

# The Fate of “The Master and His Emissary”

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## Abstract

Iain McGilchrist’s *The Master and His Emissary* is an extraordinarily ambitious book running to nearly 1,000 pages that applies contemporary neuroscience to the trajectory of western culture. Erudite, full brilliant observations and with a central thesis that rung profoundly true to many ears, its reception seemed to many to presage eventual status as a classic, that would spark debate on the state and direction of contemporary society. Its thesis also seemed, to many Buddhist readers, to show the neural underpinnings of the sort of presence that mindfulness practice cultivates. However, this broader impact on the intellectual mainstream seems to have been slow to come.

This essay aims to help interested readers understand the reaction to the book and whether relevant subsequent scientific developments have impinged upon its thesis. Firstly, the book’s thesis and character and the broad intellectual climate that greeted it are summarized. Second, and relatedly, I examine the book’s coherence with evidence available at the time of its publication as judged by experts. Amongst other things, this section shows that McGilchrist is especially confronted with a classic interdisciplinary problem: he depends on several bodies of knowledge that few others have expertise in, and which interact in subtle ways in his argument, preventing authoritative peer review. Finally, I highlight key evidence emerging since the book that impacts on McGilchrist’s thesis and its relation to mindfulness.

# Introduction

Since its 2009 publication, many have been captivated by Iain McGilchrist's *The Master and His Emissary (TMAHE)*.<sup>1</sup> The book, whose jacket is decorated by approving quotes from famous thinkers and neuroscientists, provides a compelling exploration of the curious division of the brain into two hemispheres. It also relates this hemispheric divide, which has fascinated and frustrated neuroscience for centuries, to a profound perspective on the nature of being and the evolution of western culture, all in erudite but still relatable language.

To offer the reader a preliminary, crass, and simplistic summarization of the book's argument -- the hemispheres create two worlds, and that of the right is holistic, embodied, living, and intuitive, while the left is more focused, linear, and analytical. McGilchrist is wary of such attempts at summary throughout, aware of the temptation for a nuanced account to slide towards crude dualistic hemispheric myths (right intellectual, left artistic.) He nevertheless demonstrates in painstaking detail over a few hundred pages that there is valuable substance to the idea of hemispheric duality. The book then diagnoses a widely suspected cultural illness in the West as resulting from its gradual alienation from the right hemisphere's world. Highly compelling stuff, to say the least. Many readers seem to wonder why the book's impact has not been still

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<sup>1</sup> For example: "The Book of the Century? [McGilchrist] writes with authority in natural science and humanities, and the abundant links that lie between them for those few who know how to look. ...it is one of the most important books of the 21st century. It is a grand theory for our times. If properly understood and acted upon, it has the potential to transform our view of our selves and our cultures...." *Jonathan Rowson, Head RSA.*

"Really superb! The best book on laterality I have ever read, with profound implications for the nature of consciousness ... Interdisciplinary scholarship unparalleled in recent years ... a true masterpiece ... The best book I've read in the past decade." *Professor Jaak Panksepp.*

"This is a very remarkable book ... McGilchrist, who is both an experienced psychiatrist and a shrewd philosopher, looks at the relation between our two brain-hemispheres in a new light, not just as an interesting neurological problem but as a crucial shaping factor in our culture ... clear, penetrating, lively, thorough and fascinating ... splendidly thought-provoking ... I couldn't put it down." *Professor Mary Midgley.* See more at

<http://iainmcgilchrist.com/comments/>

greater, given how well it seems to capture a pattern that those readers profoundly sense.

This review is a response to the above concerns. It is divided into self-standing sections with clear headings so that (hopefully) readers can find what they want. First, I review the main thesis of the book, and highlight aspects of the recent history of neuroscience and of the work itself that are important for understanding its reception. Second, to assess whether the book contradicted experimental evidence available at the time of its publication, I review its reception by qualified reviewers. Reviewers voiced notable praise and no damning objections *on the basis of the neuroscience*, and more guarded reactions to the historical arguments. Third, I address objections that I and likely many readers have heard repeated to the effect that any hemispheric specialization story conflicts with well-known facts about the brain. Fourth, I look at the nature of “viral ideas” and argue that TMAHE cannot by its nature be highly viral except within a particular, but nebulously defined, subset of the thought community. Fifth I discuss structural factors within science that work against its wide acceptance. Sixth, I review the results of experiments and of reviews of related neural evidence that have emerged since the book’s publication. Finally I discuss the connections between mindfulness and the book’s thesis on hemispheric specialization, including existing evidentiary connections and the difficulties and promise of establishing these.

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# Recap of the Main Thesis

This piece is written primarily for those familiar with the book. However, a brief summary of its thesis may be helpful.

McGilchrist characterizes the hemispheres as differing only somewhat in the sorts of behaviors that they take part in, but greatly in how they do what they do. The left hemisphere (LH), McGilchrist's "emissary," focuses on parts of the world, such as the objects of focused attention, and these objects' mechanistic interaction, pursuing analytical and linear thought. Its stream of attention proceeds from part to part, thought to thought, and it plays a great role in language which largely depends on taking the

world apart into pieces (such as represented by single “concepts”). The left as a whole can be seen as creating a virtual or representational world, that builds a model made of pieces, pieces it makes by a process of abstraction from the wider world of bodily and spatial experience, which is the specialization of the right.

The output of the “The Master”, the right hemisphere (RH), is what is called “being in the world”, as opposed to knowledge about the world. It includes for instance knowledge about which way to turn a particular door handle, that is not related or stored in words. It also includes automatic, but complicated behavior such as imitating another’s posture that we do without noticing that we do it. Take the process of imitating a friend who sinks back into her chair. Basic and unremarked-upon visual sensations occur to one when the friend sinks back, and bodily sensations then result when one sinks back but often, neither is thought of as sinking back at the time, and much less do we think of ourselves as mimicking, here. This is the RH at work, and it is no wonder that this process has been a mystery (Kavanagh, 2016).

The same mimetic ability of the RH according to TMAHE underlies empathy and understanding of social interrelatedness and, thus, much of our moral sense. Such complicated and automatic behavior includes much of the construction of spatial and embodied experience -- making the world is so automatic for us that we have thought that we aren’t making it, that it is just there.<sup>2</sup> As contemplative traditions have long noted much can be accomplished by ways of being that do not sound effortful. The idea that the world is just there belies a deep intelligence, as simply being in the world implies a sort of adjustment to it, and our basic experiences are just such an adjustment. The RH supports deep sensitivity that precipitates automatic response — or what we would simply call doing things intuitively.

