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ESSAY

Towards a Natural History of Psi: An Evolutionary Proposal Based on Consilience of Inductions

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ABSTRACT

For almost a century since its establishment as a scientific discipline, the field of Parapsychology has been very fruitful in terms of positive experimental outcomes that suggest the existence of psi. However, it has not been possible to integrate this body of results into an appropriate biological framework rooted in evolutionary biology. Some interesting attempts have been proposed throughout the last few decades, but almost all draw their interpretations from an anthropocentric perspective. Here, by means of an approach known as consilience of inductions, I try to overcome this problem by analyzing complementary evidence from different disciplines that point toward a common conclusion: that psi might be an ancestral capability widely distributed in many non-human organisms. Such pieces of evidence are the following: 1) That psi is not paranormal but natural and normal, as indicated by the historical record and by recent surveys applied to people around the world; 2) The reports that suggest the presence of psi in domestic and non-domestic animals, including the positive results of a large number of animal psi experiments; 3) Common brain structures to all vertebrates, which take part in certain functions and processes that have been associated with psi; 4) The apparent role of the outer layers of the brain—which are recent evolutionary innovations mainly developed in primates—in the inhibition of psi function; and 5) The evolutionary advantages that psi might confer in many human and non-human organisms, mainly those related to survival. Altogether, these pieces of evidence point towards a scenario in which psi emerged long ago, perhaps before the divergence of vertebrates, and in which it might have been preserved by biological evolution given the obvious advantages that could represent for organisms, even if it operates in an unconscious way. Furthermore, many experimental results in the field of parapsychology suggest that one specific kind of natural selection, known as stabilizing selection, might be operating behind the evolution of psi or, more specifically, its biological bases. Finally, I point out that, if we want to unravel the neurobiological bases of psi function, it is crucial to start focusing on brain regions or structures widely distributed in vertebrates and, from here, it would be possible to try to identify the genetic bases of this extraordinary function, which in turn would allow us to elucidate its evolutionary history.

KEYWORDS

Psi function, evolution, consilience of inductions, biological basis of psi.

INTRODUCTION

Since its establishment as a scientific discipline, Parapsychology has been surrounded by multiple criticisms and controversies. Besides, it is not uncommon to hear that, over almost a hundred years, there has been no positive result within this academic discipline. These are the kinds of criticisms that usually come from people outside the field who either speak from ignorance or even from bad faith. However, when we look at the data, we observe a completely different situation. From the beginning, positive results have been obtained for thousands of different experiments, and different meta analyses point towards the same overall conclusion: although no consensus has been reached on its nature or its explanatory mechanism, psi (or psychic) phenomena are real and the probability that the observed effects are due to chance alone is extremely low (usually on the order of millions to one or even billions to one) (Cardeña, 2018; Mossbridge et al., 2012; Schmidt, 2012; Storm, 2006a, 2006b).

One of the limitations for parapsychological research is that it has not been able to incorporate its extraordinary advances within a theoretical framework that is anchored to biology, and even less so within the framework of evolutionary theory. Nevertheless, several efforts have been made to try to visualize psi as a product of biological evolution, particularly by analyzing its potential role in survival and adaptation. Broughton (2010) suggested that "anomalous intuition" —a kind of intuition related to extrasensory perception (ESP)—may come from adaptive mechanisms that enhance decision-making under unpredictable conditions by making use of unconscious emotional memories and episodic memory. This form of intuition is argued to have provided early humans with foresight, a very important trait to be able to cope with complex environments. Similarly, Taylor (2003) proposed his "Evolution's Need Serving Psi" model, a neo-Darwinian framework that places psi as a biologically advantageous—though imperfect—ability that operates in an unconscious way. He postulates that psi may have evolved to serve specific needs by selectively scanning for need-serving information relevant to survival, like potential threats or necessary resources. Further supporting this view, Broughton (2006) emphasized the role that the emotional system might have for facilitating receptive psi and proposed that evolution might have co-opted emotional processing pathways to integrate anomalous information in a way that mimics natural, unconscious responses to environmental stimuli.

Psi has also been tightly intertwined with the evolution of beliefs (particularly religious ones) and psychological traits, mainly those that could enhance social cohesion and individual psychological resilience. For example, McClenon (1997) argues that early shamanic rituals, which employed altered states of consciousness (ASC) and hypnotic suggestions and were central to the survival of early human groups, selected for hipnotizability-related traits, which heightened individuals' susceptibility to therapeutic and religious experiences. Kelley (2010) extends this view by suggesting that beliefs in God, spirits, and paranormal phenomena likely evolved to alleviate death anxiety—a threat for psychological well-being—and played a role in managing existential stress, thus fostering resilience. Kennedy (2004), on the other hand, suggests that, given that the manifestation of psi often occurs independently of self-interest, serving material needs may not be psi's main purpose, but rather fostering broader consciousness and enhancing a sense of connectedness and meaning. Complementing these views, Kelley (2011a) suggests that certain traits related to beliefs in paranormal phenomena, such as transliminality and positive schizotypy, which seem to be linked to creativity and mating success, may represent adaptive genetic polymorphisms which might have contributed to reproductive success. Together, these theories highlight how psi-related beliefs may have evolved to support psychological traits advantageous for survival and adaptation within a social and cultural context.

I consider these attempts to build a bridge between biology and parapsychology to be extremely valuable and by no means do I intend to underestimate their importance. But there is one issue present in many of them which, in my opinion, has contributed to evolutionary approaches not fully permeating parapsychology: a mostly anthropocentric view greatly based on countless human testimonies of spontaneous psi experiences and on the positive outcomes of experiments in which humans are the experimental subjects. By this I mean that, most of the time, it is assumed that psi is a trait that arose in *Homo sapiens* or in an immediate ancestor of ours. But, as we will see in the next sections, there is an enormous body of evidence with non-human animals which suggests that psi is not an exclusively human trait, but in fact may be much older than is often thought.

A THEORETICAL PROPOSAL BASED ON CONSILIENCE OF INDUCTIONS

Here I will try to build a coherent framework that considers psi as a product of biological evolution, even though we are still uncertain about its biological basis. My attempt

will be through a method known as consilience of inductions, originally proposed by the philosopher William Whewell (1847) and which refers to the convergence of pieces of evidence coming from different, independent sources, to support a theory or scientific explanation. In other words, if two or more sequences of inductive reasoning from apparently distinct classes of phenomena point towards the same conclusion, we can say that a consilience of inductions has taken place (Laudan, 1971).

One of the strengths of this approach is that it relies heavily on the use of different methodologies which can either come from the same field or from very different ones, making it some sort of safeguard against biases or methodological impediments that would be limiting if we were to consider evidence from a single field.

Consilience of inductions can be used in virtually every branch of knowledge, but it has proven to be extremely efficient in historical disciplines like cosmology or biology, especially when dealing with phenomena that occurred a long time ago and for which direct evidence is nearly impossible to obtain. This is precisely the kind of problem we are dealing with here, i.e., the possible emergence and evolution of psi capabilities. But before continuing, I find it necessary to illustrate the use of consilience of inductions and how it integrates different pieces of evidence in two of the most important scientific problems within the natural sciences: the Big Bang theory and the theory of evolution by natural selection.

The Big Bang theory, perhaps the most influential theory in the field of cosmology, explains the origin and evolution of the universe, proposing that it began almost 14 billion years ago from a massive explosion which caused the expansion of space itself and led to the formation of matter and all cosmic structures that we observe today. Though it is impossible to obtain direct evidence to confirm that it actually happened, evidence from multiple independent sources give a well-supported conclusion to this theory, including: the prediction about the amounts of light elements like hydrogen, helium, lithium, and others resulting from Big Bang nucleosynthesis, which aligns with observed cosmic abundances (Steigman, 2006); the shifting of light from distant galaxies toward the red end of the electromagnetic spectrum, which indicates that they are moving away from us and suggests that the universe is expanding (Bahcall, 2015); and the cosmic microwave background radiation, a kind of faint, uniform radiation considered to be a snapshot of the early universe (circa 400, 000 years after the Big Bang), when it cooled enough for atoms to form and light to travel freely (Gawiser & Silk, 2000), aligning with the proposal of a hot, dense beginning of the cosmos.

The theory of evolution by means of natural selection, proposed by Charles Darwin in his seminal book *On the Origin of Species* (1859), and which is the most successful theory of biological evolution, is also greatly supported by an approach in which multiple evidence from different fields converge into the two main points of it: that living beings share a common ancestry and that life has diversified through a gradual process of adaptation. In this case, the progressive change of related organisms observed in the fossil record, the presence of homologous structures across different species, the distribution of species across the planet, similar patterns in development of embryos from different species (Lloyd, 1983), and the fact that all known life (both extant and extinct) share the same DNA-based inheritance mechanism (Alberts et al., 2014), virtually the same genetic code, and multiple genes with conserved functions (Koonin & Wolf, 2010), show how traits are passed down and modified over countless generations, and constitute independent lines of evidence that cross-validate Darwin's theory of evolution.

