



## Psychosis – The Default Mental State?

Professor Peter Woodruff

14<sup>th</sup> March 2022

*Psychosis is a mental state where people experience a 'different' world. If, as clinical psychiatry and neuroscience suggests, it is our 'default mental state' why isn't everyone psychotic? Psychosis does not arise de novo; external sensory input and cognitive inhibition actively prevent its expression. It is important to understand how thin the boundary is between sanity and madness and what leads from one to the other; and to appreciate the frailty of rational thought.*

The talk will cover the following points:

1. What do we mean by 'Psychosis'?
2. What constitutes 'clinical Psychosis'?
3. Epidemiology: the prevalence of psychotic phenomena in the general population.
4. Naturally occurring 'psychosis': hypnagogic and hypnopompic hallucinations; sensory deprivation; illusions.
5. How might psychotic phenomena arise? *Neuroscience - sensory input, cognitive inhibition.*
6. The capacity to have strange beliefs.
7. Vigilance and paranoia.
8. Implications for health and the human condition in society.
9. Conclusions.

We are *subjective* human beings

We all perceive things differently but fundamental to our makeup is the *capacity to believe in things beyond reason*.

When without external input, we gain *insight into the default brain* - which approximates to clinical psychosis.

Perhaps rather than ask "why do people develop psychosis?", we could ask ourselves "why *don't* people develop psychosis?". This could help re-orientate how we approach clinical care.

Perhaps we should realise we are *all* in a delicate dynamic equilibrium that keeps us in a balance between psychosis and rationality, and that as we understand more about perception, cognition and human behaviour, we should consider that *rational thought is fragile* and be aware that the motivation for our thinking, by default, is irrational.

### Introduction

Rene Descarte's famous proposition: 'Cogito ergo sum', 'I think therefore I am' (1637) relies upon a logic that assumes the pre-eminence of a rational mind that primarily 'thinks'.

But, in this age we increasingly appreciate that we also: feel, experience, *perceive* the world. For instance, how many times do we hear people express their views by feeling? "But I *feel* you are mistaken, my *feeling* is that this is true, or false ...." Opinions are often expressed as feelings. And indeed, the stronger the view, the stronger is the feeling with which it is associated, the stronger the conviction with which it is held.

Our mental domains (thoughts, mood, sensation, perception, cognition - attention, memory, and insight - how we view ourselves) all contribute to how we view the world, how we see ourselves, gauge our place within that world, the apparent 'reality' of that world as well as the 'reality' of ourselves, and the boundaries between 'ourselves' and that outside world. All of these domains work together to guide our behaviours. So, if any of these complex functions break down, and fail to act in a coordinated way, behaviour can become disturbed.

In this lecture I will present evidence that supports an alternative or embellished view from that of Descartes: that, in fact, our minds do not assume rationality by default - but rational thought and logical judgement is a development, a transformation built upon a mind that is, *by default*, illogical, irrational, a mind that can be regarded - as 'psychotic'.

'Psychosis as the default mental state' may seem a strange proposal to many, as we are used to thinking that we are intrinsically logical, purposeful and capable of sound judgement. I do not challenge the belief that we are so capable, but that to achieve such a state of rationality requires great effort, largely inhibitory, on that *natural tendency* to be disordered and chaotic.

In developing the argument, I intend to present some evidence within the following outline:

1. What do we mean by psychosis?
2. What constitutes 'clinical psychosis'?
3. Epidemiological evidence that 'psychotic phenomena' are prevalent in the general population.
4. Examples of 'naturally occurring' psychosis: hypnagogic and hypnopompic hallucinations; sensory deprivation; illusions.
5. I will explore what science might tell us about how these psychotic phenomena arise, with reference to: the neuroscience of sensory input, perception and attentional cognitive inhibition.
6. I will briefly ask why we have capacity to have strange beliefs with reference to 'vigilance' and paranoia.
7. And finally highlight some implications of these ideas for health before concluding.

## What Do We Mean By Psychosis?

Psychosis is a fragmentation of the psyche where connections between mental domains become distorted or disconnected such that mental activity becomes disturbed.

We can define Psychosis as a mental state where people experience a 'different' world, different from what most of us may experience. A world which is perhaps mysterious, strange, where the so called normal coordinates and tangible features of a world familiar to most of us seem unfamiliar; a world that may seem perplexing and perhaps unfathomable- a world populated with experiences like hallucinations that arise unbidden and outside our control- a frightening world.

In concert with hallucinations, are delusions- thoughts and beliefs that defy our understanding, that appear unlikely, or odd, or bizarre- but that are held with complete conviction, and unaltered by evidence to the contrary.

I now describe some features of clinical psychosis seen in patients, and later will attempt to persuade you that at least some of these features lie very close to the surface in us all.

## Clinical Psychosis

The German psychiatrist Kurt Schneider described features characteristic of schizophrenia as 'First Rank symptoms' (Schneider K (1939); Cutting, J. (2015)).

Hallucinations are commonly experienced - such as seeing things or hearing voices when there is no outside source.

Another common feature of psychosis is 'paranoia'. Paranoia is where the person interprets the outside world as pointing at or observing the person, and this is only happening to that person, no one else. This is often accompanied by discomfort or overt fear.