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<sup>2</sup> Worth recalling here the anecdote that Marvin Minsky, a brilliant early artificial intelligence expert, assigned the explanation of human vision to a graduate student as a summer project. This is probably because, as esteemed vision researcher Donald Hoffman says, the experience of the visual world is so immediate it seems uncomplicated (Hoffman, 2007.)

McGilchrist holds that both worlds contribute to nearly everything we do, including art (think of rules of perspective in art or forms of poetry an LH contribution), and science (think of Einstein's visualizations of riding on a beam of light which involve the RH). However, the right hemisphere's mode of being has a sort of primacy, as it is more necessary for creating our "lived" experiential world, which linguistic constructions and representations are derived from. All words are important because they are about something, or refer to something, not important in and of themselves, while their referents are often important in and of themselves. Overall McGilchrist holds that the right hemisphere's mode of being is more sufficient for viable navigation of life though we would be greatly impoverished without the LH.

McGilchrist holds that efforts to characterize nature of the hemispheres have gotten confused because they have focused on "what" the hemispheres do rather than "how" they do things, with such efforts being unable to capture the right hemisphere's implicit ways. They are simply two main divisions of a "sense-making" organ that take quite different approaches to making sense of everything in front of them. Thus, though popular left-right stories will seem to resonate somewhat with the distinctions made above, they have not captured their essence nearly as well as they might have. Some of our subtlest philosophers have, however, remarked on the distinctions between our kinds of thinking based on their examinations of experience (phenomenology).

A subtlety that cannot be ignored (according to McGilchrist and a number of other lateralisation researchers) is that the two hemispheres' unique contributions are difficult to separate because the right helps to give birth the world of the left, and the right re-integrates what has been created by the left. An example offered is piano playing, a piece is broken down into notes in a linear and deliberate process and then reintegrated into a living whole and gradually turns into a matter of intuition as it is practiced. The right observes the outside world, and the left gradually distills parts out of that world,

but these parts are returned to the living world of the right hemisphere. This means that what occurs to either hemisphere is an outcome of a dialogue with the other hemisphere, and means that left hemispheric creations, including modes of thought or perspectives, can come to influence the right hemisphere's world on a deep level. It is notable that this element of the neuroscientific account of the brain, crucial for the account of cultural development, is the least thoroughly investigated, though recent findings with regard to metaphor processing seem to back it up (see below).

This is a very, very rough summary of the first part of the book – which is divided into two parts. The second part, and the more ambitious, then seeks to relate the hemispheric dominance to the evolution of western culture “the making of the western world” in the subtitle.

McGilchrist's main cultural thesis is that The West has managed to build a culture in which the left's more mechanistic way of perceiving and doing things is (apparently) quite sufficient for day to day existence, even seemingly preferable. Its way of seeing things is more real. This started with a privileging of analytical thought, beginning with Plato, and continuing up until at least the time of Kant, after which “push back” against the analytical mode's increasing application to ever more aspects of life began. The rise of analytical philosophy gave rise to the various sciences and to the gradual building of technical infrastructures and institutions such as the legal system, bureaucracies, corporations and mass production and in turn to a reality full of nearly identical technological artifacts that perfectly obeys rules, like levers, elevators, computers, and so on. This technical culture grows in potency with increases in knowledge and is easily navigated by the left brain, and its ubiquity means that one can increasingly get through life by using a “lifeless” model of the world and develop habits of expectation and perception geared towards navigating this world. We expect things to be precise and understandable. “Predictable” and “knowable” have shaded towards become synonyms for “real.”

However, this mode of being is both less joyful than the holistic mode, and is unwise and myopic, capable of understanding only what it already grasps firmly in an analytical fashion. It more easily understands the individual as a static and predictable entity separable from its environment, rather than as fluid and intertwined with its social context. To the extent that we commit to this latter mode of being it becomes true and we attend less to our relation to others or to the whole, believing that a focus on the known self is fulfillment. McGilchrist contends that a society cannot function like this in the long run, as rising mental illness and environmental degradation shows. Thus the historical journey of the West, has included material plenty following from the Emissary's ability to find rules by which to reliably manipulate the world, but increasingly risks taking us to unsatisfying and unsafe territory as we become committed to an ultimately unrewarding mindset and values that nevertheless make sense from the left brain's perspective.

This dynamic is what McGilchrist refers to with his metaphor of master and emissary. The right hemisphere, the most basic and necessary of the two worlds for existence, is the master. The left hemisphere derives its impressive powers from the master's guidance but is now hubristic, and believes that it can steer of its own accord, that its way of viewing the world is simply superior. It is both wrong, and blind to its wrongness, in a way that McGilchrist believes is endangering the human future, citing the environmental crisis, mental illness, cynicism, and alienation as just a few consequences.

## The Book's Reception

However interesting and seemingly brilliant TMAHE was, it, and its author, have a number of factors that work against its ability to capture the fascination of either the research community or the broader intellectual mainstream.

The first and most obvious issue is that ambitious characterizations of hemispheric differences have fallen strongly out of favor after an unsubtle pop-psychology mania swept through the world in the 60s and 70s. Though McGilchrist addresses this barrier, it is worth noting just how strong this barrier really is. Scientists may tend to give ideas a fairer hearing than does the general public, but newcomers to science are typically struck to find the same biases as they thought they left behind in the wider human population. Biases are unfortunately an inescapable outcome of making bets on limited information. What is seen as a bias from the perspective of a more informed party (somebody who has actually read a) is often a good, but losing, bet from the standpoint of the less informed party. Shallow heuristic thinking and reliance on intuition will save time, and, with the vast amount of information and ideas out there, time is one thing scientists are very protective of.

So when scientists hear effusive praise for a particular work they are constantly trying to decide whether they are hearing this effusive praise because the work is interesting and stimulating or because it is true. The past has shown science that hemispheric differences make for an interesting and stimulating story — the 60 and 70s wave of interest has become something of a case study in misguided pop-science mania used in undergraduate courses.

Unfortunately, the book that needed to overcome aversion for its acceptance was a long (1000 pages) and dense book written by a person previously unknown in neuroscience. It was written in beautiful but scholastic language that harkens back to the early 20th century, in a way that might be charmingly scholarly if it did not add to an already immense reading load. The formidable tome explains its view by reference to philosophical viewpoints that most neuroscientists are unfamiliar with. I can honestly say that I don't know more than a few psychologists or neuroscientists who have genuinely plowed through a single work of Heidegger, Hegel, Wittgenstein or

Merleau-Ponty. McGilchrist references all of them, with just enough detail and exposition to give a reader some chance of grasping their main points. Finally the book advances a sweeping hypothesis on the direction of Western civilization that can easily be charged with grandiosity while, along the way, siding with a number of minority positions in the field (such as that language may descend from song, that increased human ability for frontal inhibition is what enables metaphorical thinking, and claiming that language is not necessary for abstract thought.) To be clear, all of these positions do have vocal and respected proponents other than McGilchrist, but supporting one's main hypothesis with an argument involving a number of minority positions ensures that nearly everybody disagrees with one on some crucial point. Finally, its author is a practicing psychiatrist who is not engaged in research studies himself and was nearly 60 years of age at the time of the book's publication (though one with a very respectable background -- having been named an All Souls fellow several times.) Further, he has not followed up the work with empirical collaboration, but rather with extensive lecturing.