I hope these two examples have captured the logic behind consilience of inductions. In the next sections I will take a similar approach and present several lines of evidence from different fields which, in my opinion, give some support to the idea that psi is a capability well rooted in biology. Though we still lack a consensus explanation on how psi might operate, which is not a minor issue and deserves detailed investigation, this is far beyond the scope of this paper.

LINES OF EVIDENCE POINTING TOWARD A BIOLOGICAL BASIS OF PSI

Psi Is Not Abnormal nor Paranormal, but Natural and Normal

Although the formal, academic study of psychic experiences began less than a century and a half ago with the founding of the British Society for Psychical Research (SPR) by late 19th century, descriptions of these kind of phenomena date back thousands of years. Several cave paintings from prehistoric times depict strange and fantastical scenes which are suggested to have been the result of hallucinations experienced during altered states of consciousness (Ustinova, 2011). For thousands of years, psychic experiences seem to have played a pivotal role

in the religious aspect of primitive societies. In his classic work on shamanism, Mircea Eliade (1964) pointed out that many of the wonders performed by shamans, both in ancient and present-day societies, occur under a modified state of consciousness in which one or more psychic experiences take place (e.g., divination or healing). In classical antiquity, the art of divination, which involved a mixture of phenomena like telepathy, clairvoyance, and precognition, represented a valid source of knowledge from which leaders and rulers often made important decisions (Dodds, 1946; Struck, 2016). Visual and/or auditory hallucinations have also played important roles in the shaping of more recent and organized religions such as Christianity (Lukoff, 2007), specifically the visions which are described by different prophets. More recently, at least since the end of the 17th century, stories of ghost and apparitions had become common among the British (Sangha, 2019), and the first academic journals dedicated to the serious study of psychic phenomena appeared decades before the founding of the SPR (Alvarado et al., 2006). Overall, this constitutes solid evidence that psychic phenomena are nothing new but have been experienced by people around the world over thousands of years.

Since the establishment of Parapsychology as an academic discipline in the early 30s of the twentieth century, there has been a lot of criticism from the skeptical and academic community. These critics have targeted different aspects of parapsychological research, from the researchers' integrity to flaws in experimental design and the analysis of data. But perhaps the more problematic of these arguments has to do with the very nature of psychic experiences. For decades, many researchers in mainstream academia have argued that this sort of experiences are nothing more than the product of suggestion, sensory hyperacuity, fraud, hallucinations, among others (Rawcliffe, 1959), or that they are just delusions resulting from the way some people interpret stimuli that cannot be discerned right away (Lange & Houran, 1998), and are often associated with deficiencies in emotional regulation, strong confirmation biases, and histrionic and catastrophizing reactions (Houran & Laythe, 2022). This way of thinking is illustrated in proposals like the "cognitive differences hypothesis" (Blackmore, 1992), which states that differences in psychic beliefs in different people, particularly skeptics and believers, might shape the way they process information about the world. However, when this hypothesis was tested, no differences were found in tasks related to working memory capacity, autobiographical memory distortion, and episodic memory distortion (Gray & Gallo, 2016), which are somehow related to belief in the paranormal. The only differences between skeptics and believers were found in those tasks that required analytical or logical thinking, in which skeptics showed higher results.

What belief in the paranormal does seem to be positively correlated to is having had subjective paranormal experiences (Glicksohn, 1990; Spinelli et al., 2002; Wahbeh et al., 2018). Glicksohn (1990) identified a positive correlation between the degree of absorption (i.e., the tendency to get deeply immersed in one's experiences), the experience of altered states of consciousness, and having had paranormal experiences. More recently, researchers looking for the incidence of exceptional human experiences (EHEs) found that a little bit more than 85% of respondents from the general population have had at least one EHE. They also compared the incidence of the general-population sample with one of scientists and engineers and found a strikingly similar result (Wahbeh et al., 2018). Besides, about 40% of them also reported having family members who also had EHEs. Positive correlations between paranormal belief and a positive outcome in psi experiments have also been found in some meta-analyses of forced choice, sheep-goat ESP studies (Storm & Tressoldi, 2017), although other researchers have not detected any correlation at all in experimental protocols (Hitchman et al., 2012).

Other proposals have tried to link belief in the paranormal with schizotypy, a spectrum of personality traits widely distributed in the general population that, at one extreme, can be associated with magical thinking, imaginative states, and creativity (commonly known as positive shizotypy), while at the other end is associated with severe symptoms like delusions, disorganized thinking, and social disfunction (negative schizotypy) which can indicate the possible presence of a severe mental disorder like schizophrenia (Kelley, 2011a). But although a close relationship between belief in the paranormal and schizotypy has been detected in different studies (Hergovich et al., 2008; Kelley, 2011b), it would be wrong to extrapolate this to reductionist arguments that flatly claim that people with mental disorders are more prone to resort to paranormal explanations to unusual experiences. In fact, it has been shown that people falling under the "happy schizothypy" category, characterized by the absence of psychopathology, show a higher psychological well-being, can easily incorporate belief in the paranormal and subjective anomalous experiences into their lives, and had better

mental health than people who lack schizotypal traits (Holt et al., 2008).

A relationship between schizotypy and psi performance has also been suggested, but in this case, it doesn't seem to be very clear, unlike what happens with the relationship between schizotypy and belief in the paranormal. In a study involving a group of positive schizotypes and another comprising negative ones, only non-significant differences were found between both groups in the Ganzfeld protocol and in a waking ESP condition (Simmonds-Moore & Holt, 2007), which suggests that psi performance may not depend on schizotypy at all.

The evidence presented so far suggests that having psychic (or paranormal) experiences is correlated to the degree of belief in the reality of such experiences, and that has nothing to do with being mentally unhealthy. This last idea, which is often held by skeptics denying the reality of psi phenomena, seems to be based more on prejudice than on actual evidence. In other words, we can safely discard the idea that only mentally ill people report this kind of experiences. And this acquires much greater support by looking at the evidence from surveys that have assessed the incidence of these experiences in different populations. In the U.S., for example, from a sample of about 1,000 people, more than half of them reported having had at least one psychic experience throughout their lives (Palmer, 1979). A similar percentage of psi experiencers have also been found for Icelandic and British samples (Haraldsson, 1985). Subsequent studies involving samples of people from different countries reveal that between 25 and 60% of the respondents have had at least one experience involving telepathy, clairvoyance or contact with the dead (Haraldsson & Houtkooper, 1991; Haraldsson, 2011). This high percentage of people reporting psi experiences was obtained by asking respondents if they have had *any* kind of those experiences. However, when analyzed individually by type of experience, there are some for which the percentage sharply falls, though others still retain high values of around 20-30%. And there even might be differences when dividing the sampling into different regions of the same country. This is exemplified by a study in Scotland which investigated the incidence in the population reporting the presence of "second sight", an ability typically related to tragic events, which features the occurrence of visions of events that are occurring at the moment (clairvoyance), shortly before they happen (precognition), or the feeling that someone very close has been killed or injured (telepathy). In one region of the country only 10% of people reported having this ability, while in the one with the highest incidence it was 33% (Cohn, 1994). Still, the fact that about a quarter of a given population reports having had psychic experiences is anything but rare or abnormal and helps us to refute the idea that psi experiences mostly happen to "sick" people. If this was the case, it would imply that from a quarter to more than half of a given population has some sort of mental illness involving hallucinations, cognitive or perceptive distortions, and delusions, which is totally far from reality. For example, the global prevalence of schizophrenia and schizotypal personality disorder, conditions that skeptics typically associate with a high incidence of psi experiences, are less than 1 and 5%, respectively (Charlson et al., 2018; Rosell et al., 2014).

The Distribution of Psi Across Different Species

For some people, the widespread distribution of psychic capabilities in humans around the world and throughout history could represent the best proof that psi is anything but paranormal or the product of a malfunctioning brain. However, this would be equivalent to taking a few frames from a long movie and believing that they represent the entirety of that movie. In other words, this would imply that the ability to obtain information by anomalous means and to affect matter directly with the mind is an exclusive trait of the *Homo sapiens*. Initially, this is a reasonable conclusion, but what about the many other species in which some levels of psi have been detected? Of course, some might argue that these results are somehow flawed, or that they are more likely to be the product of the researcher's own psi (experimenter effect), but the accumulated evidence is just too big to disdain it with explanations that have to do more with researchers' biases than with an objective examination of the data in an evolutionary framework.

