

**MARY GOES GLOBAL:**  
**Can a neural model explain phenomenal consciousness?**

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Mary the Neuroscientist has exited and re-entered her black-and-white room many times in the past twenty years. In fact, many of the articles written on this thought experiment address the fact that there are a plethora of papers on the subject, a testament to the difficulty in coming to any resolution on the matter. The endurance of Mary and the knowledge argument is not strictly based on the debate between property dualists and physicalists. Rather, I contend that the discussion is shifting to a dispute between antecedent physicalists and reductive eliminativists, thus keeping Mary's predicament of seeing red alive and well.

In this paper, I sidestep the question of whether or not physicalism is false with regards to the knowledge argument, opting to discuss whether or not phenomenal consciousness in a physicalist's world lies beyond our comprehension. I will present the arguments for and against eliminativism and functionalism using the Global Workspace Theory (GWT) neural model as a framework for understanding such a model's validity for explaining Mary's first red quale experience. In the end, I defend qualia and physicalism from a revised GWT perspective.

## 1. MARY THE INFAMOUS NEUROSCIENTIST

The story goes as such: Mary is stuck in a black-and-white room with a black-and-white television and books that give her all the physical facts of the world outside her little box. Remarkably, Mary is able to ingest and store all these facts in her head, knowing all there is to know about biology, physics, and neurophysiology as well as their casual, relational, and functional roles.<sup>1</sup> In essence, her brain can be viewed as a storage unit for every science class and paper ever written. One day Mary is allowed to exit her prison of knowledge and sees color for

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<sup>1</sup> Frank Jackson. "What Mary Didn't Know." *The Journal of Philosophy*, Vol. 83, No. 5. (May, 1986): 291.

the first time. Jackson believes that she learns something new – namely, the experience of what it's like to see color. He continues:

It seems just obvious that she will learn something about the world and our visual experience of it. But then it is inescapable that her previous knowledge was incomplete. But she had *all* the physical information. *Ergo* there is more to have than that, and Physicalism is false.<sup>2</sup>

Even though Mary knows all the physical facts, something novel is introduced thus some non-physical goings on must be present.

John Perry concludes that there are three ways Mary might respond when seeing a ripe, red tomato for the first time: (1) “Wow! This sure is a neat experience!”, (2) “Ah, that’s a tomato and must be red.”, or (3) “Yep. This must be the red that everyone experiences like me.”<sup>3</sup> The first experiential expression is no problem for physicalism since it does not yet invoke a subjective character – it is merely functional processing of primary sensory systems. This can be filed under Chalmers’ *psychological* consciousness. The same is true for number two where Mary simply makes a logical inference that since tomatoes are often red, then this is what it must be like to see red now. Option three, however, is what Jackson believes is the problem for physicalism. Here we move beyond sensation, awareness of sensation or memory storage of sensation and into the conceptual status of red sensation, i.e. the tomato’s “redness”.

Perry discusses this issue at length and since this paper is centered on debate between physicalism and eliminativism, I will conclude by saying that I agree with Perry’s remarks: “If subjective characters are physical aspects of experiences, as the antecedent physicalist maintains,

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<sup>2</sup> Frank Jackson. “Epiphenomenal Qualia.” *The Philosophical Quarterly*, Vol. 32, No. 127 (Apr., 1982): 130.

<sup>3</sup> John Perry, *Knowledge, Possibility, and Consciousness* (Cambridge, Mass.: The MIT Press, 2001), 95-101.

then if Mary knows all of the physical facts, she will know about subjective characters.”<sup>4</sup> In short, Mary knows that other people have qualia of experiencing red and is *not* lacking in her ability to register what it would be like to see red in her black-and-white room.

By accepting Perry’s argument in the Mary thought experiment, I am forced to eliminate property dualism as an option. So what does that leave us with? The following categories are not static but present a broad range of non-dualistic, all-is-physical treatises: functionalism, eliminativism, and antecedent physicalism. How would someone in each of these groupings respond to Mary’s initial red tomato experience?

Functionalism states that everything is physical and that all mental states (beliefs, desires, etc.) are equivalent to their functional role. Such a role can even be taken on by a computer. Ned Block accuses Global Workspace Theory of being a consciousness theory that resembles machine-state functionalism as seen in the Turing machine experiment.<sup>5</sup> For the functionalist, red is a functional property that is linked to Mary’s mentally pre-wired notion of red as noted in some particular brain state. Thus, Mary would probably exclaim in a manner similar to (3) in Perry’s options for Mary’s response to seeing red for the first time.