And it can be argued that this is just the start of the issues, because McGilchrist's own thesis implies that some of his key points are impossible to express precisely. Harkening back to the summary, the right brain's world is largely outside of language and hard to define, and therefore not fully graspable. This being the case, our ability to discuss this world in words is limited. One's ability to grasp what is being referred to as the right brain's world would be even more limited if one spent no time in unadulterated contact with this world. If McGilchrist is right, then practitioners of science, especially inclined towards analytical takes on the world, are in some ways the least suited to understand his thesis.

# Coherence of the Book with Scientific Evidence

## Some basic objections that might be encountered

Before getting to detailed reviews of the book I will address a few objections to the very ideas of hemispheric specialization that I, and likely others, have heard repeatedly.

These objections are that neural specialization is ruled out firstly, by the facts of neural plasticity, or secondly, by evidence that most tasks are performed by networks of areas spread across the brain. These objections are answered briefly below and more fully in the appendix. Readers untroubled by these objections may want to skip to the next section.

The argument that plasticity rules out specialization can be summarised as follows:

Area X is reputed to be specialized for function A, but when area X is destroyed, area Y does function A, therefore X is not specialised for function A.

This argument, if valid, could be applied to any seemingly specialised function for which plasticity effects have been shown. The problem is that plasticity effects have been shown for nearly every function the brain performs, and so by this logic, there are no specialized areas of the brain. This is plainly not the position of neuroscience, which still looks at neural areas as being especially involved in certain functions. The acronym fMRI (i.e. brain scanning) stands for “functional Magnetic Resonance Imaging” and is explicitly used to show the localization of neural functions.

Plasticity actually implies that brain areas are both specialized *and* pliable and that in fact their specialization is a product of learning *and* genetic endowment. Probably slight variations in gene expressions cause particular areas to be more able to learn certain functions. All learning implies change in the biological structure of the brain. Plasticity research has shown that the learning ability of neural tissue is so great that it is capable of radical change to make up for the destruction of neural areas that used to handle other tasks. The single point that must be emphasized is that the brain recovers its ability to respond to challenges after damage slowly, not immediately, and this recovery involves changes in the brain. Plasticity research shows an ability for re-specialisation, not that there is no specialisation. (See appendix for more detailed arguments on this point.)

The second argument, that the ubiquity of “diffuse functional networks” rules out lateralization starts with the observation that, while experimental subjects perform a particular experimental task a collection of spatially distinct and widely diffuse neural areas tend to light up on an fMRI scan. Furthermore looking across experiments, any one neural area joins with many different areas to do different tasks. One will sometimes hear it said that this pattern of results means that neural function is not localized, and so hemispheric specialization tales are obviously not true (again see appendix for fuller explanation.)

A first response is that, if no brain area were specialized for anything then either the whole brain would light up in a uniform dim glow, or activation patterns would be concentrated but chaotic as parts would take turns doing tasks. That isn't what happens, rather stable diffuse network respond reliably to the same task demands.

To put it simply the relation between larger brain subdivisions and the specific functional areas (e.g. Wernicke's area) is like the legal or accounting departments in a large corporation (the whole organization being the whole brain), and individual

members of those departments. Any activity of the whole corporation may tend to involve members of several divisions, but this doesn't mean that the divisions are meaningless categories. Members of divisions are most likely to work with one another, but across their varied activities, they are likely to collaborate with many other divisions. For example, the frontal lobe remains a meaningful functional anatomical category despite the fact that its many pieces cooperate with bits of other major divisions (e.g, temporal lobe) to perform tasks. Diffuse activation likewise does not show that the broader specialization between the hemispheres is meaningless.

## Reviews from Science

The agreement between McGilchrist's account of the hemispheres' roles and the enormous amount of evidence available at the time of book's publication is best judged by reviews of qualified professionals in academic journals. Academic journals publish book reviews and these are worth looking at. Book reviews for academic journals by neuroscientists and psychiatrists were on the whole very positive — *regarding the first section based on science*. The second half, which was not based on any direct neuroscientific evidence at all, was received on the whole as interesting and valuable but ultimately speculative.

Leslie Rogers was easily the most eminent lateralization researcher to write a detailed review, with over one hundred peer review articles and books to her credit, editorial service on the board of relevant journals, and membership in her national academy of science (Australia), etc. She has extensively studied lateralization in animals through lesion studies. I will quote extensively from her review in the journal *Lateralization* (2011), which was positive, but characteristic of reviews as a whole.

She relates initial skepticism towards the book based on its title and sweeping ambition, but concludes of the first section:

The author is clearly on familiar ground in discussing the effects of damage to one or other of the hemispheres on brain function and he presents a thorough and engaging account of the topic. Every point made is referenced: in fact, almost a quarter of the book's pages are notes and bibliography. I found myself moving back and forth between the text and the notes, and marking references that I *must* (emphasis in original) look up. The bibliography is a valuable source for scholars in the field.

And, still later Rogers approves the presentation of two worlds by saying "As McGilchrist explains in a great deal of detail, the hemispheres make individually coherent but incompatible representations of the external world, and are consequently in tension with each other." She voices no objections to the accuracy of his basic characterisations, here, and her sole complaint was that animal research (her specialty) could have been covered more comprehensively.

Of the second, historical part of the book, she writes:

There is bound to be disagreement here, as the book unfolds a broad set of ideas hung upon the framework of hemispheric specialisations. It is creative, and the breadth of the author's knowledge is nothing less than extraordinary. Yet one might be forgiven, I think, for being mildly, if not strongly, suspicious that the broad canvas of ideas and facts is being artificially moulded into the left right dichotomy, and for feeling that the case is stated too often or repetitiously.... Of course, there is no empirical evidence of these postulated shifts in the balance between the hemispheres, and critics will say that it is easy to draw up polarities that seem to fit with hemispheric differences but are a construct that trivialises the complexities. Nevertheless, McGilchrist's exploration of the idea makes a valuable contribution to thought, and it is fascinating to read. The author has not intended to impart a "truth" but to present an idea that might enhance our understanding of the world.