The formal investigation of the possible psychic capabilities of animals could be traced back to the second quarter of the last century. In fact, J. B. and Louisa Rhine were among the first researchers who tried to evaluate this ability in companion animals in a controlled, objective way (Rhine & Rhine, 1929a, 1929b). The Rhine's also, some years later, encouraged other researchers not to be limited only to studies with humans but to include other organisms, which over time could help to shed light on questions regarding the brain structures that could mediate psi function, the advantages for different organisms, the evolutionary origins of psi, among others (Rhine & Feather, 1962). During the years leading up to this call, as well as in the decades following, different studies that tried to

evaluate the presence of psi in companion animals were carried out, some of which are summarized in Table 1. Besides, as happens with human psi experiences, a great number of pet owners have reported behaviors in their companion animals that suggest the involvement of psi (Sheldrake, 2011). However, as some critics have pointed out, the close emotional bond between humans and their companion animals could be hindering the objective evaluation of psi's presence in these organisms, leading to false positives attributed to the experimenter effect (Dutton & Williams, 2009), or there could even be an intertwining occurring between the person's own psi and that of the animal (White, 1976a, 1976b).

One way to try to overcome the problems mentioned above has been the development of experimental protocols in which the researcher has minimal or no emotional relation to the organisms under study. This has resulted in numerous published results in which researchers claim to have found some evidence of psi-related processes in a wide diversity of organisms other than the typical pets, such as annelids (Wildey, 2001), arthropods (Metta, 1972; Lépes, 1992; Schmidt, 1970), and even in unicellular organisms like the protist *Paramecium aurelia* (Johnson, 1982; Richmond, 1952). Even so, most of the experimental evidence of psi's presence in non-human organisms comes from animals with which people usually interact in one way or another, such as fish (Braud, 1976; Morris, 1967, 1977), birds (Alvarez, 2010, 2012; Green & Thorpe, 1993; Peoc'h, 1988), small mammals (Chauvin, 1968; Duval & Montredon, 1968a, 1968b; Schouten, 1972) and even reptiles (Watkins, 1971). This is summarized in Table 2. By looking at the experimental protocols, we find out that almost every known psychic ability (mainly telepathy, clairvoyance, precognition, and Micro-PK) has been

Table 1. Evidence of Psi in Non-Human, Companion Animals.

Animal Under Study	Psi Ability or Phenomenon Under Study	Brief Description	Statistically Significant Evidence?	Reference
Dog	Psi-trailing	A dog named "Bobbie" got lost in Indiana while their owners were there on vacation. After six months of returning without the dog to their hometown in Oregon, the dog suddenly showed up. He must have travelled about 3,000 miles from Indiana to Oregon	—	Alexander, 1926
Horse	Mind reading / Telepathy?	It was tested if a horse named Lady could answer to the thoughts or intentions involving mathematical problems. At first the horse had a good relationship with her owner, but in the final stages the owner was so stressed that his treatment of the horse had changed. This situation remained when, on year later, a second series of experiments were performed.	Yes** (First round of experiments) No (experiments performed one year later)	Rhine & Rhine, 1929a, 1929b
Dogs	Telepathy	This study explores the possibility that a couple of dogs could telepathically receive orders from their owner and other persons, and carry them out.	Yes**	Bechterev, 1949
Dog	Clairvoyance	The dog named Chris was trained to associate each of the five different Zenner cards with a number. He gave a number of paws equal to the number associated with each card. When someone asked about which number was associated with a face-down card, he pawed the correct one.	Yes**	Wood & Cadoret, 1958
Dogs	Detection of buried land mines	Empty land mines were buried in the sand, under a shallow beach. The dog indicated which specific section the mine was buried by sitting over it.	Yes	Rhine, 1971
Cockatiels	Anticipatory behavior	A group of six cockatiels who began to chirp loudly when their owner was beginning the journey back home. They chirped many more times at that specific moments than under any other situation, like when someone knocked the door and the phone rang. The animals were videotaped during all the days that the experiment lasted.	Yes	Sheldrake, 2011
African Grey parrot	Telepathy	An African Grey parrot named N'kisi was able to say words (from a repertoire of more than 700) related to what it's owner was thinking at that moment. During the experiments, the owner and the parrot were separated in different rooms and floors. A randomly-chosen picture was given to the owner and, at the same time, the parrot's vocalizations were recorded.	Yes	Sheldrake & Morgana, 2003
Dog	Anticipatory behavior	Jaytee, a terrier owned by Pam Smart, was tested because he could apparently tell the time his owner was leaving for home, or when she set the intention to do so. Different experiments were carried out, including some in which the place the owner would visit on a specific day, as well as the time in which she was supposed to leave back home, were randomly chosen. The dog was videotaped continuously during the experiments.	Yes	Sheldrake & Smart, 1998, 2000a, 2000b

Here is a summary of some of the studies that have attempted to evaluate the presence of psi under conditions as similar as possible to the animals' familiar environment.
**Indicates that statistically significant results were obtained but only for some of the trials.
—Indicates that no statistical analyses were performed.

tested in more than one of these groups of organisms, which not only suggests that these abilities may not be exclusive to humans but also that they might have arisen in ancient times.

By looking carefully at Table 2, it is obvious that most experimental protocols have been performed with non-human animals belonging to the vertebrate clade, which happens to be the same to which the *Homo sapiens* belongs. In other words, fish, reptiles, birds, humans, and other mammals are evolutionarily related and we all share a common ancestor. Thus, although it is practically impossible to establish a point in time for the appearance of psi, we can suggest that, at the very least, it could have been present *before* the divergence of vertebrates. And we would not expect for psi to operate and be manifested in other vertebrates in the same ways that occur in humans. The fact that one morphological or functional trait is present in different, evolutionarily related species, does not mean that it has to be identical. Think about, for example, the arm of a human, the fin of a whale, the leg of a frog, and the wing of a bat. On the outside, these characters would seem so different that we could initially think that there is no evolutionary relationship between them. But by looking at them more closely, specifically at the bones that make them up, we would find that they share the same components (i.e., the same bones), which have undergone important

Table 2. Experimental Evidence of Psi in Non-Human Organisms.

Animal Under Study	Class	Phylum	Psi Ability or Phenomenon Investigated	Statistically Significant Evidence?	Reference
Paramecium	Oligohymenophorea	Ciliophora	Precognition	No**	Johnson, 1982
Paramecium	Oligohymenophorea	Ciliophora	PK	No**	Richmond, 1952
Stylonychia	Spirotrichea	Ciliophora	Mental influence	No	Randall, 1970
Planaria	Turbellaria	Platyhelminthes	Precognition	Yes	Alvarez, 2016
Earthworms	Clitellata	Annelida	Precognition	Yes	Wildey, 2001
Flies	Insecta	Arthropoda	Telepathy	Yes	Lépes, 1992
Butterly larvae	Lepidoptera	Arthropoda	PK	Yes	Metta, 1972
Cockroaches	Insecta	Arthropoda	Micro-PK	Yes	Schmidt, 1970
Woodlouse	Malacostraca	Arthropoda	Mental influence	No	Randall, 1971
Aggressive tropical fish	Actinopterygii	Chordata	Micro-PK	Yes	Braud, 1976
Non-aggressive tropical fish	Actinopterygii	Chordata	Micro-PK	No	Braud, 1976
Goldfish	Actinopterygii	Chordata	Precognition	Yes	Morris, 1967
Goldfish	Actinopterygii	Chordata	Precognition	No	Morris, 1977
Lizards	Reptilia	Chordata	Micro-PK	Yes	Watkins, 1971
Chicks	Aves	Chordata	Micro-PK	Yes	Peoc'h, 1988, 1995
Chicks	Aves	Chordata	Micro-PK	No	Johnson, 1989
Chicks	Aves	Chordata	Micro-PK	No**	Green & Thorpe, 1993
Bengalese finches	Aves	Chordata	Precognition	Yes	Alvarez, 2010
Zebra finches	Aves	Chordata	Micro-PK	Yes	Alvarez, 2012
Gerbils	Mammalia	Chordata	Mental influence	No**	Randall, 1972
Gerbils	Mammalia	Chordata	Clairvoyance	Yes	Parker, 1974
Rats	Mammalia	Chordata	Precognition	No	Hewitt et al., 1978
Mice	Mammalia	Chordata	Precognition	Yes	Duval & Montredon, 1968a, 1968b
Mice	Mammalia	Chordata	Precognition	No	Terry, 1976
Mice	Mammalia	Chordata	Clairvoyance / Telepathy	Yes	Schouten, 1972
Mice	Mammalia	Chordata	Micro-PK	Yes	Chauvin, 1968
Cats	Mammalia	Chordata	Clairvoyance	Yes	Osis & Foster, 1953

Here are included those studies in which the presence of psi was evaluated under conditions that were as controlled as possible. If we consider the results as a whole, we can see that virtually all psi manifestations detected in humans are also present in non-human organisms.
**Indicates that, although no overall significant results were obtained, there were some individuals/trials which yielded a statistically significant outcome.

modifications throughout their evolutionary history. In a similar way, psi-related behaviors in other species might be different to what we observe in humans and could be operating under specific conditions (Sheldrake, 2015), though the basic core of abilities (clairvoyance, precognition, telepathy, etc.) seems to be present in many non-human organisms (Table 2).