They may become convinced that they are being monitored or subject to a sinister plot against them that is unique to them. These thoughts can assume a delusional intensity - absolute conviction in the absence of objective evidence.

Sometimes if someone is depressed their thinking maybe unduly negative about themselves or their place in the world. They may for instance think that their life is not worth living, and that the world is better off without them. And if this reaches delusional intensity, they may think that they are personally responsible for the ills of the world.

At the other extreme, if manic, they may become grandiose and think that they have special powers to control the sun or moon for instance.

Some people may find it difficult to communicate in language (Mellor, 1970).

Insight is lost, the ability to look at these symptoms objectively and put them down to an illness that requires help or treatment. (Amador & David, 1998).

As psychiatrists we learn from our patients, so perhaps the best way to exemplify psychosis is from the descriptions people give us when in that state.

Here I pay tribute to the artist Bryan Charnley who had the courage to paint a series of self-portraits as he descended into psychosis. The paintings by Bryan Charnley provide poignant examples of links between what the artist refers to, and these clinical descriptions (Bryan Charnley, <https://www.bryancharnley.info>).

He tells us that he is more acutely aware of voices and experiences auditory verbal hallucinations. Kurt Schneider described these as first rank symptoms: hearing voices referring to the person in the third person, making a running commentary on their actions, or hearing their own thoughts (Schneider K (1939); Cutting, J. (2015)).

The state of paranoia is experienced as though the *world* refers to the person with special (*personal*) significance (so called 'saliency'), in a way that is *often persecutory* in nature, and this is frequently accompanied by *extreme anxiety*.

Other first rank symptoms include: 'delusional perception', where a *normal perception* becomes linked with a *delusional interpretation* (e.g., a red traffic light is interpreted as meaning that the person is being followed). And there are abnormalities of thought possession, as in:

*'Thought insertion': where, for example, "other people's thoughts are beamed into my head";*  
*'Thought withdrawal': where for example, "my thoughts are taken out of my head" and 'Thought broadcast': where for example, "my personal thoughts are broadcast out loud like on a radio".*

Finally, Kurt Schneider describes **Special types of delusion** where the person is no longer in control of 'self' experienced as:

Made feelings: e.g., *"my feelings are made by others"*

Made impulses: e.g. *"if I do something it is not my will to do it"*

Made actions: e.g., *"my actions are controlled directly by someone else"*

Having given examples of clinical psychosis, let us now consider how common similar psychotic symptoms are in the general population.

# Epidemiology: The Prevalence of Psychotic Phenomena in the General Population

An extensive meta-analysis of 47 from 2442 screened papers reported the prevalence of psychotic phenomena in healthy populations. Here, we see that these phenomena are actually relatively common, more so as one moves criteria from strict psychosis (3%) to psychotic experiences (85) (van Os et al., 2008). World-wide health surveys report psychotic experiences in up to a third of non-clinical samples (Nuevo et al., 2012).

And in our epidemiological studies we reported a life-time population prevalence of psychotic experiences of 27.9% in Qatar (Khaled et al., 2020).

Studies of non-health seeking populations (e.g., students) report that a significant proportion experience hallucinations and hold unshakable beliefs that some could judge as delusional. For instance, in a sample of 1777 students, nearly 20% reported thought withdrawal at least sometimes, nearly 20% had made actions, and 25% experienced auditory verbal hallucinations (Armando et al., 2010). Each of these phenomena qualify as First Rank symptoms of schizophrenia - that means that psychiatrists regard them as significant to make a diagnosis of this condition. When people who have reported psychotic experiences are followed up over 3 years, the risk of developing the disorder is estimated to be by a factor of 25 (Bak et al., 2003).

So, psychotic symptoms occur in the general population, and *everyone has the potential to become psychotic*. Factors that determine what tips people over the edge is a combination of genes and environment. At a group level, one can consider population A and population B. Population B has a genetic predisposition, and many stressful life events that push a greater proportion of them past the psychosis threshold (van Os et al., 2008).

Thus, in summary, according to these studies up to a third of healthy people have symptoms that psychiatrists regard as indicative of a psychotic illness. It does not mean that these individuals have the illness as such, as they appear not to be so affected by them to seek professional help - however, it does indicate that a high proportion of people have a tendency to exhibit psychotic symptoms. And these symptoms are not necessarily benign - often associated with significant distress.

So, when are healthy people most susceptible to these phenomena, and why?

## Naturally Occurring 'Psychotic Phenomena'

### 1. Hypnagogic and Hypnopompic Hallucinations

Many people have transient hallucinations on falling asleep and on waking - so called hypnagogic and hypnopompic hallucinations. Hallucinations that as we have seen may be shared with those in a clinical psychotic state. These experiences in otherwise healthy people may not be as vivid as in those with a clinical condition, but they are commonly experienced.

Studies report prevalence rates of hypnagogic and hypnopompic hallucinations in up to a third of the healthy population (Ohayon et al., 2000), and life-time prevalence up to two thirds (Khaled et al., 2000; Khaled et al 2022).