The many other reviews can broadly be characterized as lacking in strong criticisms of *the neuroscience*, and no review strongly disputed more than a few details in his portrait of the *hemispheres*. For instance one academic reviewer, Jeremy Holmes (2012), commented that the evidence regarding left hemispheric dominance in schizophrenia is more mixed

than McGilchrist allows (subsequent works on hemispheric differences vary across subtypes of schizophrenia). Other eminent academics with specialization in hemispheric divides who issued favorable comments were V.S. Ramachandran, Jaak Panksepp, Daniel Seagal, and Allan Schore — the latter two, incidentally, are also practicing psychiatrists.

On the other hand, reviewers varied in the reaction to the leap from the neuroscientific account to the story of a culture increasingly trapped in view of the world dominated by the left hemisphere. In most cases reviewers specialized in the brain or mind thought these ideas were valuable but explicitly left the evaluation of the cultural account to humanities scholars.

## Reviews from the Humanities

Unfortunately, reviews from scholars in the history of ideas are comparatively sparse. I will cover the most eminent reviewers, Mary Midgley and A.C. Grayling's, briefly. Mary Midgley, certainly well-suited to the task, was extremely positive (Midgley 2010), writing approvingly of the historical and cultural elements and concluding:

McGilchrist's explanation of such oddities (as contemporary notions of objectivity) in terms of our divided nature is clear, penetrating, lively, thorough and fascinating. *Though neurologists may well not welcome it* (emphasis added) because it asks them new questions, the rest of us will surely find it splendidly thought-provoking.

A.C. Grayling (2009) was impressed by the book's ambition, but had ambivalent conclusions about the cultural arguments:

The fact is that the *findings of brain science are nowhere near fine-grained enough yet to support the large psychological and cultural conclusions Iain McGilchrist draws from them* (emphasis added.) Absorbing and fascinating though the book is, it does not persuade one that returning our Western civilisation to the government of such supposed right-hemisphere possessions as religion and instinct would be anywhere

near a good thing. (Author's note: McGilchrist would obviously object to the charge that religion is a "right brained possession" as this would imply there were no context-independent rules in religion)

Fascinatingly, both of these reviews emphasize that scientists need to ask more questions for the book to be judged. At least these two reviewers partially passed the responsibility for evaluating the importance of second half back to science, though Grayling read the book as advocating a return to the right brain's world, a move he is skeptical of based on the superiority of current conditions over those of the past<sup>3</sup>.

Two other academic philosophers, Rupert Read (2012) and Arran Gare (2012) and an independent scholar, Bob Trubshaw (2009), wrote reviews for relatively obscure journals. Gare and Read were extremely positive while Trubshaw was disparaging and felt the second half of the book needed far more detail and cross cultural comparisons to be convincing.

## Synthesis of Initial Response

The main takeaway from reviews is simply that *the basics* of the roles proposed for the hemispheres proposed are much less controversial than one might think amongst researchers in neuroscience, *or at least the lateralization community*. Another interesting point is that the book was not reviewed in the more generalist journals in the field. Perhaps these points are related – lateralization as a subfield has lost influence within the wider neural research community, and it is my distinct impression that hemispheric roles are familiar to psychiatrists who recognize them as important, but receive little

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<sup>3</sup> This draws a false alternative between the current culture and that of the ancient past, as if we face a binary choice between the way things are now and the way we were in the past. The history of politics is full of attempts to answer criticism by arguments of this kind, which have been shown by history to wrong-headed (we always move to new state unlike either the present or the past.) McGilchrist history posits sways in the dominance of the hemisphere's perspective over a wide arc of history, such that very different periods were associated with balance or imbalances. So it seems possible that balance could be restored without fully returning to the culture of the renaissance era. Balance between the kinds of views of the hemispheres are not independent of, but rather are interdependent with, technology and culture of the time. McGilchrist really calls for new cultural innovations to restore balance. If the RH is indeed related to mindfulness and embodiment, we could be in the middle of such innovation, now.

emphasis among research neuroscientists and psychologists outside of the lateralization community<sup>4</sup>. It is worth noting that emotion and nonverbal behavior both have quite a bit to do with the right hemisphere (see below for corroborating accounts), and both fields feel that they receive little research emphasis in proportion to their importance in human behavior. This is what every field claims, but many fields are correct. It may also be that such fields have a structural difficulty in arguing for their value.

My impression based on these reviews and many conversations is that most people outside the scientific community and, importantly, many scientists outside the lateralization community, read the first half as being more uniformly controversial than it is. Note I don't think this because McGilchrist claims to be particularly controversial with regard to his summaries, but because neuroscience as a whole seems to disagree with its own specialists. The public thus thought that the story should stimulate a new interest in lateralization research which would support its wider narrative. In contrast, qualified lateralization scientists saw the book more as a philosophical tome that wove a historical account on top of a compelling exposition of relevant scientific facts.

It seems from these reviews that McGilchrist most distinguished himself by putting the hemisphere's specialisation into words especially satisfactorily and completely, rather than proposing roles that no lateralization researchers had previously anticipated. Readers may remember how often this section relies on long quotes from philosophers, which have the distinct feeling of persons straining for words. It may be that whenever one tries to describe the RH's role *succinctly*, one either: ends up in over simplistic dualisms, gives up simplicity and communicates by disquisitions, or utters something simple, and elegant but lacking in scientific precision. For example the early researcher John Cutting's statement about the role of the RH: "It is life, life itself." If accessible summaries are oddly unsatisfactory, then it is little wonder why non-specialists have developed an aversion to cleanly separating hemispheric roles.

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<sup>4</sup> As far as I know, there is no survey data to measure this.

McGilchrist's conundrum seems similar to that of a book on mindfulness. A mindfulness book usually takes a statement such as "be here now" as its theme, but few appreciate the nature of this theme easily. So, hundreds of pages are spent trying to transmit the spirit behind this elusive statement -- this is the point of mindfulness books. Yet, these many pages' best brief summarization may remain "be here now"<sup>5</sup>. McGilchrist might be similarly be thought of as proposing a simple thesis on hemispheric roles and then writing one book (part 1) to explain what he meant by the thesis in a manner which denies quick summary -- but then writing a second book (part 2) trying to show this thesis' relevance to history.

Such a dynamic creates a problem for the simple communication of the book's overall arc by word of mouth. More "viral" works typically propose novel but very clear theses and then spend a few hundred pages proving that this thesis is true. A few stark facts in support of this thesis can then quickly create reader engagement with the thesis, and short summaries can create buzz even among those who have not read it. In contrast McGilchrist would seem to have the best chance of going viral within communities that have enough background to understand the thesis without much reading, such as the Buddhist community, or people who've read philosophers such as Heidegger that hit upon the distinctions between two sorts of mental life that McGilchrist sees in the Hemispheres.