The Possible Anatomical Basis of Psychic Function

Throughout the last decades, once there was sufficient evidence in favor of psi, parapsychologists began to delve into the next obvious question: if psi was real, then what brain regions/structures were involved in its execution? One of the earliest proposals was that the right hemisphere of the brain, which is involved in functions like visual and spatial processing, intuition and emotions, and creativity and imagination, among others, had a role in facilitating psi, and several experimental results involving the evaluation of the outcome at psi tasks in people in whom one or the other of the cerebral hemispheres dominated, initially seemed to support this hypothesis (Andrew, 1974; Braud, 1975). However, considering the accumulated results on this line of research, there doesn't seem to be conclusive evidence supporting the view that people in whom the right brain hemisphere is dominant are better at psi tasks (Alexander & Broughton, 2001; Broughton, 1984, 2015).

From an evolutionary framework in which psi is not exclusive to humans, there is a crucial problem with hypotheses that associate it with the dominance of one brain hemisphere: differences at the hemispheric level are mainly associated with the neocortex, which is one of the most recent structures in the evolutionary history of vertebrates and is exclusive of mammals (Kaas, 2019). Recent evidence reveals that the basic neuron types that are part of the neocortex are also found in basal vertebrates like reptiles, but their distribution and organization is widely different from what is observed in the mammalian brain (Tosches et al., 2018). A similar issue occurs with the corpus callosum, another structure that has been proposed to be involved in psychic function (Kelley, 2011a). The main argument behind this proposal is that it seems to mediate transliminality, i.e., the propensity for information, feelings and thoughts to transcend normal boundaries of perception, from the unconscious to the conscious mind and vice versa (Thalbourne & Houran, 2000), and which is a variable that correlates positively with anomalous beliefs, experiences, and abilities (Roxburgh et al., 2024). Despite the corpus callosum not being part of the neocortex (it mediates communication between brain hemispheres), it is a novel structure that appeared relatively late in vertebrate's evolution and is only present in eutherian (placental) mammals (Aboitiz & Montiel, 2003). Homologous, though much simpler structures have been detected in non-placental mammals (Suárez et al., 2014, 2018) and in some birds like pigeons (Letzner et al., 2016). Hence, if there is a brain structure involved in psi processes, it is most likely one that is present in most, if not all, groups of vertebrates.

One brain complex which has also been proposed as a candidate for psi mediation is the amygdala, given its role in the modulation of the emotional system, mainly the fight-or-flight response (Broughton, 2006), a physiological reaction to perceived danger which triggers the body to either confront (fight) or escape (flight) the threat. This response is a basic survival mechanism and is conserved across all vertebrates. But as happens with the corpus callosum, the amygdala *per se* is not evolutionarily conserved throughout vertebrate clade; it is restricted to mammals (Johnston, 1923), though amygdala-like complexes have been detected in virtually every other vertebrate including birds (Jarvis et al., 2005), reptiles (Lanuza et al., 1998), and even fish (Porter & Mueller, 2020). Unlike the corpus callosum, the basic structure, connections, and functions of the amygdala and amygdala-like structures are well conserved across the vertebrate clade (Janak & Tye, 2015), which in principle makes it a more suitable candidate for psi mediation. But there are at least two objections to considering this structure as the most viable candidate for mediating psychic function. The first one is that, despite being involved in a universal, vertebrate mechanism like the fight or flight response, there are considerable differences in the anatomical organization of the amygdala of tetrapods (including anuran amphibia) (Moreno & González, 2007), and the amygdaloid complex of non-anuran amphibians (Deryckere et al., 2023) and fish (Lal & Kawakami, 2022). The second objection has to do with the dependence of the amygdala and the amygdaloid complex on lateralization. Though every known vertebrate group shows some level of it, complex brain lateralization like the one found in humans and non-human mammals is considered a relatively late event in the evolution of vertebrates. According to Ehrenwald (1975), given the nature of psi processes, it is likely that the structure (or structures) mediating it is independent of lateralization, unlike superior mental functions. Therefore, it is important to try to look for candidate structures that are not

only highly conserved in all vertebrates but also do not depend (or barely) on lateralization.

Thus, more suitable candidate brain regions for the mediating of psychic function might be those subcortical, at the inner part of the brain, which function in a more bilateral, integrated way. One of such structures which fulfill those conditions, according to Ehrenwald (1975), is the reticular formation, a network of neurons that extends throughout the brainstem. This structure is involved in both basic life-sustaining functions and higher-order cognitive processes functions like pain control, integration of sensory inputs, cardiovascular function, regulation of sleep-wake cycle, regulation of arousal, vigilance, mediation of sympathetic effects during stress, regulation of reflexes and of crucial visceral functions, and filtering of sensory information (Al-Shaarawy et al., 2011; Ehrenwald, 1975; Traurig, 2008). It is precisely this last function which Ehrenwald (1975) considers the most important for psychic processing: the reticular formation could act as the first line of defense against the ever-flowing stimuli that are perceived by any kind of anomalous cognition and also as a barrier so that the organism is not constantly exerting motor impulses in the form of psychokinesis. The reticular formation is one of the most ancient portions of the brain (Balcells, 2015; Novak, 2008) and is widely conserved across all groups of vertebrates (Feinberg & Mallat, 2013), even in the primitive groups such as jawless fish (Ronan & Northcutt, 1998) and cartilaginous fish (Smeets et al., 1983).

Another set of brain structures which I consider that might be involved in psychic functioning are the basal ganglia, a group of subcortical nuclei that lie deep within the right and left hemispheres, near the base of the brain and adjacent to structures like the brainstem and the thalamus. As happens with the reticular formation, the basal ganglia do not depend on brain lateralization, are among the oldest structures of the brain, and are conserved in all vertebrates (Grillner et al., 2013; Stephenson-Jones et al., 2011) including cartilaginous and jawless fish (Wullimann, 2011). Among their functions we find motor control, action selection, emotional regulation, executive functions, and procedural learning (Lanciego et al., 2012; Rocha et al., 2023). More recently, brain processes that are usually associated with psi, such as decision making (Hikosaka et al., 2018) and intuition (Wan et al., 2012), have also been identified as dependent on the activity of the basal ganglia, specifically the caudate nucleus. This is quite striking because several decades ago, before the discovery of its role in processes like intuition and decision making, it was suggested that this structure was some sort of antennae which could mediate every ability related to anomalous cognition, such as clairvoyance and telepathy (Neal & Karagulla, 1983).

I think that at this point the logic of this proposal might have been envisioned. I have only mentioned some structures that may or may not ultimately have to do with psi processing, considering its location in the brain, its distribution and its relative antiquity. It is not a straightforward task to try to identify this sort of structures and, in the end, psychic function might be dependent on the joint action of multiple brain structures. However, if psi is indeed present throughout the vertebrate clade, we would expect both a subcortical and conserved brain structure in all vertebrates, such as the reticular formation or the basal ganglia, to be involved. I will expand on this in a later section.

Inhibition of Psi Function by Outer Layers of the Brain

In keeping with the previous section, it is clear that human psi is manifested in a very wide range of situations that go beyond survival-related ones, and it seems that certain people have some conscious control over it. This suggests that there might be additional brain regions that regulate the way in which psi-related stimuli are processed, in ways more complex than what we observe in other vertebrates. The most obvious candidate structure seems to be the neocortex, which comprises more than three-quarters of the human brain and is much more voluminous than in basal mammals and even in other groups of primates (Kaas, 2019).

The idea of the potential role of the neocortex in mediating psi-related stimuli is not new, and it could be traced back to the "brain as a filter" model. This hypothesis, originally proposed by Henri Bergson (1911) and William James (1929) posits that the brain acts as a filter for external information and prevents it from crossing to conscious awareness. It also impies that the brain does not generates consciousness, but instead narrows down a wider form of it which exists independently of the brain. While James did not suggest any specific brain region that could serve as a "valve" for filtering information coming from the outside, Bergson proposed the brain cortex as the most likely structure that could fulfill that role. More recently, neuroscientists like Alexander Luria (1973) and Karl Pribram (1973) expanded on Bergson's ideas and suggested that

this selective filtering might be mediated by the frontal and temporal lobes. During the next decades, experimental support coming from neurological and neurophysiological research with subjects that showed some kind of brain lesion, revealed some brain regions that might have a role in mediating psychic functioning, such as the right temporal lobe (Persinger, 2001), the right parieto-occipital region (Persinger et al., 2002), and the right parahippocampal gyrus (Persinger & Saroka, 2012; Venkatasubramanian et al., 2008).