These can be auditory, visual, somatosensory (felt or sensed on the body) or in any sensory modality. And to further exemplify their commonality we have many examples from literature and art through the centuries, exemplified by 'the Incubus', 'Witch pressing' and the 'Maere' or 'Hagge'. The Incubus and Maere can be seen in the painting of the 'Nightmare' by Henry Fuselli. Goya alludes to psychotic content in his painting 'the sleep of reason produces monsters'. Edvard Munch describes how a normal scene in full wakefulness provokes an unbearable scream, and Salvador Dali paints a dramatic scene full of psychotic symbolism in that transient moment between sleep and waking up.

These hallucinations occur while the higher cognitive control of the brain is 'asleep' but on waking becomes aware of current experience and before the brain starts processing external sensory input. Hence, this

transient window of semi-wakefulness is when we *aware, in conscious awareness*, of the messages sent from the default brain.

Not only during transient periods of falling asleep or waking, but hallucinations also occur in full wakefulness, e.g. seeing ghosts or apparitions, mentioned later.

## 2. Sensory Deprivation and Hallucinations

Perhaps the condition that provides the most natural environment within which to observe the 'default brain' is one of *complete sensory deprivation*. Without any external input, the brain relies completely upon its own self-generated activity for any thinking or experience. So, what happens under these circumstances?

It is of course, extremely difficult to create such an environment, divest of all sensory input, except in carefully controlled experimental conditions, conditions that, when prolonged, are extremely unpleasant.

In the 1950s and 1960s a number of experimental studies were performed to investigate the mental state changes consequent upon such deprivation. The Canadian psychologist, Donald Hebb, invited participants to spend time in a sound-proofed environment, surrounded by pillows to minimise sound, wearing translucent visors, and cotton gloves and cardboard cuffs to prevent sensory stimulation. Within minutes many became anxious and disturbed - and experienced disturbing hallucinations (Heron, 1957).

These were described as points of light, evolving into formed shapes and forms such as squirrels marching with sacks over their heads, dogs, babies, or eyeglasses processing down the street.

Sounds included music and felt sensations of being shot in the arm and electric shocks. Importantly for providing evidence of the default mental state is their statements that they "had little control over these experiences".

Hebb wrote that the results were "very unsettling to us... to find, in your own laboratory, that merely taking away the usual sights, sounds, and bodily contacts from a healthy university student for a few days can shake him, *right down to the base*." (Heron, 1957; Brown & Milner, 2003).

Was he referring to what we could now consider the '*default mental state*'?

More recent experimental evidence of the psychotogenic effects of sensory deprivation comes from a recent study by Daniel and Mason (2015). They selected 24 high hallucination-prone versus 22 low hallucination prone people from 562 participants and measured hallucinations before and after 25 minutes in complete auditory and visual sensory deprivation in an anechoic chamber. Even after this short period of sensory deprivation, psychotic experiences increased, especially in those who were prone to hallucinations.

We also learn from these early experiments that participants developed attentional techniques to control the hallucinations, and that in addition to hallucinations, they *lost touch with reality* - an area I will return to.

And we have examples from the real world. For the reason that sensory deprivation is so unpleasant that it has been used as a means of torture, used for centuries before, during the time of Thomas Gresham, and to the present day.

We have, for instance, first-hand accounts from prisoners kept in solitary confinement about the terrors they experienced at the hands of their own brain's unfettered activity- unconstrained by external stimulation which we all need to keep ourselves sane.

Accounts from those subjected to solitary isolation include that from: Sarah Shourd, was accused of spying and kept in solitary confinement for over a year. She described how her "mind began to slip" after about two months, she heard phantom footsteps and flashing lights, and spent most of her day crouched on all fours, listening through a gap in the door. "In the periphery of my vision, I began to see flashing lights, only to jerk my head around to find that nothing was there" (Shourd, S. *New York Times*, 2011). And we do not have to look hard for other real-life examples of the adverse effect of sensory deprivation on our mental state: e.g. the trapped Chilean miners in 2010, some of whom developed hallucinations, and the effects of isolation during the Covid pandemic.

### 3. Examples of How the Brain 'Gets It Wrong' - Illusions

So, in order to explain these phenomena, perhaps we need to look at examples of how we perceive - or mis-perceive the world around us under normal conditions. Here, I give the example of illusions where the brain 'generates a reality', making inferences about the external world that differs from objective reality.

These illusions can be quite robust and instantiated in the brain. For instance, the Hering Illusion, and the Ebbinghaus Illusion. And the extent to which we may experience the Ebbinghaus illusion may relate to our underlying brain matter (Schwarzkopf S. et al., 2011).

The McGurk Illusion exemplifies how consistently our brain 'get it wrong' even in full non-psychotic consciousness ([https:// Auditory Neuroscience.com](https://AuditoryNeuroscience.com)).

Our brains that provide the substrate for all our mental life also provide a bias which we may be unaware of. Here, in my Sheffield research laboratory we showed using neuroimaging how we give priority to the female over the male voice (Sokhi et al., 2010; Weston et al., 2015). And to demonstrate that we hear what we expect to hear, we performed an experiment of imaging people while listening to identical sound under two visual conditions: on seeing a tranquil beach scene, and a non-tranquil motorway scene. People heard the beach as softer than the motorway, and the hearing systems of the brain were more connected to areas considered to be those related to meditation or tranquility - despite the auditory input being identical in both conditions (Hunter et al., 2010).