I find that most people who find the short summary of McGilchrist's thesis that I provided at the outset to be quite understandable and cogent, without having read the book itself, fall into one of these camps. So I don't think this review could do much to help the book's reach outside of the community who can ground its arguments. Instead,

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<sup>5</sup> Some readers may feel that successful scientific testing of mindfulness shows that is not difficult to describe. Its effects – or *what* it does, are not vague, but *how* it does this, how it feels, or how it evolves out of culture and environments is not easy to state.

my aim is to help those who do understand the book's main thrust to understand what we can learn from its reception.

## Some Scientific Developments Since the Book

Here I will discuss a number of neuroscientific findings that have emerged, which touch on the book's general characterizations of the hemispheres' roles. Though no laboratory experiment can directly measure the neural career of western culture, more research could make the leap from neuroscience to cultural criticism more explicit -- some formative work along these lines is also discussed.

I cannot claim that this is by any means an exhaustive account of relevant research, but the work that I have been able to find shows that the main divides posited by the book have continued to be viable, and that important aspects of the account have on the balance gained support.

### The Revenge of Mirror Systems?

I start with the recent controversy surrounding mirror neurons, given the fact that McGilchrist emphasized a role for the RH mirror system (empathy) in his account of shifting tastes and morals. This is yet another circumstantial factor working against the book. Research on the mirror system came under attack, in many ways quite rightly, shortly after the book's publication.

"Mirror neurons" is a name given to neurons that are observed to "fire" both when one is performing a certain action and when one merely watches this same action being performed by another organism. It is worth making clear that the term "mirror neuron" can be misleading since it may seem to imply that these individual neurons "do

mirroring.” In fact, any neuron whose activity is measured by single cell observations is just a part of a system composed of great numbers of neurons.

Names aside, the observation of these neurons’ behavior in macaque monkeys (Di Pellegrino et al., 1992) set neuroscience ablaze with speculation about mirroring systems in human brains -- they seemed to show a neural basis for empathy and imitation. Unfortunately, identification of this intriguing neuronal behavior drove wild speculation which, eventually, gave the basic research finding a bad name. Speculative overreach about these neurons and the systems they are part of included the contention that mirror neurons fully “explained” our understandings of action and of speech and language, autism, and civilization. The explosion of speculation reminded people of hemispheric speculations of a few generations earlier.

These claims were criticized roundly within the scientific community after receiving popular press coverage. The situation deteriorated to the point that the mere mention of mirror neurons, or more correctly, the mirror system, in non-disapproving tones was enough to elicit visible irritation from many researchers. For example, Gary Cottrell a prolific mathematical modeller, who with a team involving the highly accomplished imaging specialist Martin Serino, ventured into the area and worked to publish careful studies on mirror activity (Filimon et al, 2014), told me that nobody in the group had seen anything like the resistance to publication in this area in the early 2010s. In short, in the years following TMAHE, neuroscience’s main concern with mirror system was over whether there was a baby worth saving in the dirty bathwater (see Keysers, 2015 for a representative example of the timbre of this debate.) Nevertheless, a great deal of work (e.g. Filimon et al, 2014) supports the existence of widespread mirroring activity in the brain<sup>6</sup>, and single cell-recordings of mirror neurons in humans have since been taken, proving their existence (Mukamel et al., 2010.) Particularly, findings have emerged

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<sup>6</sup> See <http://sitn.hms.harvard.edu/flash/2016/mirror-neurons-quarter-century-new-light-new-cracks/> for a readable review.

showing differences in the kind of mirroring activity that happens in the two hemispheres.

## The specialisation of the right hemisphere in implicit versus explicit emotions

In 2013 Guido Gainotti published a review of the right and left lateralization of emotions that were unconscious versus conscious in origin, showing that both understanding of and control over unconscious emotions was primarily done by the right hemisphere. Note that the findings here covered emotions expressed via the face. Facial information is of course also consciously recognised and is typically focused on by the gaze. Therefore, fMRI responses to faces are typically bilateral, as faces are processed by both implicit and explicit routes. Gainotti relies on subtle differences in methodology and data from abnormal participants to tease apart the roles of the hemispheres. His findings were again in line with TMAHE showing.

## The Specialization in Right Lateralized Areas For Understanding Nonverbal Behavior

It is interesting to note that in all of the long furor over mirror neurons very little was done to investigate whether the mirror neuron system had a special role in the understanding of the implicit and emotional aspects of behavior versus the goal directed aspects of behavior until quite recently. The lab of Rizzolatti himself in Parma (Di Cesare, 2012), have recently started investigating neural distinctions between the way things are done rather than what is done — for instance an angry action raise of the arms versus a joyful one, for example. What they have found, again, is that right lateralized activity is involved in the recognition of the emotional timbre of movements. This takes place in regions specializing in physical motion, and the authors take this as another instance of mirror activity. That there is relatively clean lateralization of the

recognition ability makes sense as the timbre of bodily motions is less remarked on explicitly. Related results have been obtained by other groups (e.g. Kuzmanovic, 2012.)

Further evidence has also emerged from Rizzolatti's group that this activity involves the nonverbal aspects of speech such as tone. Experiments in which subjects had to differentiate between emotional tones with which something was said show that the right insula, which has been shown to have mirror properties in the past, was especially activated during this differentiation (Di Cesare, 2017).

## The role of the right hemisphere in mimesis

Mimetic (copying) abilities are one of the major reasons why the right hemispheric earns the label of "Master" importance, according to McGilchrist. This was one of the more controversial claims made in the first section of TMAHE, as there was a little evidence.

Mimicry or the unconscious copying of behavior is a well known activity with obvious relation to mimesis. Very few studies have been done of this behavior's neural correlates, none of them involving the spontaneous imitation of expressions — the mirror neuron community instead had focused on paradigms involving intentional actions which are mirrored in the left hemisphere. TMAHE predicted rightward lateralization of the neural correlates. When subjects were exposed to faces in a scanner, and their facial movements recorded fMRI recordings showed that mimicry was timed with right lateralized activation in areas known to have mirror properties this was different from intentionally copied facial expressions (Likowski, 2012.) This would seem to show that not only are intentional actions and implicit actions differently lateralized but copying of the same is also differently lateralized, as TMAHE held.

# Metaphor Comprehension

Another important aspect of McGilchrist's story is that the right hemisphere plays more of a role in metaphorical thinking, especially when we are finding new ways to put things into words. In a highly influential paper Desai and colleagues (2011), repeated exposure to metaphors was shown to move the neural addresses of metaphorical comprehension leftwards, capturing the process of conventionalization by which metaphors turn into commonly used language. That is "understand" can be seen as metaphorical, for standing under or holding a piece of knowledge, but is so commonly used that we do not think of it as a metaphor at all (e.g. it is conventionalized.) In another consistent finding, the tendency for metaphors to be processed by the left or right was shown to depend on the difficulty of those metaphors -- how far they depart from what is already understood (Yang, et al., 2009.) A review of the evidence from across fMRI studies of metaphor processing (Yang, 2014) also had similar findings, but also concluded that complexity of context increased right hemispheric involvement.