Additional experimental support comes from a series of experiments performed by Morris Freedman and his collaborators throughout the past two decades, in which they have investigated the impact of frontal lobe lesions on the ability of individuals to influence the output of a Random Event Generator (REG). In the first series of them, two groups of subjects of six people each, one made up of people with frontal lobe injuries (experimental) and the other made up of six healthy subjects (control), were seated in front of a computer displaying an arrow on the screen and were asked to try to move the arrow either to the left or to the right, or to keep it at the center of the screen (baseline). The movement of the arrow was controlled by the output of the REG. The main finding of this work was that one of the subjects in the experimental group showed a statistically significant ability to move the arrow in the indicated direction, especially rightwards (Freedman et al., 2003). Though no other subject in this study obtained results that departed from chance, a replication attempt with the subject mentioned above was performed and, once again, statistically significant results were obtained across multiple blocks of trials but, as in the first attempt, only when the subject was asked to move the arrow to the right (Freedman, 2010).

Several years later, the researchers aimed to replicate their original findings, for which they recruited the subject who had obtained a significant outcome in their 2003 study, and another one who also had frontotemporal lobe damage. The experimental protocol was the same as in their previous study, and they also included a control group made up of subjects with no brain damage. At the end of the trials, both participants from the experimental group obtained significant results when asked to move the arrow in the screen to the right, and both exhibited considerably larger effect sizes in comparison to subjects from the control group (Freedman et al., 2018). The authors concluded that the frontal lobes, particularly the left medial middle frontal region, may act as a biological filter to inhibit psi, and that damage to this area seems to weaken that barrier, allowing for the enhancement of psi capabilities.

More recently, the authors took a step further and explored the possibility of finding the same effects in people with temporary brain lesions. To accomplish this, they recruited 108 healthy participants who were assigned to either the control group or one of two experimental groups. For participants in both experimental groups, the researchers applied repetitive transcranial magnetic stimulation (rTMS) to induce temporary lesions in the frontal lobe, specifically in the left medial middle frontal region for one of the experimental groups and in the right for the other one. Only participants in whom rTMS was induced on the left side of the brain showed significant micro-PK effects (Freedman et al., 2024) and, as in their previous studies, only those rightward intentions (i.e., getting the arrow to move to the right of the screen) produced significant results. This initially suggests that participants with temporary lesions in the frontal lobe may represent an enriched sample for further studies in which this effect can be replicated.

The final piece of evidence pointing in a similar direction involves a recent poltergeist-like case investigated by several UPIDE members in Mexico City, Mexico. It involves a married couple unaffiliated to mediumship, comprised by a 56-year-old man, referred to as HM, and a 45-year-old woman, referred to as LP. The case involves typical phenomena often found in poltergeist-like cases like raps and apports, but also others which are not so common, such as apports, which are mostly coins. Additional details on reported phenomena and research methodology can be found elsewhere (D'León et al., 2025). What the evidence so far suggests is that HM seems to be the main agent, around whom most of the strange phenomenology occur, but what is more interesting here is the way that detonated these phenomena that have been occurring since 2012. According to HM, one day of that year he was coming out of the shower, slipped and fell face down, hitting the floor hard. He was immediately taken to the hospital by his daughter and son, and there, neurological studies were performed that revealed an injury of about 3 mm at the frontotemporal lobe. HM told us that, although before his accident a few episodes of strange phenomena like moving or falling objects have occurred at his home, it does not compare to the manifestations that followed his accident at the bathroom. In fact, the first apport case that he ever registered came a few months after the brain damage was detected. Around that time, HM was also diagnosed with

epilepsy. However, recent neurophysiological analyses which were performed to him a few years ago, including EEG exploration and simple and contrasted MRI, turned out to be within normal parameters. Despite this, apport and other strange phenomena have continued to this day, at a similar rate as in the period in which we investigated this case (unpublished results).

Plausible Evolutionary Advantages of Psi

One of the most common arguments against the biological and evolutionary bases of psi is that, if it was a trait subjected to evolutionary forces, it should be consistent and able to use at any time (see Levin, 1996). Such kind of arguments come from a very simplistic view of biological evolution and implicitly assume that directional selection (i.e., a specific mode of natural selection which favors one phenotype, in this case, the volitional and effective use of psi) is the only evolutionary force and that, in order for a trait to be subjected to evolutionary forces, it must confer some direct advantage to the organism's fitness. This couldn't be more wrong, and there are plenty of examples of traits that do not confer any advantage to the organism, which have been preserved due to a variety of reasons. For example, non-functional copies of genes, which are known as pseudogenes, do not have any effect in the reproductive success or survival of an organism and have been preserved by neutral evolution (Sisu et al., 2014; Torrents et al., 2003). Other traits, such as polydactyly resulting from the Ellis-van Creveld syndrome in certain, often genetically-isolated human populations (Goldblatt et al., 1992) and color variations in island populations of some lizards (Runemark et al., 2010), seem to have been preserved by genetic drift, a process in which random fluctuations in allele frequencies in a specific population can lead to the fixation of traits that are neutral or even slightly deleterious. And there can also be some non-functional traits whose elimination hasn't occurred because they cause no deleterious effects and thus haven't been selected against. This is what happens with vestigial traits that are now just remnants of functional ones in ancestral populations, but its original purpose has been lost in modern ones, such as the human appendix.

In the case of psi, what the accumulated evidence (both from human and non-human animals) strongly suggests is that it indeed can confer an evolutionary advantage, even if it operates in an unconscious, non-predictable way. This is precisely the reason why it is important to put aside an anthropocentric view of it and begin to consider the possibility that it is a widespread trait in many other vertebrate species.

One way to address the above point is to try to look for those manifestations of psi that might have a role in survival and/or reproduction, as has been suggested by Broughton (2015) and Sheldrake (2015). For example, the feeling of being stared at, i.e., the capacity of many people to perceive when someone else is staring at them, is one of the best to fit in an evolutionary framework because it clearly could represent an advantage in terms of organism survival (think of a person that by means of psi suddenly detects that a potential aggressor is staring at them and can escape safe and sound from that place). Though it has mostly been studied between humans (Sheldrake, 2003), there is some evidence that people can also perceive when an animal is staring at them (Corbett, 1986; Cotrell et al., 1996) and of animals feeling people's gaze from a point where it was not possible for the animal to distinguish it directly (Cotrell et al., 1996).

Another behavior that might be psi-dependent is the apparent telepathic communication between nursing mothers and their babies, especially when their milk let-down reflex was activated. In cases in which the mother was away from her baby, the activation of their let-down reflex coincided with the exact moment in which the baby showed signs of distress (Sheldrake, 2002, 2003). This manifestation of psi may not be limited only to humans but also present in other mammalian species. For a mother that was away from her children, for example, looking for food, it would clearly be an advantage if her reflex was activated in the way that human mothers have reported, because she could return to her offspring. However, the let-down reflex might not be a requisite, especially if we consider that the lasting of the mammalian breastfeeding period goes from a few days in some species (e.g., small mammals such as rodents) to even several years as happens with elephants. The mother could leave their offspring even after the breastfeeding period has ended, but in any case, a telepathic connection at times that the offspring is distressed or in danger would clearly make a difference for the ensuring of their survival.

The final example for this section is the abundant, though mostly anecdotal evidence of animal premonitions, specifically those concerning natural disasters like earthquakes, avalanches (Sheldrake, 2011), and tsunamis (Sheldrake, 2005). Possible alternative, psi-independent mechanisms have been proposed, such as infrasound detection, seismic

vibrations, changes in water or air pressure, and changes in the electromagnetic field, but there are many extraordinary cases for which precognition seems to be the most plausible explanation (Sheldrake, 2011). Furthermore, this extraordinary behavior has been observed in many species that span all major groups of vertebrates, including fish, frogs, snakes, birds, rodents, elephants, and domestic animals like dogs and cats. As happens with the feeling of being stared at and the telepathic connection between mothers and babies, the ability to precognitively anticipate the outcome of a natural disaster has an obvious role in ensuring survival, in this case not only of an individual but even of a whole population.

What examples like the above suggest is that such spontaneous manifestations of psi processes seem to be related to the emotional system (Broughton, 2006, 2015), whose basic components are highly conserved in all vertebrates (Panksepp & Biven, 2012) and it is also essential for decision making, a process with a very important role in survival behaviors like fear and threat detection. Some theoretical frameworks like the psi-mediated instrumental response (PMIR) model indeed posit that psi has evolved as a survival mechanism that could mediate decision making in a goal-oriented, unconscious, and adaptive way (Stanford, 1974a, 1974b, 1990). Despite decision making in higher vertebrates like the *Homo sapiens* and other mammals is largely mediated by the cerebral cortex, other structures such as the basal ganglia in general (Ding & Gold, 2013) and the caudate nucleus in particular (Hikosaka et al., 2018) are also involved, not only in these organisms but also in the rest of the vertebrates.