The eliminativist is often lumped in with the functionalists, but this is not necessarily appropriate since eliminative materialism takes an even bolder position by ridding of mental states entirely. Such a viewpoint stands as a reaction to folk psychology and is loudly touted by

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<sup>4</sup> Ibid., 98.

<sup>5</sup> In his article “Troubles with Functionalism” (1980), Block lays out his objections to functionalism by presenting the “Chinese nation” hypothesis, a variation on John Searles’ famous Chinese room thought experiment. In Block’s hypothesis, he imagines the entire nation of China organizing as a brain with each individual representing a neuron. According to functionalism, by aligning in the proper manner, consciousness will be achieved yet Block believes this to be absurd. His objections are furthered in the special 2001 Cognition issue regarding Global Workspace Theory.

Patricia Churchland<sup>6</sup>, Paul Churchland<sup>7</sup>, and Daniel Dennett although even among this triumvirate there is much variation. “The eliminativist's claim with respect to qualia is that there is no unbiased evidence for such experiences when regarded as something more than propositional attitudes.”<sup>8</sup> So how would Mary respond to seeing the tomato here? Since mental states just are biological brain states, there is no such thing as qualia therefore no “this is what it’s like to see red” exists. Mary would say, “Red. Just as I knew it would be.”

Lastly, there is the physicalist who holds that there are no facts outside the physical facts. The prior two categories fit into this scenario as well and in order to differentiate them from this current categorization, when speaking of physicalism that does *not* negate qualia I refer to antecedent physicalism. Individuals like Perry, Anthony Jack, and Tim Shallice accept the fact that qualia exist as long as these subjective features are not nonphysical in nature.<sup>9,10</sup> And what would Mary’s reaction be to the tomato in the antecedent physicalist’s case? I hold that it would need to be something akin to (1) of Perry’s three options. Why? Because for this type of physicalism, the element of *experience* is essential and the red quale is intrinsically tied to the act of seeing the red tomato for the first time, eliciting a response of newness that necessitates a *relation* in order to get a categorization. In other words, Mary would see the tomato and be shocked by the new felt sense of “redness”. She would not deem this a *red* tomato until an observer watching the entire scenario informs Mary that the tomato she saw in her black-and-

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<sup>6</sup> See her monumental work *Neurophilosophy: Toward a Unified Science of the Mind-Brain*

<sup>7</sup> See his book *The Engine of Reason, The Seat of the Soul*.

<sup>8</sup> Eliminative materialism. (2006, December 3). In Wikipedia, The Free Encyclopedia. Retrieved 23:41, December 5, 2006, from [http://en.wikipedia.org/w/index.php?title=Eliminative\\_materialism&oldid=91860459](http://en.wikipedia.org/w/index.php?title=Eliminative_materialism&oldid=91860459)

<sup>9</sup> Perry, 27.

<sup>10</sup> Anthony I. Jack and Tim Shallice. “Introspective physicalism as an approach to the science of consciousness.” *Cognition*, 79 (2001): 161-196.

white books is indeed red (as opposed to a yellow or green tomato which she would have assuredly read about in her room).

## 2. GLOBAL WORKSPACE THEORY

Numerous institutions are currently building models that claim to be hot on the trail of explaining consciousness by way of mathematical neural modeling, one of which is being constructed here at Boston University in the Cognitive Neural Systems department headed by Stephen Grossberg.<sup>11</sup> Little, if anything, is written on the philosophical ramifications of Grossberg's ART model whereas Global Workspace Theory has captured the attention of several philosophers of mind. For this reason I will focus exclusively on GWT even though the arguments raised here could be considered indicative of other consciousness neural models such as ART.

Bernard Baars is the father of GWT, formally introduced in his 1988 work *A Cognitive Theory of Consciousness*. The theory has, as most models tend to do, morphed into a more complex structure over its 18-year life span, yet the basic tenets pertinent for discussion here remain the same for his view on consciousness modeling. Since other variations of GWT now exist, I will call Baars' theory Classic GWT.