At the same time the idea that human abstract thinking is at its base metaphorical, and that such metaphors are embodied has gained increasing attention (Bergen, 2012.) Putting these two findings together would indeed seem to provide evidence that powerful abstract systems of thought are understood initially through right hemispheric activation, but move to the left. It should be noted that the process by which this happens is not understood in great detail, however. Further, the task of documenting the process of novel idea generation has received very comparatively little attention from neuroscientists, and this would be required to fully substantiate McGilchrist's cultural story showing creation and removal.

# Lack of Attention Towards Implicit / Explicit Distinctions

A work published before the book but still worth mentioning is a synthetic review of humor research by Matthew Gervais and David Sloan Wilson (2005.) They reviewed evidence on humor in an attempt to ascertain its evolutionary origins. One of their main findings was that the lack of attention to the divide between implicitly and explicitly produced laughter has kept the field back. While many studies of humor had been done, almost none of them measured whether laughter was intentional (Non-Duchenne after the famous French investigator) versus non-intentional. These would be entirely different responses according to Gainotti and McGilchrist – as well as common sense! Gervais and Wilson concluded that on the basis of this methodological oversight, a great deal of laboratory studies cast little light on the origins of humor.

This is worth mentioning because it highlights the fact that measuring the distinction between two different ways of producing the same outwardly similar behavior is hard. So hard, in fact, that an entire experimental research program has barely attempted to create experimental measures of the commonly accepted distinction between displays of genuine and fake humor. This despite the fact that the distinction is widely recognized and lack of attention to it has seriously compromised researchers' ability to make sense of the data.

## WEIRD People

Joseph Henrich, Steven Heine, and Ana Norenzayan published a highly cited article in 2010 within the field's single most influential journal, *Brain and Behavioral Science*, that echoes some of TMAHE's statements about western culture. The evidence reviewed in this article, showed that the subjects of western psychology were very different from the rest of the world in many ways. Importantly, these "White Educated Industrialized Rich

and Democratic (WEIRD)” subjects have very different concepts of the self, greater individualism, and a far greater tendency towards analytical strategies. Western subjects show less attention to the scene that an object occurs in, rather than the object itself, less sensitivity to the context of a behavior, and a greater tendency to reason about moral behavior in terms of moral rules, all as would be predicted from McGilchrist’s thesis. Further, what longitudinal evidence there is shows that this has been increasing over time — for example, the Flynn effect of rising intelligence is driven by rises in the analytical subjection of intelligence tests (see section 6.3 of Henrich et al.)

This article is worth mentioning solely for the evidence that it presents, though this was gathered before publication of TMAHE (though much was not cited by McGilchrist). It is also notable that a review concluding that western subjects are so unusually analytical, individualistic and negligent towards context that experimental results based on this population should be viewed skeptically, was able to pass the most difficult peer review process. Not only must articles in *Brain and Behavioral Sciences* be reviewed by seven people considered at the top of the field, but extensive comments on the article by peers are published. None of the 28 commentaries disputed the veracity of the West’s special emphasis on analytical strategies.

## The Right and Left Hemispheres and the Connectome

The leading light of the science of “connectomics,” Olaf Sporns, has asserted that brain areas seem to be located so that those that must frequently talk to each other are closer to one another (see appendix on diffuse neural networks). This would seem to imply that the two hemispheres, which are ostentatiously separated by a fissure, reducing their interconnectivity, should tend to contain sorts of areas that tend to be interrelated. Research based on network analysis indeed shows evidence of the hemispheres tend to keep activity within themselves ([Iturria-Medina et al, 2010](#)) and that this is more

pronounced in the left hemisphere than with in right, as well as showing broadly differential patterns of interconnectivity (Daianu et al, 2012),

Though much scientific substantiation remains to be done, the broad patterns of connectivity would seem to be consistent with fundamental hemispheric differences and the idea that the left hemispheric mode tends to lead back into-itself. This can be taken as evidence for a plausible means (from a biological angle) by which historical alienation from right hemispheric modes of thought could happen. Substantiation of the idea of such a link could only be achieved by longitudinal fMRI studies, which have not been done.

## Parallels between the Book's Right Hemisphere World and Mindfulness

The Right Hemisphere is, according to McGilchrist, what gives us presence in the world: a sense of embodiment or of *being in the world*, rather than of *thinking about the world*. The similarities with states resulting from mindfulness practice is hard to miss. Heidegger, in McGilchrist's estimation, gives the clearest exposition of the right hemisphere's world and arguments for its value (without, of course, any reference to the neural processes.) Allegedly Heidegger agreed that he had arrived at a philosophy similar to Zen Buddhism after reading Suzuki (Barret, 1956.) Accordingly, there has long been a feeling that Heidegger's preferred mode of being was closely related to mindfulness.

In TMAHE, McGilchrist does not deeply explore the possibility of such a connection. This seemed an oversight to many readers with mindfulness practice, who felt he

missed engagement with one growing audience who are positioned to understand his thesis. After all, the right hemispheric states related by McGilchrist seem not only connected to presence but to “action through inaction”, the famously difficult to grasp contention that we can do many things without conscious intention. This state of being, which is an aspiration of many meditators, seems to be quite in line with the RHs modes of “thinking” as described in the book and the book’s claims of the sufficiency of the RH.

In subsequent work McGilchrist (2016) himself noted the seeming connection between the view of the self that he attributes to the LH and RH and what are called “illusory” or true selves, respectively. Related terms common among buddhists would be the small mind -- the mind *as conceived of* that is separate from the world -- and the big mind, which “is the world.” McGilchrist asserts that these views of the self are likely rooted in the views of the two hemispheres, and also briefly alludes to the fact that mindfulness would seem to have a connection with the right hemispheric world.

Why did McGilchrist largely not explore this connection in TMAHE<sup>7</sup>? The answer, I hazard, is that this connection was temporarily missed because he relied on sources that did not differentiate between meditative practices. In particular, McGilchrist noted in a lecture that I attended that studies have shown an association between meditative experience and increased left hemispheric activation. This called into question, for him, the suggestive connections between right hemispheric states and mindfulness. The bliss states which McGilchrist referred to, however, have nothing to do with the famed “Nirvanic bliss” of Buddhism.

Instead the studies in question were focused on bliss states achieved during meditation for concentration (the Jhana) that Buddhism has always differentiated from Nirvana.