The nature of psi processes, especially the spontaneous ones, has also been associated to different forms of intuition or subconscious awareness like hunches, gut feelings, impressions, etc. (Beloff, 1981; Radin & Pierce, 2015). Though intuition is a multicomponent process and seems to be mediated by different brain structures, including some very ancient like the amygdala and the hippocampus, more recently it has been shown that the basal ganglia—especially the caudate nucleus— also play an important role in the development of this function (Wan et al., 2012).

Overall, that psi-related processes like decision making and intuition are mediated by ancient, highly conserved structures like the basal ganglia is not only compatible with an evolutionary framework in which psi appeared at least some time before vertebrate diversification but also highlights its potential role in survival-related situations that would require a rapid, sometimes unconscious response.

IMPLICATIONS OF THE POSSIBLE BIOLOGICAL BASIS OF PSI FUNCTION

Taken together, the accumulated pieces of evidence which I have presented above point towards the following scenario: the ability to obtain information in ways which are typically labeled as "anomalous cognition", and perhaps also the capacity to interact with matter without exerting a known direct action on it, is likely to have emerged long ago—some time before the diversification of vertebrates—and it may have been preserved by biological evolution because it might confer an advantage for organisms, even if its execution is carried out in a non-volitional way, in situations where the organism's survival may depend on the outcome.

Of course, one could argue that psi might be much more ancient and that it appeared millions of years before the first vertebrates. Though this is certainly a possibility, this does not invalidate what I am proposing here. Trying to establish a specific point in time at which psi emerged is something that, as of today, we are far from achieving. To do so, we would require not only a broader repertoire of organisms in which psi has been reliably detected, but also the identification of genetic markers associated with psi-related brain structures. In other words, focusing primarily on vertebrates does not exclude the possibility of psi in other organisms; rather, it intentionally limits the problem to a well-known clade for which the available evidence is robust enough to allow meaningful hypotheses.

Indeed, despite candidate brain structures involved in the mediation of psychic function evolved at early stages in the vertebrate lineage (Grillner, 2021; Medina & Reiner, 1995), evidence from several ANPSI experiments suggests that psi might also be present in organisms ranging from protists (Johnson, 1982; Randall, 1970; Richmond, 1952) to various invertebrates, with a great deal of research conducted on arthropods (Lépes, 1992; Metta, 1972; Randall, 1971; Schmidt, 1970). This raises the intriguing possibility that psi in non-vertebrates might be mediated by traits that are not evolutionarily related to those of vertebrates. For instance, arthropods lack structures such as the basal ganglia, yet possess analogous structures involved in similar functions (Smarandache-Wellmann, 2016). Moreover, recent findings suggest that insects exhibit consciousness-related components analogous to those of vertebrates, which might contribute to subjective experience (Barron & Klein, 2016). On the other hand, homologous genes could also be playing a role across diverse taxa. For

example, planarians, a basal animal group in which psi phenomena have been tested (Alvarez, 2016), exhibit key neuronal features remarkably similar to those of vertebrates, to the extent that their protobrain has been proposed as an ancestral form of the vertebrate brain (Sarnat & Netsky, 2002). Furthermore, homologous genes involved in synaptic processes have been identified in both vertebrates and invertebrates (Nithianantharajah et al., 2013), and even in evolutionarily distant organisms like yeasts, where they participate in environmental responses and cellular organization (Emes et al., 2008). Although we cannot currently assert that these traits mediate psi, their presence underscores the possibility that similar neurobiological mechanisms—whether homologous or analogous—may exist beyond the vertebrate lineage. Thus, psi's biological basis in invertebrates could involve evolutionary-related (homologous) structures or processes to those observed in vertebrates, traits with similar functions that evolved independently (analogous), or perhaps a combination of both. Clearly, this is highly speculative and extends beyond the immediate scope of the present proposal.

Returning to the main discussion, and given our current knowledge, there are two alternative hypotheses regarding the evolutionary origins of psi capabilities in vertebrates. These hypotheses are, in principle, equally plausible: the independent origin and the common origin of psi. The first refers to psi appearing independently in each vertebrate lineage in which it has been detected (Figure 1A), representing a case of convergent evolution—that is, the process by which unrelated species independently evolve similar traits due to adaptation to similar environments or ecological niches. At present, we cannot categorically exclude this scenario; however, in my opinion, it faces significant theoretical challenges due to two main reasons. First, the fight-or-flight response, which has been strongly associated to the situations most conducive to the manifestation of psi in non-human animals (i.e., those related to ensuring survival) (Broughton, 1988, 2010; Taylor, 2003), is a process known to be homologous in all vertebrates (Romero & Gormally, 2019), and the neural circuits mediating it are highly conserved (Suryanarayana et al., 2022). Second, common brain structures to all vertebrates, which seem to be the most likely candidates for mediating psychic function, share the same overall structure and organization, which suggests that their basic components evolved only once throughout vertebrates' evolutionary history. This includes both the reticular formation (Manger, 2009) and the basal ganglia (Reiner et al., 1998). And there is also the issue regarding parsimony. In evolutionary biology, as in many other branches of science, when we are faced with two or more possible explanations, the one requiring the fewest number of changes is preferred when reconstructing evolutionary relationships. Though parsimony should not always be assumed as a rule of thumb for the best evolutionary scenario for a specific trait (Crisci, 1982; Wanninger, 2024), there have been many examples in which similar traits in different groups of evolutionary-related organisms—like wings in birds and bats or amniotic eggs in reptiles, birds, and mammals—were originally thought to have different origins, but when more evidence was uncovered it turned out that they did share a common origin.

Here I am arguing in favor of a single origin of psi at some point before the divergence of vertebrates (Figure 1B), given the common origin of the candidate ancient brain structures that are likely to mediate it and of the mechanisms that seem to be related to it, such as the fight-or-flight response and decision making (Branco & Redgrave, 2020; Ding & Gold, 2013; Romero & Gormally, 2019). Considering that we lack direct evidence of the biological basis of psi, opting for a parsimonious hypothesis involving a common origin prior to the divergence of vertebrates seems to be a good starting point, in part supported by the five pieces of evidence I have developed above.

The issue of the possible evolutionary forces behind the neural basis of psi will be discussed in a later section. Here, I will only mention that, although structures like the basal ganglia and the reticular formation share a common origin in all vertebrates and are conserved throughout their phylogeny, this does not mean that there were no variations between them, as if they have remained frozen in time since their appearance. Such differences between groups of vertebrates could be linked to: a) variation in specific anatomical features of involved brain components and b) different manifestations of psi in different groups of organisms, which could in principle be related to a).

Despite the wide spectrum in the degree of complexity of the vertebrate brain, there is a common core of components which is conserved in all of them at different levels (Eilbert, 2014), including genetic, cellular and connectivity ones (Karten, 2015). Primitive emotions like anger, fear, lust, search, care, among others, are also conserved throughout this clade (Panksepp & Biven, 2012). And even at the level of cognitive (Pessoa et al., 2019) and behavioral (Eilbert, 2014) processes there are neural networks which are conserved in many groups of them and that involve common brain regions. Regarding specific brain structures