Baars' view begins with a "contrastive analysis" of paired comparisons between conscious and unconscious processes that correlate directly with first-person, subjective experience. Baars believes that consciousness is necessary to recruit unconscious, specialized networks that function as the primary vehicle for working memory. In other words,

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<sup>11</sup> Grossberg's theory of consciousness and cognition implements the renowned Adaptive Resonance Theory developed by the CNS faculty. It focuses on the linking of attention to learning, expectation, competitive networking, synchronization and consciousness.

*consciousness creates global access.*<sup>12</sup> He continues by discussing Classic GWT as a “working theatre” in a manner similar to Daniel Dennett where consciousness is like a theatre. In this theatre focal consciousness is the “bright spot” on stage, beamed there by a selective attention-based spotlight. The faded light at the bright spot’s edges are considered to be vaguely conscious events. “The entire stage of the theatre corresponds to ‘working memory’, the immediate memory system in which we talk to ourselves, visualize places and people, and plan actions.”<sup>13</sup> The audience out in the dark receives information from the bright spot on stage and is analogous to unconscious events. Most recently, Baars has teamed up with Stan Franklin to pair Classic GWT with Franklin’s IDA model that processes conscious thought as a cognitive cycle that consists of perceptive, competitive, and executive functions that choose and produce action output.<sup>14</sup>

A theatre-based interpretation of GWT is not the only option. In the impressive 2001 special issue of *Cognition* on cognitive neuroscience of consciousness, Stanislas Dehaene and Lionel Naccache give a provocative and expansive overview of basic evidence for a global neuronal workspace that borrows from Baars’ work yet differs from it by eradicating the theatre concept in its entirety. Their framework states that “at any given time, many modular cerebral networks are active in parallel and process information in an unconscious manner.”<sup>15</sup> Conscious information is made available by the long-distance connective nature of “workspace neurons” that reside primarily in the prefrontal cortex and anterior cingulate (two areas typically known

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<sup>12</sup> Bernard J. Baars, “In the Theatre of Consciousness.” *Journal of Consciousness Studies*, Vol. 4, No. 4 (1997): 292.

<sup>13</sup> Ibid.

<sup>14</sup> Bernard Baars and Stan Franklin, “How Conscious experience and working memory interact,” *Trends in Cognitive Science*, Volume 7, Number 4 (April 2003), 166-172.

<sup>15</sup> Stanislas Dehaene and Lionel Naccache. “Towards a cognitive neuroscience of consciousness: basic evidence and a workspace framework.” *Cognition*, 79 (2001): 1.

for producing higher executive function). Dehaene and Naccache believe that availability of information throughout the workspace is what we “subjectively experience as a conscious state.”<sup>16</sup> To summarize, *dynamic mobilization of workspace neurons* – rather than cerebral localization seen in a theatre-based model – is what makes up phenomenal consciousness. This mobilization becomes available throughout the workspace as a global phenomenon in a heavily constrained, yet stochastic manner where the entire “audience” and theatre itself simply *is* the staged spotlight. This postulate stands in stark contrast to Baars or Dennett.

So what would these two variations of a global workspace have to say about qualia and Mary’s situation? The diagnosis for Baars is a bit easier to attempt due to his continual comparison with Dennett’s research, thus it should come to no surprise that Baars views the subjective self as illusionary.<sup>17</sup> Baars alludes to Chalmers’ easy and hard questions of consciousness by saying that they are just two different aspects of the same thing. Baars (via Dennett) believes that consciousness is parallel to what one has access to, assuming that person has access to all elements of past experience by firing up unconscious activity into the spotlight. This is simply not true. The history of psychological and its diagnoses of disorder show that nature does seem to hide information in subconscious activity in order to regulate a healthy emotional and autonomic life.<sup>18</sup>

Let’s see how Mary would react in a Classic GWT framework. When she opens the door and sees the red tomato, all of the physical facts learned in the room will call up unconscious processes onto center stage where Mary’s conscious response will speak from the spotlight at

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<sup>16</sup> Ibid.

<sup>17</sup> Bernard Baars. “Understanding Subjectivity: Global Workspace Theory and the Resurrection of the Observing Self.” *Journal of Consciousness Studies*, 3, No. 3 (1996): 211-16.