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<sup>7</sup> McGilchrist does in a few places cite the Buddha as agreeing with limits of language and draws a fleeting analogy between escape from the right hemisphere’s world and zen meditation but does not pursue it at length.

Further, the distinction between mindfulness and concentration meditation is probably the most fundamental distinction between classes of meditation that exists in Buddhism. Tradition has stated from very early times that concentration states are a means to the end of gaining greater wisdom (Brasington, 2015.) Some lineages, particularly many forms of Zen, eschew these concentration meditations altogether. Here concentration meditations, which predate Buddhism, are eschewed in favor of mindfulness meditations, which the historical Buddha is thought to have originated (Laity & Hanh, 1990.) Accordingly, the left-hemisphere's involvement in these concentration-filled bliss states should not impinge upon the notion that the right hemisphere has a special relationship with mindfulness.

In fact left hemispheric involvement should be expected in these states, which are arrived at by cultivating "the rapture born of seclusion<sup>8</sup>." Seclusion is essentially isolation in predictable surroundings. One well-known procedure for reaching concentrated bliss states includes focusing on external objects until a replica of that object appears in the mind, and then focusing on that already known replica, until a luminous replica appears<sup>9</sup>. The process of disappearing into an ideal replica of reality completely hardly sounds like the right hemisphere at work. If anything LH involvement in such states offer further evidence for McGilchrist's division. In personal correspondence with McGilchrist, he agreed with the above arguments.

Recent studies do indeed show that mindfulness activates a wide array of regions in the RH (Berkovich-Ohana, Glicksohn and Goldstein, 2012; Hölzel et al., 2011) as well as the left hemispheric area known to be involved in inhibition of language. From a meditator's standpoint, this seems a realistic picture of an internal state, even after years of mindfulness practice -- a shift towards the right hemisphere (accepting TMAHE's general picture of what this is like) and an active suppression of the internal dialogue.

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<sup>8</sup> [http://www.palikanon.com/english/the\\_jhanas/jhanas04.htm](http://www.palikanon.com/english/the_jhanas/jhanas04.htm)

<sup>9</sup> [http://www.palikanon.com/english/the\\_jhanas/jhanas03.htm](http://www.palikanon.com/english/the_jhanas/jhanas03.htm)

It is worth contemplating the finding that mindfulness meditators show a shift in activity to the right hemisphere, but not activity *only* in the right hemisphere. What does this imply for the relation of the RH to mindfulness? The fact of the matter is that most meditators report that they have a significant amount of “busy mind” (i.e. inner dialogue, primarily associated with the LH). So, if internal chatter is identified with the left hemisphere, we should indeed expect continued leftward activation, even in expert meditators. Further meditators can be mindful and non-judgemental towards their own chattering mind and towards the objects of internal thoughts. Many forms of meditation also involve active yoking of the intellect to the present moment by describing thoughts as they arise. In this case we might say that the use of intellect is one of the things that we are “mindful of.” Notably this is the case of MBSR, the most commonly studied type of meditation. All this *could* explain the leftward activation observed in meditators, but does not prove that mindfulness is solely identified with the right hemisphere.

It is worth considering how the RH-mindfulness connection could be more precisely measured in a way that will be compelling within science’s current standards of proof. We might imagine that the RH’s role in mindfulness could be more easily established by measuring neural activity when various levels of “quietness” or “wholeness” were reached during meditation. How shall we measure such quietness? Certainly not by measurements of RH activation, as that would amount to a circular argument.

The most straightforward way would seem to be to ask meditators for information about the quietness of their conscious experiences. Such a question would inevitably interrupt meditation, however, and arguably even anticipation of such interruptions will disturb meditation. Even if a satisfactory method could be devised, the resulting study would rely on first person reporting correlating the self-described mindfulness with the RH. In the end then, the study would have to rely on “subjective” self-report to establish mindfulness. But, the attraction of fMRI, in the first place, is that it measures

neural states that can be correlated with observable experimental behavior, creating a semblance of objectivity.

Study methodologies that focus on connecting self-reported consciousness states with brain measurements, are dubbed “neuro-phenomenology.” They have been called for since the early days of meditation research by no less than the co-founder (along with the Dalai Lama) of the Mind and Life Institute, Francisco Varela, who felt it was the only way to study consciousness. Neurophenomenology has, however, found few backers until very recently as scientific research has focused on *what* mindfulness does rather than *how* it feels. In the last few years, however, the general neurophenomenological project finally started to gain some traction (Thompson, 2017.) An interest in the brain basis of the experience of mindfulness seems inevitable, and if this in turn yields what McGilchrist leads us to think it will, interest in the right hemisphere and perhaps the wider thrust of his story may garner greater interest. Though neuroscience can only provide circumstantial evidence about the divided brain role in the making of the western world, the book’s historical account may prove its worth by suggesting and explaining the routes by which presence, perhaps achieved partly by mindfulness meditation, can impact the social ills that McGilchrist describes.

In the meantime, I hope in this review to have provided some means of evaluating whether, if McGilchrist’s historical account had some merit, this would have been conclusive by now. For a variety of methodological and historical reasons, the answer I believe is “no” and the jury will remain out for quite some time. I do not claim to have proven or disproven McGilchrist’s claims but, I strongly agree with him that science’s powers are limited, and so there is danger in expecting worthwhile but difficult ideas to be proven speedily.

# Appendix

## Responses to objections that Plasticity or Diffuse functional Networks rule out Hemispheric Specialization

Objection 1: Don't plasticity findings mean that parts of the brain don't really specialize?

*Objection 1: Don't plasticity findings, which show that the brain develops differently according to experience, and that one part of the brain can take over for another part that is damaged, mean that parts of the brain don't really specialize?*

Neural plasticity, the brain's ability to remain viable by changing its structure after brain damage or changing tasks has gained a great deal of attention over the last 20 years providing a great antidote to crass genetic determinism. If many brain areas are ultimately capable of doing a given task, one might think this contradicts the idea that two halves of the brain are "for" different things.

A quick response is to read reviews of book by neuroscientists in professional journals, to see if they share this objection. The buzz over plasticity started with Neuroscience in the 1990s with the pioneering M. Merzenich being inducted into the US National Academy of Science in 1999 for his plasticity work, and retiring in 2007. So, though members of the public may think plasticity is new and pioneering because the buzz took some time to spread to popular sources, qualified reviewers would likely have

spent years hearing about such findings and teaching undergraduates about them by 2009.

The only neuroscientist or psychiatrist who alluded to plasticity in their review of the book did so to criticize McGilchrist for not doing enough to forestall objections of this kind, even though such objections were wrong-headed.