So, even when fully conscious in a normal environment, our brains can mislead us by giving us perceptions that differ from external reality.

## How Might Psychotic Phenomena Arise?

### Neuroscience – Sensory Input, Cognitive Inhibition

In order to understand how psychotic phenomena arise, we return to the example of auditory hallucinations, where we are told by people who experience them that they are *heard* like we hear external voices. And neuroimaging studies show us that when people hear auditory hallucinations, these activate the parts of the brain that normally process external speech (Woodruff et al., 1995; Shergill et al., 2000).

In the first functional magnetic imaging study of its kind, we reported that hearing hallucinations activated the same part of the brain that perceives voices from outside the head - within the auditory cortex (Woodruff et al., 1995). We also scanned a group of patients actively hallucinating voices and examined the brain's response to *externally presented* speech, and the same group after recovery. We found that when people are actively hallucinating voices, the brain's response to *external speech* was actually *less* than when they had no hallucinations. This phenomenon we explained as the '*saturation hypothesis*' where 'auditory hallucinations compete with external speech for common neurophysiological resources'.

So, when people are actively hallucinating voices, the presentation of external speech actually *lessens* the brains response to the hallucinations and is consistent with coping strategies patients adopt to alleviate their hallucinations (Nayani & David, 1996). The saturation hypothesis can therefore be regarded as a feedback mechanism whereby external speech and the brain signal responsible for auditory hallucinations compete with each other for brain processing capacity, illustrated by Figure 1 adapted from Woodruff (2004).

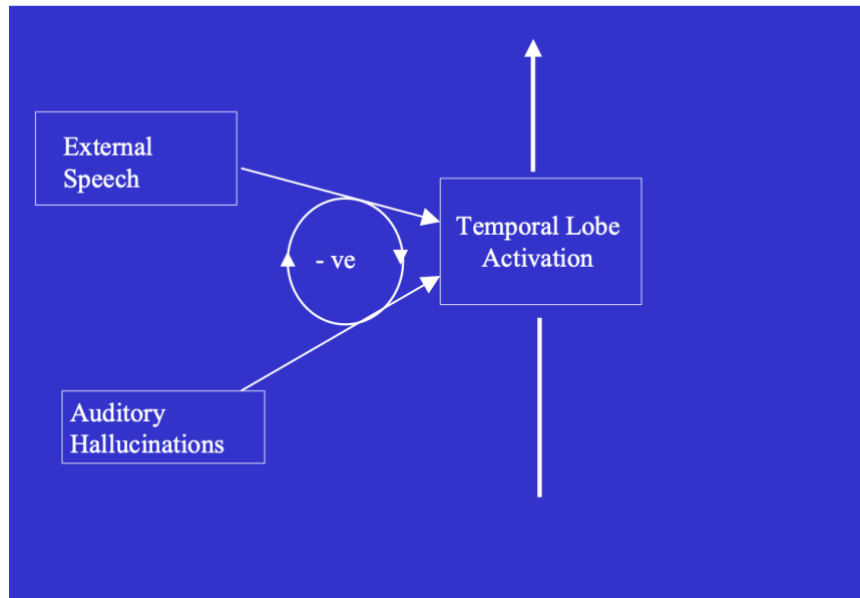


Figure 1.

The model presupposes that the hearing apparatus in the brain *generates intrinsic signal*, which we also demonstrated using functional MRI (Hunter et al., 2006). These observations support the notion that the brain generates its own signal responsible for hallucinations, and that signal is inhibited by external sensory input.

So perhaps external sensory input is needed to inhibit the natural tendency for hallucinations, as was seen in those whose external sensory input was deprived.

But we are not *passive recipients* of signals from the environment - we *attend* to features of interest to us. A common example is the cocktail party effect whereby we can hone in on conversations of interest. And *attention actually enhances brain activity* in the relevant sensory processing region. I illustrate this in two neuroimaging studies, one showing how attending to one visual scene enhances brain activity in visual cortex (Heinz et al., 1994), and another how when presented with *identical* auditory and visual input, how selective attention to one modality enhances brain activity in the respective sensory cortex (Woodruff et al., 1996). These observations fit with the clinical descriptions from patients who find that they can alter their hallucinations by concentrating on them (Nayani & David, 1996)

We can further develop the hallucination model Figure 2 (adapted from Woodruff, 2006).

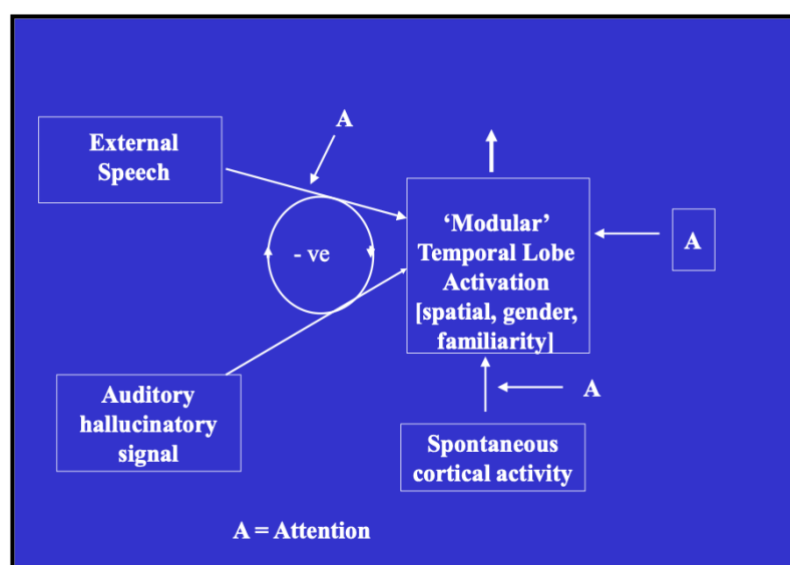


Figure 2.