<sup>18</sup> See the extensive work currently being done on the topic of evolutionary psychology and its relation to mental states by Scott Atran and others.

center stage: “That’s red. I knew it would be as such.” There is no qualitative experience in this view, thus Mary wouldn’t be surprised or awed by the beauty of seeing red for the first time since her conscious experience of red was already processed in the neurophysiological facts about red perception which she read in her black-and-white books. The same reaction would hold true were Mary to see the Rocky Mountains for the first time, having read all the geological physical facts about the Rockies beforehand. It seems as if such an account leaves no room for emotive diversity when introduced to novel sensory perception since knowledge and recall of the physical facts is instantly understood. I contend that in order to elicit emotion of cognition from sensory experience, deviation from conscious processing must occur. It may be for this reason that an inaccessible subconscious exists in order to couple an intended action with an actual action. Such a view is similar to the going theory of rewards-based learning in the basal ganglia.

Dehaene and Naccache present a very different view of qualia in a global neuronal workspace than the one presented by Baars:

The contents of perceptual awareness are complex, dynamic, multi-faceted neural states that cannot be memorized or transmitted to others in their entirety. These biological properties seem potentially capable of substantiating philosophers’ intuition about the ‘qualia’ of conscious experience....<sup>19</sup>

With this theoretical setup (which is not too far from Patricia Churchland’s construct) each workspace state is highly differentiated with each individual state associated with a perceptual experience that transcends verbal description or complete long-term memory storage. Such diversity is intrinsic to each individual despite similar development of a species and modular brain evolution. Keeping this structure in mind, three levels of accessibility are presented: set  $I_1$  – information in the nervous system that is permanently inaccessible; set  $I_2$  – information in

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<sup>19</sup> Dehaene and Naccache, 30.

contact with the workspace that could be amplified (were it to reach a certain threshold); and set  $I_3$  – at a given time only a subset of  $I_2$  is mobilized into the workspace.<sup>20</sup>

Mary experiences something quite different under Dehaene and Naccache's neural model hypothesis – qualia has reentered the picture. When Mary takes her first steps outside and sees the tomato, she exclaims, "Oh my goodness! What a pretty...color." Why? First of all, this model would find the Mary thought experiment to be physically impossible since Mary would never be able to retain or recall long-term storage of all the physical facts. This aside, the physical facts would be parsed out into the three sets mentioned above, making her incapable of consciously associating conscious neurophysiological data for the brain state of red in her books with the experiential mental state of "redness". Some information would be inaccessible in set  $I_1$  while other information may not reach a high enough spiking threshold for set  $I_2$  to register the conscious recall from long-term memory that makes Mary say, "Oh, that physiological process is just this certain red brain state." Rather, the combination of the three sets elicits a reward-based process of learning due to the parallel processing of conscious and unconscious information. Solely taking into account current neurobiological and evolutionary research, Dehaene and Naccache's theory appears far more tenable than that of Baars – inconclusive and theory-laden as that subsystem-based research in relation to consciousness may be.

### 3. NED BLOCK – AN ARGUMENT FOR QUALIA IN MODELING

Writing in the same 2001 *Cognition* issue, Block's primary contribution here is sifting out the numerous uses of the word consciousness in its various articles. The abstract says this:

Functionalists about consciousness identify consciousness with a role; physicalists identify consciousness with an implementer of that role. The global workspace theory of

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<sup>20</sup> Ibid.

consciousness fits the functionalist perspective, but the physicalist sees consciousness as a biological phenomenon that implements global accessibility.

Block accuses Dehaene and Naccache, Dennett, and Jack and Shallice with having the same form of functionalist approach to global workspace theory.

Before discussing this role, I will briefly mention Block's well-known two-part system for consciousness, which sounds quite similar to that of David Chalmers at first glance yet retains distinct differences. The first part is *phenomenal consciousness* which is experience resulting from sensory modalities like seeing or touching or even cognition. *Access consciousness*, on the other hand, is used for direct control of action and speech. Such access depends on reportability as information becomes globally available; it is here that qualia such as belief or desire can be found. Block shows in his paper for *Cognition* that sometimes these two types of consciousness do not work well together or link up as most GWTs purport.

