del body	.663

Extraction Method: Principal Component Analysis.

5b. This general capacity to influence sense awareness through deliberate attention and focus will be related to Mindfulness. Mindfulness as measured by an abbreviated version of the Mindfulness Attention Awareness Scale (MAAS)[27] with proven reliability and validity[28] is related to this general capability of deliberate sensing with a large effect size. Deliberate sensing is also related to experiencing novelty (.29 p<.01) and presence (.27 p<.01) and is related to the proximal/embodied senses (.12 p<.05) rather than the distal senses.

ANOVA: MAASTOT	Sum of Square	df	Mean Square	F	Sig
Between Groups	64.705	27	2.396	1.730	.016
Within Groups	354.624	256	1.385		
Total	419.330	283			

[27] Brown, K.W., & Ryan, R.M. (2003). The benefits of being present: mindfulness and its role in psychological well-being. pp. 822-848. Journal of Personality and Social Psychology, 84.

[28] Nicholas T. Van Dam, Mitch Earleywine & Ashley Borders (2010). Measuring mindfulness? An Item Response Theory analysis of the Mindful Attention Awareness Scale. p 805–810. Personality and Individual Differences 49.

EDUCATIONAL IMPLICATIONS

Finally, we enumerate some of the many consequences that flow from the neglect of sentient experiencing and the celebration of conceptual knowledge that can be seen in educational systems that emphasize, esteem and reward conceptual "knowledge about", treating perceptual "knowledge of acquaintance" as secondary. The predominant methods of educational practice have diminished the role of perception and have given priority to conceptual analysis, creating a meritocracy for the "best and brightest". There is little evidence though that these two qualities are correlated. There is evidence that moral qualities of character (best) are more associated with subjective experiencing processes like empathy than with conceptual thinking which inevitably leads to disconnection from the lived experience. David Brooks in a recent Atlantic article pointedly and brilliantly places the blame on Ivy League universities for this neglect and exclusive reliance on intelligence test scores for admissions. "Our definition of ability shouldn't be restricted to who can ace intelligence tests at age 18. We need to stop treating people as brains on a stick and pay more attention to what motivates people: What does this person care about, and how driven are they to get good at it? We shouldn't just be looking for skillful teenage test takers; we want people with enough intrinsic desire to learn and grow all the days of their life."[29]

These consequences can be seen at many levels and in many contexts. Higher education is acclaimed, and vocational education is devalued. Sensory-motor skills are seen as being lower level than cognitive skills. The arts that give meaning and "voice" to silent perception are shrinking from the educational scene while STEM flourishes. Sports and play and dance and music are eliminated, along with recess, to "cover" the required curriculum content.

We would not ask that the situation be reversed to make perception first but that the two be brought into balance and harmony. William James created the philosophy of radical empiricism and the dual knowing theory of experience (DKTE) to show how perception and conception are united in experience:

> *"We thus see clearly what is gained and what is lost when percepts are translated into concepts. Perception is solely of the here and now; conception is of the like and unlike, of the future, and of the past, and of the far away. But this map of what surrounds the present, like all maps, is only a surface; its features are but abstract signs and symbols of things that in themselves are concrete bits of sensible experience. We have but to weigh extent against content, thickness against spread, and we see that for some purposes the one, for other purposes the other, has the higher value. Who can decide off-hand which is absolutely better to live and to understand life? We must do both alternately, and a man can no more limit himself to either than a pair of scissors can cut with a single one of its blades."*[30]

[29] Brooks, David . (2024), How the Ivy League Broke America. p.35. The Atlantic December 2024

[30] James, William .(1967) The Writings of William James John McDermott (ed) p. 243. University of Chicago Press

Without both blades, experiencing and thinking, the experiential learning cycle cannot be completed. The learning cycle drives a recurring process of dipping into the perceptual stream of consciousness to name each momentary experience, to think about it and to dip again downstream. In this way, learning is a process of naming and renaming experience that integrates experiencing and thinking through reflection or action. In Paulo Freire's words learning is about "naming experience in dialogue".