The hallucinations result from activity in the hearing cortex - the temporal lobe of the brain - and spontaneous brain activity drives the hallucination signal, whilst inhibited by external speech. Attention shown as 'A' sets the threshold at which this system is activated and leads to the overall auditory perception.

And this attentional enhancement was also seen in healthy participants, who developed hallucinations due to sensory deprivation where their hallucinations increased when they attended to them (Leiderman et al., 1958; Zubek et al., 1961; Knobel & Sanchez, 2009).

As the largely inhibitory cerebral cortex comprises 80% of brain grey matter, these ideas are summarised by Kenneth Hugdahl's (2009) paper entitled: "auditory hallucinations as failure of top-down (*inhibitory*) control of bottom-up perceptual processes", processes I propose come from the default mental brain.

Does neuroscience tell us something about how the brain controls our decisions? Patients with psychosis tell us they can feel controlled by an outside agency- the so-called passivity phenomena. So, this leads to the question: Are we free to make decisions?

I give one example from brain imaging that follows the idea of Benjamin Libet that our brains make decisions for us *before* we are aware of making them. In a functional neuroimaging study, the task was to move the right or left index finger, and indicate the moment of decision. We can see significant brain activity in the brain 4-5 seconds *before* the person is aware of having made the decision. This contrasts with activity in the motor cortex that occurs *after* the decision (Soon et al., 2008).

Whatever the 'default brain' is doing, it is doing it before we are aware of making our own decisions. So, are we under our brain's control without being aware of it? Does the unconscious default brain 'prime' our decision making?

We don't need to look at science, but T.S. Elliot hinted at this gap between cognitive awareness and behaviour in his poem 'The Hollow Men':

Here the poet talks about the shadow between intention and action, the gap where the default brain could intervene.

"Between the idea  
 And the reality  
 Between the motion  
 And the act  
***Falls the Shadow***

Between the conception  
 And the creation  
 Between the emotion  
 And the response  
***Falls the Shadow"***

So far then, I have proposed:

Psychotic experiences are common.

We all have the capacity for psychosis.

While asleep or during sensory deprivation, unimpeded by our higher cortical inhibitions, our experiences share features with psychosis (hallucinations).



And what we perceive depends on what our brain's expect (e.g., illusions) or give attention to (e.g. hearing female voices or tranquil scenes);

The default brain may prime our decisions.

So, what about the other characteristic of psychosis - delusions?

## The Capacity to Have Strange Beliefs

*“The human understanding is not composed of dry light,  
but is subject to influence from the will and emotions,  
a fact that creates fanciful knowledge;  
**man prefers to believe what he wants to be true”.***

Francis Bacon: 'Idols of the mind '1620

We have countless 'strange beliefs' and to harbour beliefs without objective evidence could even be said to be an intrinsic part of our makeup. For instance, some still ask the question: "is the Earth flat?".

## Ghosts

Studies indicate that many people have seen ghosts and also *believe* in their existence in the outside world. According to several YouGov polls, 30% of the British (YouGov poll, 2014) and, in a sample of 1293 American adults, 40% of the North American public believe in ghosts (YouGov PLC., 2022).

Seeing ghosts is not universal, but common, and occurs usually under certain conditions. If one imagines spending a dark blustery night in an old creaky house alone, it is easy to understand how odd sounds of creaking beams, or flickering lights can be mis-interpreted as a presence, particularly if there is a history of such phenomena. Sometimes such visual or auditory perceptions can be misinterpretations of actual objects or hallucinations in the absence of such a stimulus. We may be susceptible to these experiences when anxious and in high arousal, as our autonomic nervous system can prime us to be hyper-vigilant and so more easily mis-interpret events in our environment.

It is easy to conclude that these reactions may have had evolutionary advantage to alert us to predatory threats, and indeed may alert us today to a potential attack, but in the absence of such an external threat, can prime our brains to over-react and perhaps generate a threat that doesn't exist in external space.

Which all leads to the big question: What is Reality? Even hard-science physicists question how we think. In quantum mechanics we change the nature of matter by the very fact of observing it, all of which leads to the question: "is there an objective reality at all?"

## Vigilance and Paranoia

If the brain creates its own reality, then is there an evolutionary advantage to thinking in certain ways? I take the example of vigilance as a possible precursor of paranoia.

Over 1.5 million years of evolution, *homo sapiens* has needed to be vigilant to survive predators. Now it is essential to avoid being mugged or run over by a car. We have unconscious (autonomic) alerting systems ('fight and flight') to direct attention, but limited cognitive attentional resources. So as social animals we can share these - so others alert us to danger while we can perform other tasks.