Block automatically distinguishes global accessibility from phenomenality and says that there may indeed be times that phenomenality exists without global broadcasting. He uses the example of being startled by hearing a jackhammer even though the sound had been going on for quite some time before its realization.<sup>21</sup> This statement is true, but I believe there is *still* a globally accessible state simultaneously existing elsewhere in the brain. Let's assume that while the jackhammer is working away, you are deep in thought about what you want to make for dinner that night; only once you have decided on eggplant parmesan do you become startled by the loud noise of hammering around you. I suggest here that Block's access consciousness is indeed broadcasting an event in the brain – just not the one we would expect.

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<sup>21</sup> Ned Block. "Paradox and cross purposes in recent work on consciousness." *Cognition* 79 (2001), 203.

To further Block's view: "The theory that consciousness is ventral stream activation plus, for example, neural synchrony, and the theory that consciousness is broadcasting in the global neuronal workspace are instances of the two major rival approaches to consciousness in the philosophical literature, *physicalism* and *functionalism*."<sup>22</sup> Block sees GWT as mirroring the philosophical idea of multiple realizability whereas physicalism is bound by the biological properties that make us human. The problem with Block's argument is the fact that his notion of GWT is *not* the form of GWT that Dehaene and Naccache advocate. Block lumps Dehaene's theory in with that of Dennett and Baars, yet Dehaene is clear about his radical departure from a purely functional, Dennettian role of a central "Cartesian theatre" where conscious information is displayed.<sup>23</sup> The different expressions Mary experiences, as discussed earlier, make this evident.

Then there is Block's rightfully suspicious questioning of functionalists with regards to global workspace broadcasting in relation to human biological realization. Again, Block does not make the distinction between Baars/Dennett and Dehaene/Naccache, the latter of who believe any theory of consciousness must take into account evolutionary emergence in the course of phylogenesis, meaning the core nature of their proposal is indeed biologically contingent. The early models introduced by Baars and others do fall victim to Block's criticism, which is why more recent models like that of Dehaene and Naccache are attempting to improve upon the mistakes of prior models and theories.

Despite Block's glossing over some important details in Dehaene and Naccache's analysis, his ideas have done much to challenge neural modelers to recognize the inseparable biology from the model. Perhaps his primary contribution here continues to be the persistence on qualia. On the other hand, it seems that Block's intuition links qualia with actual brain states that

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<sup>22</sup> Ibid.

<sup>23</sup> Dehaene and Naccache, 14.

are the mental states yet the two are not necessarily always in communication with one another. Such a theory can easily invoke nonphysical properties a la Chalmers, instead of showing that there is indeed a *physical* “what it is like” experience that is unique to every human being. Block’s critique of all GWTs as being virtually identical must be expounded upon and changed, since they are most assuredly not the same. Mary’s reaction to red swings from one end of the pendulum for Baars and to the other end of the pendulum for Dehaene.

#### 4. DANIEL DENNETT – AN ARGUMENT AGAINST QUALIA IN MODELING

Dennett does not like the way global neuronal workspace is going because it sees global accessibility as the *cause* of consciousness. The issue for him is that consciousness should not be considered a further condition upon the brain, rather the brain just *is* consciousness. Dennett uses the metaphor of fame to illustrate his eliminativist view of consciousness:

It (consciousness) is not a privileged medium of representation, or an added property some states have; it is the very mutual accessibility that gives some informational states the powers that come with a subject’s consciousness of that information. Like fame, consciousness is not a momentary condition, or a purely dispositional state, but rather a matter of actual influence over time.<sup>24</sup>

His worthwhile point here is that modelers such as Dehaene may be leaving out the Subject of consciousness while attempting to provide an analysis of the Subject. It must be noted here that Dennett has in recent years changed position from his Multiple Drafts Model (which sounded more like Baars theatre model) to the revised “fame in the brain” hypothesis. Consciousness is thus more like fame than a staged spotlight at the theatre or switching channels on a television.

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<sup>24</sup> Daniel Dennett, “Are we explaining consciousness yet?” *Cognition* 79 (2001): 221.

Rather, like fame, unconscious contents are in competition with other fame-seeking contents. This is consciousness.<sup>25</sup> This is also quite the switch for Dennett!