*Research on animals has shed light on the influence of experience on the development of hemispheric specialisation, and something could have been said about these developmental processes in the book, if only to make completely sure that readers will avoid making the erroneous assumption(emphasis added) that the author is referring to genetic determinism. This is not the case, as McGilchrist states, but in these times of over-attraction to simplistic genetic explanations for human behaviour, I think this point could perhaps have received a little more emphasis than is given in the book.*

– Leslie Rogers (prominent animal lateralization researcher), book review in Lateralization

But, for thoroughness' sake, a more detailed explanation of what plasticity is and how it works is offered below.

Plasticity's implications for neural specialization are nuanced, but understandable. If some neural area is destroyed, then other areas tend to get recruited to fill the functional void. In the process of helping to perform a task previously performed by another neural area, these "fill-in areas" must change because learning to do new things always implies physical change in neurons. Learning involves physical changes in synapses the distances between axons and dendrites. The more distant are the signal sending end of one neuron, the axon terminal, and the receiving end of another neuron, the dendrite, the more difficult it is for one neuron to make another fire, and thus to send signal on to further neurons, in a process that will eventually result in an action, which will in turn

result in positive and negative reward. If the end result of the action is positive, then the pattern of signal passing between neurons that produced this action is reinforced by strengthening the relevant sequence of connections between. As the saying taught in neuroscience programs worldwide goes: "neurons that fire together wire together." Drastic changes in the demands on a neural area will force drastic changes in the connections it needs to make, which is the same thing as saying that its structure changes.

This does not at all change the fact that in undamaged adult brains certain brain regions strongly tend to be involved in certain tasks and that the pattern is far too regular across individuals not to have some kind of basis in genetic endowment.

Simply put, what the brain is clearly hard-wired to do is to learn and therefore to change, and certain neural areas adjust to certain things more easily. The brain recruits the part that is best able to learn how to change its structure so that a satisfactory response is produced -- the area best suited to support learning. If that part, with its biological changes acquired in process of learning, is destroyed then another part will be recruited to help produce a satisfactory response. If the brain region that already learned some kind of knowledge is destroyed, then memory and past learning is destroyed, and new learning will have to take place in order to deal with the same situation as were dealt with by the destroyed area. This adjustment demand changes in the structure of the brain, sometimes large ones. None of means that it is a waste of time to think of parts of the brain as being specialized -- they are both specialized and pliable.

Question 2: Doesn't recent research show that the brain isn't divided into distinct specialized modules? And doesn't this contradict lateralization?

On a quick reading, McGilchrist's story of hemispheric differences might seem contrary to some relatively recent developments in Neuroscience that have challenged traditional notions of the way that the brain is specialized. The simple traditional way to explain how brain works is to divide it into different parts and to explain those parts in terms of particular functions that are relatable to the listener — such as recognizing a face. This style of explanation is similar to the way that DNA has often been explained, genes control particular traits that are familiar to the listener's day to day experience or "controlling" these traits — so we might think there is a gene "for" blonde hair.

Work in brain and genetic sciences have illustrated the limitations of these simple and relatable explanatory styles. In genetics, we have found that a change in a particular gene will often result in changes in many observable relatable traits, and in the brain we have found that particular areas are often involved in many of the different tasks that we can relate to in daily life, and many brain areas are involved in one task.

So, it is true that theories "modularity of mind" has been attacked forcefully, but replacement theories do not rule out hemispheric specialization. The idea of modularity that has been disposed of is one in which each area is used for one thing and one thing only. The diffuse patterns of activation observed in fMRI brain scans are such that not one contiguous module, but a number of areas that sometimes far apart are active during a certain task. This has led to shift in language so the brain is said to "recruit" various neural areas into networks that accomplish the performance of important tasks. This does not mean that the pieces making up a network are not specialized, it means

that their specialization is not such that it makes them good for one thing only. The same network (group of brain areas) gets activated over and over again when doing the same task, but this is seen as implying that various specialized pieces work together to do a particular tasks, and a given task usually requires many neural areas.<sup>[2]</sup>

A simple analogy all the tools in your toolbox are specialized, few of them are only useful in one kind of job. A hammer may always pound nails but it pounds nails as part of many overall pursuits. A task also often requires many tools. More complex analogy — we like to think of there being one or one dominant gene for a particular feature, like brown hair or soft skin, but now we know that most features result from interactions of many genes, and genes contribute to many characteristics. It isn't the case that genes are substitutable for one another, they are multi-purpose, and most purposes require many genes, just like neural areas are multi-purpose, and individual purposes usually require many neural areas.

A concrete example of shifts in thinking is that the recognition of faces used to be said to be localized in “the facial fusiform gyrus.” But it was found that people who were experts in birds used this area to look at birds. Now this same area is called “the expert area” by many people (who are clearly more right), because many studies show that it supports fine distinctions between instances of a category. Its abilities to see fine distinctions are recruited during a variety of tasks other than recognizing faces, along with a changing cast of collaborating areas. Another area the right Inferior Parietal Cingulate (rIPC) seems to specializes in sensing “magnitudes”, and is recruited during a diverse array of tasks. Involving the magnitude of any quantity — a potential infinity of applications.

The emerging consensus is just that way the brain divides up work into functions (what tools it makes/uses) is oftentimes very different than the way that our conceptual

system divides our behaviors into functions. Nature has different ideas about how to do things than we do, and doesn't feel obliged to make our conceptual system aware of its plans.

The emerging consensus on neural organization can very easily be used to argue for the specialization of the hemispheres. In fact, highly influential research by Olaf Sporns and colleagues shows that the brain is organized so as to minimize the distance between the various pieces that frequently work together to perform tasks -- allowing them to connect easily. Since each distinct area is recruited into a variety of networks, making it impossible that all networks are composed of adjacent pieces, but overall the pieces are so organized as to be grouped close together with other pieces with whom they must oftentimes work. This thesis necessarily implies that the right and left hemispheres' parts tend to be interrelated -- though it doesn't, by itself, imply that they are two distinct "worlds."

## Why are Such Objections Popular?

The reason above arguments against the possibility of hemispheric specialization are so widespread despite being mistaken is, I believe, because of past overreach of popular lateralization tales. This has resulted in unduly favorable conditions for any argument purporting to argue against them.

Popular construals of hemispheric roles have become the canonical example of science myth. I have seen this same dynamic prevail in the case of the "mirror system." As mentioned the overreach of mirror system speculation included that mirror neurons fully "explained" our understandings of action and of speech and language, and received sensationalist popular press coverage in a situation reminiscent of the hemisphere-mania of the 60 and 70s.

In the years afterwards, similarly weak arguments against the existence of the mirror system were commonly accepted, for instance that its evolutionary importance was disproven by studies showing that tendencies for automatic imitation could be extinguished with extensive conditioning – eyeblink and gagging responses can be extinguished with proper determination as well, but we would not deny their existence or their importance for human evolution.

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