I will give one example of the advantage of how we cooperate to conserve vigilance. Gomes and Semin (2020) studied people during a task requiring attention to a central target while also remaining vigilant to a

peripheral 'threat'. Results showed that in the presence of another person, vigilance to the external threat was less, and attention to the central task, more.

Hence, when alone, we are more vigilant, and when with other (cooperative) people we are less vigilant, so we can concentrate on other tasks. We have evolved to focus our attentional resources to share out vigilance and maximise our group safety from predators.

So, perhaps the cost of vigilance is the potential to be paranoid.

## Implications for Understanding Health and the Human Condition in Society

Psychotic experiences are common.

They may be associated with risk for psychosis.

It is important to identify and detect psychotic experiences early as these may indicate risk factors that need assessment and treatment.

Loneliness and isolation are now considered a major mental and public health issue.

A better understanding of the balance of vulnerability versus resilience to psychosis could help re-orientate how we prioritise clinical care to those who need it most.

## Conclusion

Thinking is assumed as rational, and *awareness* that we think (insight) as evidence of sanity.

We are *subjective* human beings.

We all perceive things differently BUT fundamental to our makeup is the *capacity to believe in things beyond reason*.

In psychosis, the mind loses the natural assumptions we may make about the world we experience, and hence may experience a 'different' world. The mind is beset with hallucinations and delusions. We refer to people with psychosis being 'out of touch with reality'.

But in the absence of external sensory input, *the default brain* approximates to clinical psychosis - psychosis that needs external sensory input and cognition to *actively inhibit* its natural expression.

Perhaps we should realise we are *all* in a delicate dynamic equilibrium that keeps us in a balance between psychosis and rationality, and that as we understand more about perception, cognition and human behaviour, we should consider that *rational thought is fragile* and be aware that the motivation for our thinking, by default, is irrational.

We may not be aware of it, but our default mental state affects our whole experience of the world.

Hence our propensity to believe weird things, or things that do not seem weird, but which have no basis in rational thought, but which are held with absolute conviction without objective evidence.

Sometimes it is apparent that our brains make incorrect assumptions (illusions) but we seem unaware of our default mental state; except perhaps on waking or falling asleep, or in the unusual situation of complete sensory deprivation.

Even in science, we try to make sense of the world *through the refraction of our thoughts and senses* ..... that often conflict with each other .... And may not make sense ...

Hence:

Examples of psychotic thinking are commonplace in everyday life.

That we do not think completely rationally.

We are basically psychotic by default.

But that tendency to psychosis is *inhibited* to a greater or lesser degree.

Hence, it is of societal relevance: to register how thin the boundary is between sanity and madness; to understand factors that lead from one to the other, and to appreciate the frailty of rational thought.

And perhaps then, rather than ask "why *do* people develop psychosis?", we should ask ourselves "why *don't* we all develop psychosis?"

© Professor Woodruff 2021

## References and Further Reading

Armando M, Nelson B, Yung AR, et al. Psychotic-like experiences and correlation with distress and depressive symptoms in a community sample of adolescents and young adults. *Schizophrenia Research*, 2010;119 (1-3):258-265. doi:10.1016/j.schres.2010.03.001

Bak M, Myin-Germeys I, Hanssen M, et al. When Does Experience of Psychosis Result in a Need for Care? A Prospective General Population Study. *Schizophrenia Bulletin*, 2003;29(2):349-358. doi:10.1093/oxfordjournals.schbul.a007010

Brown RE & Milner PM (2003) The legacy of Donald O. Hebb: more than the Hebb Synapse. *Nature Reviews: Neuroscience*, 4, Dec 2003, 1013-1019.

Cutting J. (2015) 'First rank symptoms of schizophrenia: their nature and origin', *History of psychiatry*, 26(2), pp. 131–146. doi: 10.1177/0957154X14554369.

Daniel C & Mason OJ (2015). "Predicting Psychotic-Like Experiences during Sensory Deprivation", *BioMed Research International*, vol. 2015, Article ID 439379,10 pages, 2015.

<https://doi.org/10.1155/2015/439379>

Eliot TS. *The Hollow Men*. In: T.S.Eliot, *Collected Poems 1909-1962*. pages 89-92. Faber and Faber 1963. ISBN 0 571 10548 3.

Gomes N & Semin GR (2020) Mapping human vigilance: the Influence of Conspecifics. *Evolution and Human Behavior* 41,1, 69-75

Heinze H J, Mangun GR, Burchert W, Hinrichs H, Scholz M, Münte TF, Gös A, Scherg M, Johannes S, Hundeshagen H, Gazzaniga MS, Hillyard SA (1994) Combined spatial and temporal imaging of brain activity during visual selective attention in humans. *Nature*, 372, 543-546.

Heron W (1957) The pathology of boredom. *Scientific American*. 196, 52–56.

Hugdahl K (2009) "Hearing voices": Auditory hallucinations as failure of top-down control of bottom-up perceptual processes. *Scandinavian Journal of Psychology*. 50, 6, 553-560. <https://doi.org/10.1111/j.1467-9450.2009.00775>

Hunter MD, Eickhoff S, Miller T, Farrow TFD, Wilkinson ID, Woodruff PWR (2006). Neural activity in speech-sensitive auditory cortex during silence. *Proceedings of the National Academy of Sciences of the United States of America*. 103 (1): 189-194.