Dennett disagrees with Dehaene and Naccache in accounting for the Subject in terms of “a collective dynamic phenomenon that does not require any supervision” because it leaves out the Subject when it has nothing left to do.<sup>26</sup> The goal, then, would be to simply make the conscious elements of consciousness just another level of subconscious elements in executive function of the prefrontal cortex. We must move beyond consciousness to explain consciousness. Dehaene and Naccache’s comment on qualia<sup>27</sup> did not go unnoticed either. Here Dennett sees cognitive neuroscientists getting in over their head concerning the philosophical ramifications of a concept like *qualia*.

Part of the issue of qualia here is indeed semantic. Dennett agrees that situations such as dispositions to a certain color after traumatic experience or less dramatic sensations such as the home-like scent of pines at Christmas are a residue of consciousness. And if this residue is called qualia, then *yes qualia exist* “but they are just more of the same, dispositional properties that have not yet been entered into the catalog.”<sup>28</sup> It is this quoted portion of the prior sentence that I feel Dennett tacks on in order to salvage his theory that qualia do not actually exist.

The current model of global workspace theory does not bode well for Dennett’s position which he calls a “backslide” in progress. The other definition of qualia as neither downstream effects such as reactions to color or verbal reports nor upstream “causal progenitors” of experience such as lateral cortical interaction make qualia intrinsic properties of experience, isolated from their cause or effect and logically unconnected to *all* dispositional properties. This

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<sup>25</sup> Ibid., 224.

<sup>26</sup> Ibid., 229.

<sup>27</sup> Dehaene and Naccache, 30.

<sup>28</sup> Dennett, 233.

claim is an easier target since it mimics the philosophical arguments of Chalmers and Jackson more than the reinterpretation of qualia by Dehaene seen in the former definition of qualia above.

Rather than elaborate on the former definition of qualia touted by Dehaene, Dennett focuses on the latter definition and then chooses to focus on this version's possible confusion of functional roles with computational roles in early versions of AI. I believe this concern is invalid, seeing as how the majority of current research in neural modeling has left behind the Turing machine interpretation years ago. It is well known that a serial-based, linear computer program could never understand the non-linear nature of biological systems. Granted, Dennett's concern over the confused understanding of first-person versus third-person points of view is alive and well, yet there is mounting evidence that qualia is here to stay for some time.

Wrapping up, Dennett's argument against qualia is more an argument against separating intrinsic properties from their cause and effect rather than an argument against the residues of dispositional properties. As for parsing out conscious thoughts into more unconscious thoughts at the executive level, this seems to negate the entire purpose of the global neuronal workspace. The global workspace is set up as a sort of adaptive resonance similar to that of Steve Grossberg with a complex set of outstar and instar learning networks that have both feedforward and feedback loops, thus the conscious accessibility is a property of self-excitation rather than further projection onto unconscious subsystems within the executive portion of the brain.

## 5. NEUROBIOLOGY AND MARY'S TWIN

An argument for qualia in terms of a global neuronal workspace can be looked at in another way. Assume Mary knows all the physical facts, yet in the brain all this long-term memory storage of factual information is constrained. Knowledge storage is *not* the same as

storing all the physical facts in the brain. Mary, having been deprived of color in her room, will indeed learn new information. The distinction is this: her brain will relay the information to an area not reserved for storing factual data, thus it is a matter of *reappropriation* of a felt sense not an introduction of new physical facts. Upon seeing the red tomato, Mary's somatosensory mapping for color imagery, which lay dormant for the entirety of her life, will now be awakened with strong action potential bursts to the visual cortex and parietal cortex. Mary may have read all about the shininess of a red tomato but the processing of this is of no avail to her *knowing* red. Mary does indeed learn something new, but that is only because the association from a dormant brain region was necessary for its correlation. The same physical facts are all there – just rearranged. The only variance is in cascade synaptic plasticity due to new associational data.