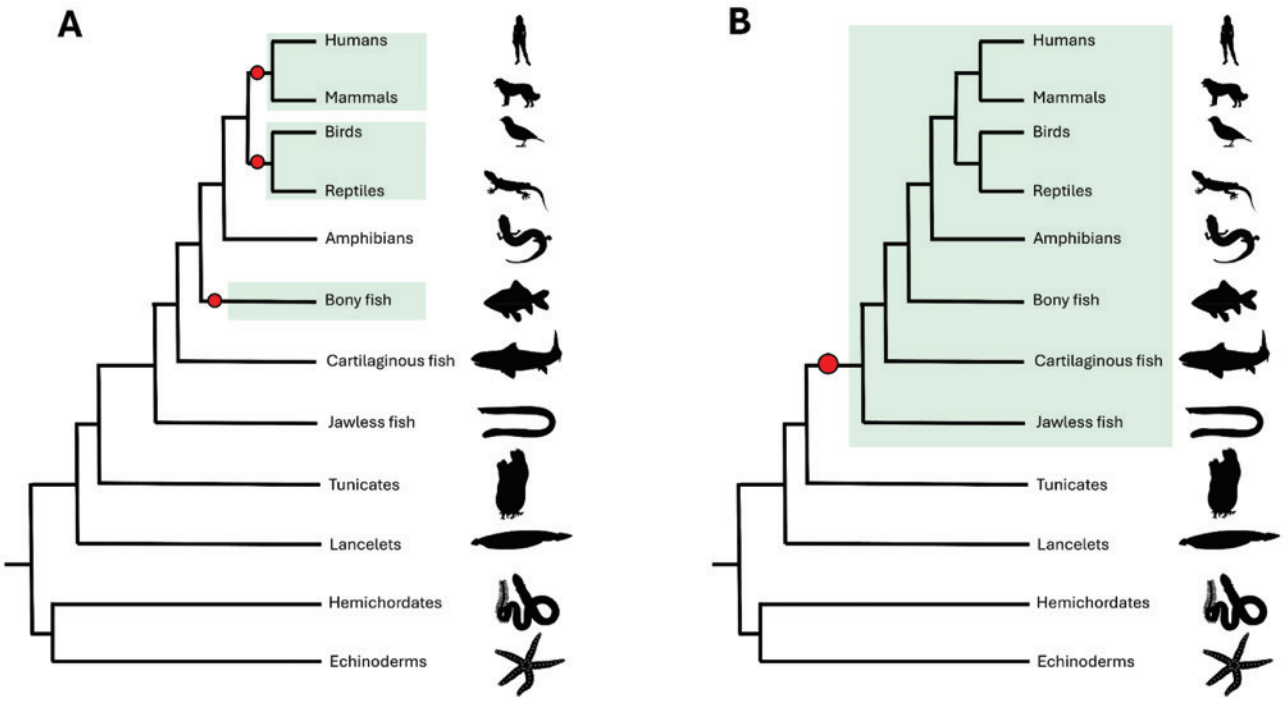

Figure 1. Two Possible Hypotheses for the Origin of Psi Function. In (A), it is assumed that psi evolved as a result of convergent evolution in each of the vertebrates' groups in which it has been detected (represented by a red circle). This scenario implies that psi appeared independently—at least—on three different occasions throughout the evolutionary history of vertebrates. On the other hand, (B) depicts a scenario in which psi had a common origin before the divergence of vertebrates, which is a more parsimonious one than (A) and coincides with the evolutionary history of brain structures like the basal ganglia and the reticular formation—both possible candidates for mediating psychic function. The fact that psi has not been detected in all groups of vertebrates may be because it has not been searched for in that group or because it has been lost in one or more lineages.

that might have something to do with psi, though the basic elements are conserved in all vertebrates, there are considerable differences which involve their specific organization, and the circuitry involved, both for the basal ganglia (Reiner et al., 1998) and the reticular formation (Manger, 2009). Such variations could, in turn, be linked to different expressions of psi capabilities in distinct groups of vertebrates, such as those proposed by Rhine and Feather (1962). By reviewing many case reports of pet owners, they identified five kinds of behavior that could be psi-related, including homing behavior, reactions to impending danger (both to the owner or the pet itself), anticipatory behavior involving the owner's return, perceiving the owner's death at a distance, and cases in which the animal managed to follow the owners over great distances and even to a place it had never visited before (psi trailing). Just as all vertebrates share the same, overall brain structures as the reticular formation and the basal ganglia, but with specific features in different taxonomic ranks, the same principle could be applied for psi capabilities. What is suggested in Table 2 is that the whole repertoire of known psi phenomena is present in the vertebrate clade, but each branch of them could show specific, psi-related behaviors, which might depend on the organization of their anatomical basis.

EVOLUTIONARY FORCES AND PSI

Until a few decades ago, the traditional view of brain evolution was based on the triune brain hypothesis, an oversimplified model which divides the brain into three regions: reptilian brain, which is the oldest and innermost part, comprising structures like the brainstem and the basal ganglia; the limbic system or "paleomammalian layer", in which we find the amygdala and the hippocampus; and the neocortex, the outermost and most recent layer which is usually called the "neomammalian brain" (Cory, 2000). Even though from the outside the central point of this theory would seem right, there are two main objections. Firstly, it postulates that the different layers of the brain operate somewhat independently. And secondly, it considers that some brain structures, especially those more ancient and which are in the reptilian brain, have

remained evolutionary stagnant (MacLean, 1990), as if the selective pressures acting upon them were so strong that no evolutionary change can be allowed.

Within the field of evolutionary biology, the triune brain hypothesis is no longer an accepted one, especially thanks to recent advances in neuroscience, comparative anatomy, genetics, and molecular biology. Different brain processes like emotion or cognition (both of which might be involved in psychic function) and their underlying neural circuits are no longer seen as separate and independent, but as interdependent and part of integrated functional networks (Steffen et al., 2022). Furthermore, it has been demonstrated that the innermost and oldest parts of the brain have not been "frozen in time", but rather have co-evolved alongside most recent, cortical structures (Chin et al., 2023).

What does this have to do with psi? The reason is that we cannot separate the possible evolution of this function from the changes that the brain structures that might mediate it throughout the evolutionary history of vertebrates have undergone. If we want to get a better understanding of the differences in psi capabilities across species, we also need to understand the processes that have shaped the necessary scaffolding for their operation. However, until further evidence is available about the biological basis of psi, proposing hypotheses about the possible evolutionary forces affecting any of the candidate structures is highly speculative.

At this point, the best we can do is to try to get a better understanding of the distribution of psi in the human population. Several meta-analyses that take into account hundreds, even thousands of different experiments within the field of Parapsychology (see Cardeña, 2018; Mossbridge et al., 2012; Schmidt, 2012; Storm, 2006a, 2006b) have provided enough evidence to establish that psi phenomena are real and not an artifact related to issues like measurement error or the file-drawer problem (Radin, 2006). For this purpose, there are two results that have been obtained consistently over time and that could give us a clue about how this trait might be distributed in the population. These are:

1. Most of participants in experiments that test for clairvoyance, precognition, micro-PK, etc., show some level of psi, including psi-missing.
2. Only very few subjects show no psi degree at all or, on the contrary, a very high degree.

In a graphical way, the distribution of this trait (having psi) would resemble a normal distribution in which, at the extremes, we would have those individuals with a total lack of psi and also those that would be considered true prodigies, whereas the central part of the distribution would comprise individuals showing some level of it (Figure 2A). Now let's take a look at it in an evolutionary framework. For the sake of simplicity, I will focus only on one aspect common to both humans and non-human animals: survival. As I stated above, ensuring survival is crucial for any organism, and what the evidence suggests is that psi-related processes might have something to do with it. Picture an herbivorous animal or an early *Homo sapiens* individual looking for food. Let us now suppose that this mammal is suddenly endangered due to the presence of predators in its surroundings and that the only way of getting away was by some sort of anomalous cognition exerted in an unconscious, non-volitional way (for example, perceiving the pack of predators at a distance and in real time). Evidently, this individual would have a higher fitness (and a higher chance of escaping) than another with a complete lack of psi. But also, more than one in which anomalous cognition was operating all the time. In this specific case, it is likely that the organism would not be able to distinguish which information fragment was needed to save its own life. In other words, there is a great chance that the important signal was lost in a sea of noise. Thus, having some basal level of psi, even if it only operated at specific situations, would be an evolutionary advantage if those situations were determinant for survival of the organism.

The situation described above agrees with a scenario in which stabilizing selection is the evolutionary force behind the shaping of psi function (Figure 2B). This is a specific type of natural selection that favors average traits within a population (in this case, organisms with some level of psi) and selects against extreme ones (organisms lacking psi and those in which it is present all the time) because those with the average phenotype are more likely to survive and reproduce. Stabilizing selection seems to be the most common evolutionary force acting upon many different, phenotypic traits (Estes & Arnold, 2007) and examples include the wing size in birds, human head size at birth, clutch size in reptiles, an intermediate fur color in some mice, among others.

Some critics against the reality of psi that have pronounced against its existence argue that if psi is so useful, and if it has been present for a very long time, by now we should see a lot of individuals in which this capacity was highly developed (Levin, 1996). As I argued above, this implicitly considers that directional selection is behind the evolution of psi capabilities. It would be more coherent if psi was a conscious process in which an individual could use her