Hunter MD, Eickhoff SB, Pheasant RJ, Douglas MJ, Watts GR, Farrow TFD, Hyland D, Kang J, Wilkinson ID, Horoshenkov K, Woodruff PWR (2010) The state of tranquility: Subjective perception is shaped by contextual modulation of auditory connectivity. *NeuroImage* 53 (2) , 611-618.

Knobel KAB & Sanchez TG (2009): Selective auditory attention and silence elicit auditory hallucination in a nonclinical sample, *Cognitive Neuropsychiatry*, 14:1, 1-10

- Kendler KS, Gallagher TJ, Abelson JM and Kessler RC (1996) Lifetime prevalence, demographic risk factors, and diagnostic validity of nonaffective psychosis as assessed in a US community sample. *Archives of General Psychiatry* 53, 1022–1031.
- Khaled SM, Wilkins SS, Woodruff PWR. Lifetime prevalence and potential determinants of psychotic experiences in the general population of Qatar. *Psychological Medicine*, 2020;50(7):1110-1120. doi:10.1017/S0033291719000977
- McGrath JJ, Saha S, Al-Hamzawi A, Alonso J, Bromet EJ, Bruffaerts R, Caldas-De-Almeida JM, Chiu WT, Jonge PD, Fayyad J, Florescu S, Gureje O, Haro JM, Hu C, Kovess-Masfety V, Lepine JP, Lim CCW, Mora MEM, Navarro-Mateu F, Ochoa S, Sampson N, Scott K, Viana MC and Kessler RC (2015) Psychotic experiences in the general population. *JAMA Psychiatry* 72, 697.
- Leiderman H, Mendelson JH, Wexler D, Solomon P. Sensory Deprivation: Clinical Aspects. *AMA Arch Intern Med*. 1958;101(2):389–396. doi:10.1001/archinte.1958.00260140221032
- Mellor C (1970). First Rank Symptoms of Schizophrenia: I. the Frequency in Schizophrenics on Admission to Hospital II. Differences between Individual First Rank Symptoms. *British Journal of Psychiatry*, 117(536), 15-23. doi:10.1192/S0007125000192116
- Nayani TH & David AS (1996). The auditory hallucination: a phenomenological survey. *Psychological Medicine* 1996; 26: 177-89.
- Nuevo R, Chatterji S, Verdes E, Naidoo N, Arango C, Ayuso-Mateos JL. (2012) The Continuum of Psychotic Symptoms in the General Population: A Cross-national Study. *Schizophrenia Bulletin*, 38(3):475-485. doi:10.1093/schbul/sbq099
- Ohayon MM (2000) Prevalence of hallucinations and their pathological associations in the general population. *Psychiatry Research* 97:153- 164.
- Saha S, Scott JG, Johnston AK, Slade TN, Varghese D, Carter GL, McGrath JJ (2011) The association between delusional-like experiences and suicidal thoughts and behaviour. *Schizophrenia Research*, Volume 132, Issues 2–3, 197-202, ISSN 0920-9964, <https://doi.org/10.1016/j.schres.2011.07.0>
- Schneider K (1939) *Psychischer Befund und psychiatrische Diagnose*. Leipzig: Georg Thieme.
- Schwarzkopf DS, Song C, & Rees G (2011) The surface area of human V1 predicts the subjective experience of object size. *Nature Neuroscience*. 14,1: 28-30.
- Shergill SS, Brammer MJ, Williams SCR, Murray RM, McGuire PK. Mapping Auditory Hallucinations in Schizophrenia Using Functional Magnetic Resonance Imaging (2000). *Archives of General Psychiatry*. 2000;57(11):1033–1038. doi:10.1001/archpsyc.57.11.1033
- Shourd S. Tortured by solitude. *New York Times* Nov. 5<sup>th</sup> 2011.
- Sokhi DS, Hunter MD, Wilkinson ID, Woodruff PWR (2005). Male and female voices activate distinct regions in the male brain. *NeuroImage*. 2005 Sep;27(3):572-8.
- Soon CS, Brass M, Heinze HJ, & Haynes JD (2008). Unconscious determinants of free decisions in the human brain. *Nature Neuroscience*, 11(5), 543-545.
- Van Os J, Linscott R, Myin-Germeys I, Delespaul P, & Krabbendam L (2009). A systematic review and meta-analysis of the psychosis continuum: Evidence for a psychosis proneness–persistence–impairment model of psychotic disorder. *Psychological Medicine*, 39(2), 179-195. doi:10.1017/S0033291708003814
- Weston PS, Hunter MD, Sokhi DS, Wilkinson ID, Woodruff PWR. (2015) Discrimination of voice gender in the human auditory cortex. *NeuroImage*. 2015 Jan 15;105:208-14. PMID 25449748 DOI: 10.1016/j.neuroimage.2014.10.056
- Woodruff PWR, Brammer M, Mellers J, Wright I, Bullmore E, Williams S. (1995) Auditory hallucinations and perception of external speech. *Lancet*. 1995 Oct 14;346(8981):1035.