The problem with the Mary argument is that it assumes storing knowledge is universal and accessible to the entire brain, but this is a fallacious argument. Mary does learn something new, which protects Dehaene's view of qualia from slipping away, but it does not prove physicalism to be false. *Knowing* all the physical facts is not the same as *living* the physical facts. Mary seeing the red tomato releases photons of a certain wavelength which hit the eye, bending at the lens onto L cone receptors. This begins a quick relay down the optic nerve and through the thalamus to the occipital lobe towards the rear of the brain. At this point there's no arguments between dualists or physicalists – this is simply a psychological process, as Chalmers would put it. The processing of this color information in Mary's brain from hereon would be extremely interesting to watch with an fMRI scan. Since L cone receptor information has never been relayed to the primary visual cortex before, a feedforward propagating signal will be sent throughout the brain to figure out what in the world this new input is. Information will be sent to the parietal, motor, V2-V5, and associational cortices which, in turn, feedback signals to the

activity pattern specified storage of long term memory to find a match. There will be no match. Rather, stored knowledge of the tomato's shape will try to find logical deduction of its color, but no match can be made until it is given reference by an outside source. The brain must await someone telling Mary "That's a red tomato" before Mary can say "Ah, so that's what red is like!" Hence, the knowledge argument can be seen as a problem of association rather than negation of physicalism.

Furthermore, Mary's quale of red will be different than yours or mine. Why? Because each "what it feels like" aspect is dependent on a lifetime of processing a constant flow of homeostatic, sensory, motor, emotive, cortical, and autonomic information. The magnitude of variation among these different subsystems at one instant in time is staggering enough, let alone each neuron's reaction to stimulation patterns in the global neuronal workspace over a sixty or seventy year period of time.

Mary's first quale of red will be unique due to the novel introduction of L cone receptor stimulus to an area of the parietal mapping that has most probably shriveled to near nothing, being allocated to other tasks as her black-and-white world progressed. Those of us raised outside Mary's room will behave otherwise when seeing red. We will assuredly have a larger area allocated to color in our cortical mapping area. More importantly than this, however, is the coupled reaction to certain colors in various experiences during a lifetime. For example, my quale of red would register a negative sensation if I were once dropped on my head as a toddler by my uncle who happened to be wearing a bright red sweater. This is a simple case of classical conditioning: a conditioned stimulus is paired with an unconditioned stimulus to elicit a conditioned response. In the case of my uncle dropping me on my head, every time I see that bright red (especially in sweater form), my instinctual reaction is to brace myself in fear. What I

am advocating here is a different perspective of the same theoretical model as Dehaene and Naccache in *Cognition* which has been formed from reshaping prior global workspace theories.

In conclusion, let's consider a variation on the Mary thought experiment. What if Mary had a twin who was locked in a room adjacent to Mary's, the two sisters unaware of one another's existence. We'll name Mary's twin Martha. Martha has been given the same black-and-white television and books in order to learn all the neurophysiological facts and their causal relations. On the day Mary gets to experience red for the first time, Martha continues reviewing all the physical facts to pass the time. The next day Martha's door opens and she sees the very same red tomato that Mary saw yesterday. Will the two sisters have the same reaction?

Baars and Dennett would find the question to be silly. Of course Mary and Martha would have the same reaction to seeing red; in fact, every normal-functioning human being would have the same reaction. This is consistent with Classical GWT, yet there is a reason Classic GWT is quickly becoming replace – it doesn't accurately explain the conscious-subconscious dichotomy.

Dehaene, Naccache and Perry would most likely question whether or not a phenomenal consciousness experiment is empirically repeatable. Each human being is unique in the manner by which synaptic connections in the brain are made. Mary may have had dreams of one day picking bright red tomatoes from a field, thus creating a soothing quale of what red might be like before even stepping into a color-filled world. Martha, on the other hand, opened a book that went into great detail about an entire village being killed by poisons found in red tomatoes. Thus, any time Martha reads something containing the word "red" and "tomato" in it, she feels a twinge of fear despite rationally knowing all the facts about red as just being a certain wavelength property of photons. When Martha steps out of the room, her reaction to seeing red might be one of panic. Both Mary and Martha would have the same initial sensory reaction to

seeing red, yet their processing of this color into a quale at the global level could be starkly different based on years of pre-wired conceptions about red. Perry sums this up well: “The sensations are not one and the same; it is what they are sensations *of* that is one and the same.”<sup>29</sup>

Experience is key. This is what seems to be missing in Dennett and Baars’ theories. This seems similar to the problem Peter Bokulich has with David Chalmers not taking into account dynamical facts. It is the evolution of subsystems in a physical world that is integral to the biological system that is the human body. Spatio-temporal along with dynamic dependence of Mary’s consciousness when seeing the red tomato is not just a byproduct – it’s a mandate.

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<sup>29</sup> Perry, 8.

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