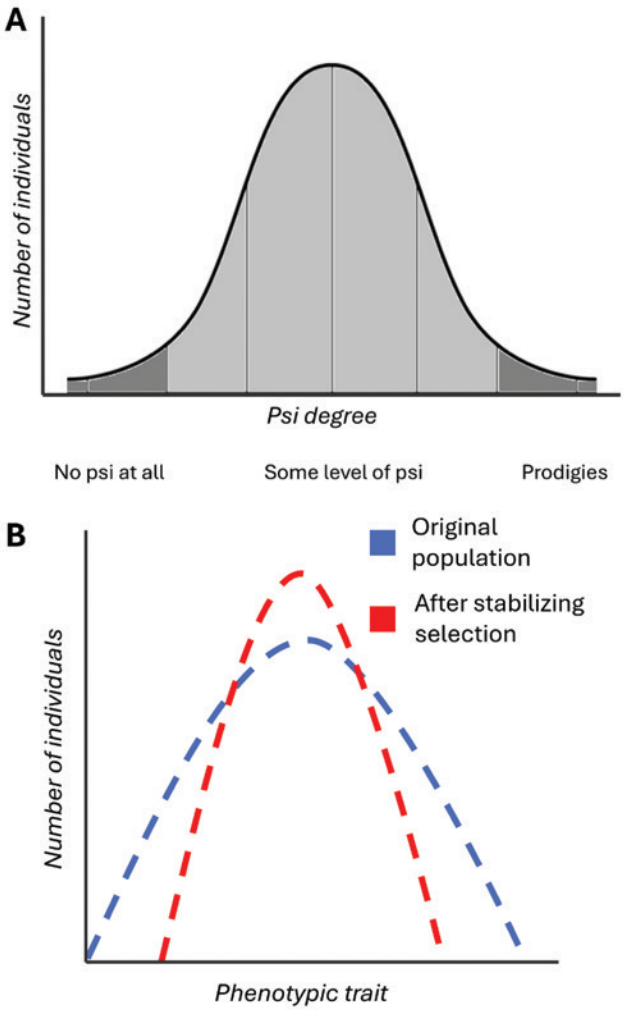

Figure 2. The Distribution of Psi in the Population as a Result of the Action of Evolutionary Forces. Based on the results of thousands of experiments, we can postulate that the distribution of psi in the general population resembles a normal one, with most people showing some level of it, whereas only a few would be true psi-prodigies or exhibit no psi at all (A). Such distribution suggests that stabilizing selection, a kind of natural selection which favors the intermediate or moderate phenotypes in a population while eliminating extreme variations at both ends of the spectrum (B), could be behind the evolution of psi function.

or his anomalous cognition at will. But again, if we look at the experimental and anecdotical evidence, this doesn't seem to be the case. Instead, it seems that individuals with intermediate phenotypes are likely to be more fitted because they could effectively use psi under situations in which their own life is at stake. Think about, for example, those individuals who avoid getting on a plane or taking a specific highway due to a gut feeling, hunch, etc., only to find out later that a fatal accident occurred in which they could have been involved had they made a different decision.

To close this part, I'd like to mention that, though what I have suggested is a generalization of a possible common evolutionary framework to human and non-human animals, there is certainly a greater complexity surrounding human psi, which has led to alternative and innovative proposals that aim to explain why this trait has been preserved over countless generations of human beings. One of them is the Ritual Healing Theory (McClenon, 1997), which suggests that group healing practices like shamanic rituals led to placebo and hypnotic effects that are correlated with anomalous experiences like spiritual healing, waking ESP, PK, among others. Such experiences seem to have fostered the belief in healing powers, which in turn promotes physical and mental health, resulting in shamanic practices and thus completing the cycle. McClenon argues that behaviors associated with ritual healing have played a role in human evolution by fostering social cohesion and belief systems that are centered on healing and anomalous experiences. The theory also states that such cycle has acted as a selective pressure, favoring genotypes associated with hypnosis-related features such as dissociation and absorption (McClenon, 2013).

The analysis of hundreds of reports of anomalous experiences supports the RHT over other theories that postulate that psi confers a direct benefit in the form of survival advantages (McClenon, 2000, 2002). However, the RHT might be untenable if we extrapolate it to non-human animals. With this I'm not trying to invalidate the RHT; it is likely that the processes it describes have occurred in human societies at least since the earliest forms of shamanic rituals and religious-like practices. In fact, there could be an interplay between selective forces behind the RHT and others related to the evolution of psi capabilities that are common to humans and non-human animals, which might involve additional brain regions, likely those with a high degree of development in humans but not in non-human animals. This seems to be in line with psi effects observed in subjects with brain damage in the neocortex, specifically in the frontal lobes, such as the ones participating in the experiments led by Morris Freedman and his collaborators (Freedman et al., 2003, 2018, 2024) which I described above.

IMPLICATIONS AND APPLICATIONS

This study proposes a novel framework for understanding psi phenomena by placing them within the context of evolutionary biology. By identifying brain structures and regions widely shared among vertebrates that could

potentially underlie psi capabilities, this work opens the door for experimental research. Behavioral scientists, neuroscientists, psychologists, and other experimental scientists could use this framework to investigate whether these regions are indeed involved in psi function, employing diverse techniques and studying various organisms.

Furthermore, the findings highlight the importance of integrating psi into a biological and evolutionary framework, rather than relying exclusively on mathematical models or speculative physical theories. By focusing on the evolutionary reasons for the existence of psi—such as its potential role in survival—this approach encourages the generation of testable hypotheses about its evolution and mechanisms. Ultimately, this perspective may help establish a more grounded and interdisciplinary path forward in the study of psi phenomena.

CONCLUSIONS AND FINAL PERSPECTIVES

What I have tried to do throughout these pages is to build up a comprehensive framework that could help to integrate psi into evolutionary biology, and to provide some arguments for a natural history of this outstanding capability. I hold firmly that, despite its extraordinary advances, modern parapsychology still lacks a proper biological foundation that goes beyond what we observe in human subjects. This seems to be reflected in the fact that, even though there is a huge amount of literature on animal psi (see Dutton & Williams, 2009 for an extensive review), it has not been given enough weight in the few attempts that have tried to explain the role of psi in evolution, nor in theoretical models that have attempted to explain its mode of action. Only a handful of researchers have taken this issue seriously, such as Jule Eisebund, who long ago suggested that, just as happens in humans, animal psi didn't seem to be restricted to a few prodigious individuals. Instead, given its apparent role, it was more likely to exist to a greater or lesser degree in all members of species in which it had been detected than only in a few "gifted animals" (Eisebund, 1966)—a proposal which implicitly reflects the role of stabilizing selection, as I have suggested occurs in humans.

The lack of an evolutionary framework also applies to research on the possible neurobiological basis of psychic function. As I have mentioned above, this is a topic that has been addressed by researchers from different areas of knowledge, but no consensus has been reached about the brain structures and regions that might be involved. I think that this could be due to two main reasons: 1) they are mainly looking for structures of recent evolutionary origin and 2) psi might be a process that is not limited to a specific brain region or structure, but rather operating in a more integrated, holistic way, which makes perfect sense from an evolutionary perspective. If psi was indeed around before the divergence of vertebrates into the current major groups, it would be naturally expected that, as different species evolved, the common core underlying all mechanisms that mediate psi function would be integrated into increasingly developed neural circuits—a scenario that clearly goes against obsolete views of brain evolution like the triune brain model.

If we want to advance in our understanding of the neurobiological basis of psi function, it is crucial to firstly reach a consensus on those brain structures that could be playing a role in such processes. The best way to do this might be using techniques that allow observing brain function in real time—such as functional magnetic resonance imaging (fMRI) which has been done for a couple of decades. As a result, several brain regions and structures have been proposed to play a role in psi-related processes, including the visual cortex (Bierman & Scholte, 2002; Standish et al., 2003), the anterior cingulate cortex, frontal superior areas, and the precuneus (Achterberg et al., 2005), the occipital region (Richards et al., 2005), and the right parahippocampal gyrus (Venkatasubramanian et al., 2008). However, other researchers have not been able to find any evidence suggestive of a psi-related neuronal response (Moulton & Kosslyn, 2008). Though I could not discard that those structures might actually have a role in mediating psi function—perhaps in joint action with more internal ones—it is important to point out that all of them are recent evolutionary innovations mainly developed in primates. Hence, my suggestion would be to try to observe the activity of deeper brain regions like the ones I have proposed above. This might be challenging for fMRI-based approaches, but the combination of techniques like Positron Emission Tomography (PET), Single-Photon Emission Computed Tomography (SPECT), and High-Resolution Structural MRI (for anatomical context) could prove to be useful.

Although the identification of such structures would be a tremendous step forward in our understanding of the biological basis of supernormality, it would only be the first one towards unraveling the evolutionary history of this exceptional trait. Once a consensus is reached, the next step would be to try to identify which gene products are expressed in those regions. This could be achieved by building gene expression profiles using microarrays and/or RNA sequencing (RNA-seq) techniques which, in addition to providing insights into gene function and regulation, can also shed light on the identification of conserved functions

across species and on how changes in gene regulation contribute to species diversity.

The final step would be looking for homologous gene sequences in other vertebrate species and then performing phylogenetic analyses with genes expressed in those regions. And thus, by comparing their distribution across different species and analyzing their substitution rates we could obtain a wider picture of their divergence times and evolutionary trajectories.

It was several decades ago when Theodosius Dobzhansky, one of the most influential geneticists and evolutionary biologists of the twentieth century, in an attempt to make a wake-up call for the integration of molecular biology with organismal biology, stated that "*Nothing in biology makes sense except in the light of evolution*" (Dobzhansky, 1964). In his brief essay, Dobzhansky cautioned his colleagues against a purely reductionist approach and asserted that genes and molecular mechanisms should be studied within the framework of evolutionary biology so that their roles in adaptation and diversity could be revealed. I think that following a similar, holistic approach could be what ultimately bridges the gap between parapsychology and biology, paving the way for new inquiries.

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