Object Based Learning. Object based learning is a popular new approach to experiential learning practice that integrates both blades of James' scissors. Parker Palmer suggests that presence is created when the object of study is brought into the room as a "third thing" for both teacher and learner to explore and learn from as equals in conversation. The reality of the object becomes the final arbiter of differences:

"The subject-centered classroom is characterized by the fact that the third thing (the subject) has a presence so real, so vivid, so vocal, that it can hold teacher and students alike accountable for what they say and do. In such a classroom there are no inert facts. The great thing is so alive that teacher can turn to student or student to teacher, and either can make a claim on the other in the name of that great thing. Here teacher and students have a power beyond themselves to contend with–the power of a subject that transcends our self-absorption and refuses to be reduced to our claims about it."[31]

Object-based learning is well established in the GLAM (galleries, libraries, archives and museums) sector, particularly for working with school groups. Aaron Padilla, the Director of Learning and Engagement at the Honolulu Museum of Art, gave us an example of how students at the museum school turn visual appreciation of the pieces in the museum's collection into a deeper understanding of how the work was created by involving the haptic network. After studying the piece, they return to their studio to replicate the techniques they had observed. In this way, the sensory-motor senses of the Haptic network can deepen art appreciation into art understanding. Gary Gress has observed, "…the observation of art relies on completing the image—that is those elements not seen previously—through the observer's active participation. They are drawn into the creative act by this involvement, and so experience the joy of 'making' which previously had only been the artist's providence." McGowan and colleagues stress the importance of haptic learning via the proximal senses in object-based learning:

"Haptic learning via the proximal senses, where students learn through a sense of touch, has been described as a 'hands-on approach', or 'learning by doing'. However, looking at haptic learning from a neuroscience perspective, where haptics involves the stimulation of the brain through tactile feedback, haptic learning takes on a deeper significance – above and beyond just practicing techniques by 'doing' with the hands, learners are building meaning and understanding through sensory touch and interaction with objects. The physical stimulus that comes from handling artefacts embeds learning more deeply than purely auditory or visual learning alone.

[31] Palmer, P. (1998). The Courage to Teach: Exploring the Inner Landscape of a Teacher's Life. p. 117. San Francisco: Jossey-Bass.

Moreover, interaction with objects assists students who learn kinesthetically to keep pace with their peers who respond more to auditory or visual stimuli. In addition, when conveying complex and challenging course content, active engagement with objects and the haptic learning that comes with it has the benefit of decreasing cognitive load and improving overall knowledge uptake In a study in the anatomical sciences, learning activities designed using haptic learning modalities were not only significantly more appealing to students, but also led to higher scores in associated assessment, as students could better recall concepts and properties of models they had touched.[32]

Figure 1: An archaeological scenario in which students interact with the objects to identify them based upon their attributes, and then form a hypothesis for the interpretation of the deposit by drawing upon their own knowledge and their reading of the literature prescribed for the class

Similarly, Kevin Pijpers in his study of bodily practices in archaeological knowing contrasts conceptual knowing standing on the edge of the dig trench to the haptic experiencing of being in the trench. He describes the case of the archaeologist, David, and his experience of knowing through conceptual and experiential encounters:

In David's "I think I know" there is an undisclosed relation between his thinking and his knowing, standing at the edge of a trench, waiting to emerge. When he is in the trench however, David notes that "I 'just know'." …Knowing for David has something to do with where his body is in relation to the soil. There is a qualitative difference in the way his body is positioned, and perhaps also in its movement from outside ("I think I know") to inside ("I just know") the trench.[33]

[32] Glenys McGowan, Gerhard Hofstadter, Jennifer Creese. (2022) Object Based Learning in the Social Sciences: Three Approaches to Haptic Knowledge Making, pp. 97-107, Teaching Anthropology Vol. 11, No. 2.

[33] Pijpers, Kevin (2017). Haptic Encounters with Archaeological Knowing: Bodily Practices in Excavation. Doctor of Philosophy at the University of Leicester School of Business

CONCLUSIONS AND LIMITATIONS OF THE STUDY

There are many limitations. The usual problems of inferring causality from correlation apply. Questions about self-report data can also be raised, but how else can we understand what someone is experiencing subjectively? We have not found any other studies that examine phenomenologically how the senses interrelate to produce the unified stream of conscious awareness called sentience. This was an exploratory study that raises more questions than it answers, answers that we will continue to pursue. Specifically, there is a need for:

- Replication of the presence network and structure of sentience model.
- The impact of a person's sense spaces (that Kabat-Zinn calls the "Sense landscape")
- The health and acuity of a person's senses.

Given the above limitations a few tentative conclusions seem warranted.

First, based on the study results and corroborating evidence in the literature reviewed, the typology of the senses with their different characteristics and functions seems to be supported. Distal senses, dominated by vision and supported by hearing, direct cognitively controlled attention to the new and unexpected as part of the brain's attempt to assimilate them into its existing picture of the world and you in it. This Vh network is subordinate to the proximal and embodied senses that combine to make up the haptic touch network.