Woodruff PWR, Benson RR, Bandettini PA, Kwong KK, Howard RJ, Talavage T, Belliveau J, Rosen BR (1996). Modulation of auditory and visual cortex by selective attention is modality-dependent. *NeuroReport*. 1996 Aug 12;7(12):1909-13.

Woodruff PWR, Wright IC, Bullmore ET, Brammer M, Howard RJ, Williams SC, Shapleske J, Rossell S, David AS, McGuire PK, Murray RM. (1997) Auditory hallucinations and the temporal cortical response to speech in schizophrenia: a functional magnetic resonance imaging study. *American Journal of Psychiatry*. 1997 Dec; 154(12):1676-82

Woodruff PWR. (2004) Auditory hallucinations: Insights and questions from neuroimaging. *Cognitive Neuropsychiatry*. 2004 Feb-May; 9(1-2):73-91.

Zubek JP, Pushkar D, Sansom W, & Gowing J (1961). Perceptual changes after prolonged sensory isolation (darkness and silence). *Canadian Journal of Psychology/Revue Canadienne de Psychologie*, 15(2), 83–100. <https://doi.org/10.1037/h0083205>

## Books and Further Reading

Allen P, Larøi F, McGuire PK, Aleman A. (2008) The hallucinating brain: A review of structural and functional neuroimaging studies of hallucinations. *Neuroscience & Biobehavioral Reviews*, Volume 32, Issue 1, Pages 175-191. ISSN 0149-7634, <https://doi.org/10.1016/j.neubiorev.2007.07.012>.

Amador XF & David AS (Eds). (1998) *Insight and psychosis*. Oxford University Press, 1998.

Bacon, Francis: In *The New Organon*, eds Lisa Jardine and Michael Silverthorne, Cambridge University Press, 2000, XLIX, p 44.

Bentall, Richard, P. *Madness Explained- Psychosis and Human Nature*. Penguin Books 2003.

Blackburn, Simon. *Truth: A guide for the perplexed*. Penguin Books 2005.

Cuonzo, M. (2022) The power of paradoxes. *New Scientist* 8 Jan 2022 pp 44-48.

Descartes, Rene. [Discourse on the Method](#) (1637) and [Principles of Philosophy](#) (1644). Available in: 'Discourse on Method and the Meditations' ISBN: 0140442065 EAN: 9780140442069 Penguin Books Limited Published: 01/01/1984.

Hancock PA. (2017) On the Nature of Vigilance. *Hum Factors*. 2017 Feb;59(1):35-43. doi: 10.1177/0018720816655240. PMID: 28146675.

Kahneman, Daniel. *Thinking fast and slow*. Penguin Books 2011.

McKenna, Peter (2017) *Delusions Understanding the un-understandable*. Cambridge University Press, 2017.

Myin-Germeys I, van Os J, Schwartz JE, Stone AA, Delespaul PA. Emotional reactivity to daily life stress in psychosis. *Archives of General Psychiatry*. 2001;58(12):1137-1144. doi:10.1001/archpsyc.58.12.1137

Oyebode, Femi. (2016). *Sims' Symptoms in the mind*. Textbook of descriptive psychopathology. Fifth Edition. Saunders Elsevier, 2016.

Peters E, Ward T, Jackson M, Woodruff P, Morgan C, McGuire P, Garety P. (2017) Clinical relevance of appraisals of persistent psychotic experiences in people with and without a need for care: an experimental study. *Lancet Psychiatry*. 4(12): 927-36

Peters E, Ward T, Jackson M, Morgan C, Caralambides M, McGuire P, Woodruff P, Jacobsen P, Chadwick P, Garety PA. (2016) Clinical, socio-demographic and psychological characteristics in individuals with persistent psychotic experiences with and without a “need for care”. *World Psychiatry*. 15(1):41-52. doi: 10.1002/wps.20301.

Poulton R, Caspi A, Moffitt TE, Cannon M, Murray R, Harrington H. Children’s Self-Reported Psychotic Symptoms and Adult Schizophreniform Disorder: A 15-Year Longitudinal Study. *Archives of General Psychiatry*. 2000;57(11):1053. doi:10.1001/archpsyc.57.11.1053

Shermer, Michael. (2002) Why people believe weird things. Henry Holt and Company LLC, New York.

Vellante M, Larøi F, Cella M, Raballo A, Petretto DR & Preti A. (2012). Hallucination-Like Experiences in the Nonclinical Population. The Journal of Nervous and Mental Disease, 200 (4), 310-315. doi: 10.1097/NMD.0b013e31824cb2ba.

## Websites

Bryan Charnley: <https://www.bryancharnley.info>

How extreme isolation warps the mind: <https://www.bbc.com/future/article/20140514-how-extreme-isolation-warps-minds>.

The Flat Earth Society: <https://www.tfes.org>

The McGurk Illusion: <https://AuditoryNeuroscience.com>

YouGov poll for the Sun October 31, 2014. <https://yougov.co.uk/topics/politics/articles-reports/2014/10/31/ghosts-exist-say-1-3-brits>

YouGov 2022. Paranormal beliefs ghosts demons poll. <https://today.yougov.com/topics/lifestyle/articles-reports/2019/10/21/paranormal-beliefs-ghosts-demons-poll>. Copyright © 2022 YouGov PLC.