Second, sentient sensual stimulation alone does not activate the presence network. What is missing is the active participation required for the recursive cycle of sensing and acting that deepens involvement and sustains presence. Like Humphrey's strange attractor, this recurring virtuous cycle leads to deeper and deeper levels of sensory motor experiencing and acting. The similarity between Humphrey's strange attractor and the sensing/acting positive feedback loop of the presence network is central to our argument linking his sentience theory to subjective experiencing. Positive and negative feedback loops and the field of cybernetics created by Norbert Weiner in the mid-1940s are the intellectual progenitors of strange attractors and dynamic systems and chaos theory. Recursiveness is characteristic of both strange attractors and positive feedback loops. Recursiveness in this context refers to the process where the output of a system is fed back into the system as input, amplifying the initial effect. This recursive process unchecked by the limit setting of negative feedback loops can lead to exponential growth or runaway effects.

Third, the result that being in nature stimulates presence is a replication Karen Stock's equine-assisted education study that showed that the natural setting with the horses had by far the greatest effect on participants' presence. In very recent experiences and experiences in buildings, sensual arousal was like other times and places. The Presence Network, however, was not aroused in buildings or in recent experiences.

Fourth, the finding that deliberate sensing is a general capability and that the practice of mindfulness can increase sentience suggests a way our senses can flower from basic instincts to sophisticated sentience; from gourmand to gourmet to use taste as an example. More widely this can be seen as a process of what Freud called sublimation where primitive, unacceptable urges are channeled into socially acceptable and creative outlets, a peacock's tail of the senses.

Finally, there is a sense of urgency for this work. Ray Kurzweil is an AI Visionary at Google, a renowned futurist, and a leading developer in artificial intelligence. In the The Singularity Is Nearer: When We Merge with AI,[34] he lays out how the coming Singularity is arriving sooner than he had previously predicted:

"As artificial intelligence grows in ability and information becomes more accessible, we are integrating these capabilities ever more closely with our natural biological intelligence. Eventually nanotechnology will enable these trends to culminate in directly expanding our brains with layers of virtual neurons in the cloud. In this way we will merge with AI and augment ourselves with millions of times the computational power that our biology gave us. This will expand our intelligence and consciousness so profoundly that it's difficult to comprehend. This event is what I mean by the Singularity." P1

He bases his predictions on Moore's law of accelerating returns where information technologies like computing get exponentially cheaper because each advance makes it easier to design the next stage of their own evolution.

"In the early 2020s we entered the sharply steepening part of the exponential curve, and the pace of innovation is affecting society like never before. A key capability in the 2030s will be to connect the upper ranges of our neocortices to the cloud, which will directly extend our thinking. In this way, rather than AI being a competitor, it will become an extension of ourselves. By the time this happens, the nonbiological portions of our minds will provide thousands of times more cognitive capacity than the biological parts. As this progresses exponentially, we will extend our minds many millions-fold by 2045."

When the conceptual cortex is merged with AI, our sentience as human beings is all that stands in the way. Will the moral compass that our collective human sentience provides be up to the task of guiding us through a future driven by artificial intelligence? There is a great need and opportunity for a rebirth of sentience, a Coming to our Senses. As individuals we have the capacity to deliberately develop sentience. Cultures and organizations can foster sentience by attending to the sense spaces they create.

[34] Kurzweil, Ray. (2024) *The Singularity Is Nearer: When We Merge with AI*. Penguin Publishing Group. Kindle Edition.

For example, The Gilder Center is an addition to the American Museum of Natural History designed by Studio Gang, the design firm led by Jeanne Gang. The Gilder Center's unique, organic design is informed by the natural paths wind and water carve into landscapes that are exciting to explore, as well as the forms that water etches in blocks of ice.

"Perhaps it is time for us to own the name we have given ourselves as a species, to own our sentience, and come to our senses while there is still time for us to do so. And while we might not realize it, that time, by all reckoning, is shorter than we think. And the stakes higher. What is at stake, finally, is none other than our very hearts, our very humanity, our species, and our world. What is available to us is the full spectrum of who and what we are. What is required is nothing special, simply that we start paying attention and wake up to things as they are. All else will follow."[35] – Jon Kabat Zinn

[35] Kabat-Zinn, Jon. (2010) Coming to Our Senses: Healing Ourselves and the World Through Mindfulness. p. 610. Hachette Books. Kindle Edition.