

**SUPPLEMENT TO
CHAPTER 1, V1¹:
INTRODUCTION**

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Psychology has an explanatory problem. Psychologists have formed separate schools and camps each with its own vocabulary, theoretical orientation, methods, findings, and adherents since its formal inception in 1895 resulting in what Kuhn (1996) referred to as a preparadigmatic science. Michel (2008) described this theoretical diversity as a consequence of our “*toothbrush problem*”, “Psychologists treat other peoples’ theories like toothbrushes — no self-respecting person wants to use anyone else’s” (p. 3). Kruglanski (2001) referred to our “theory shyness” (p. 871); our reluctance to move beyond midlevel theorization to more comprehensive explanations. Gigerenzer (2009) observed that “much of the theoretical landscape in psychology resembles a patchwork of small territories” (p. 22) that substitute surrogates for theory in the form of one-word explanations, circular restatements, and lists of dichotomies. Such theoretical diversity has been interpreted as a sign of scientific health by some (McNally, 1992) and a crisis with corrosive properties (Staats, 1983) that threatens to tear psychology apart (Spence, 1987) by others. Science values parsimony. Parsimony also extends to theory. All else being equal, we prefer to use fewer theories to explain our facts. Ideally, one theory is best. Introductory psychology textbooks demonstrate that we are far from this ideal. Tryon (2014) aims to advance psychological science and clinical psychology by showing that a network approach can explain a broad variety of well-established psychological phenomena in a consilient (Wilson, 1998) way that links psychology and biology. This approach is sometimes called connectionism by psychologists and

¹ V1 stands for Version 1 which implies that subsequent chapter updates will become available.

computational neuroscience by biologists. Tryon (2014) promotes a hybrid form of connectionism that is heavily informed by neuroscience.

Gigerenzer (1998, 2009) emphasized the need to specify underlying mechanisms. Kazdin (2007) defined mechanism as “the basis for the effect, i.e., the processes or events that are responsible for the change; the reasons why change occurred or how change came about” (p. 3). Squire, Knowlton, and Musen (1993) said, “Ultimately, one wants to understand cognition not just as an abstraction, or in terms that are simply plausible or internally consistent. Rather, one wants to know as specifically and concretely as possible how the job is actually done.” (p. 454). Kazdin (2008) clarified his meaning of mechanism as follows: “By mechanisms, I refer to the processes that explain why therapy works or how it produces change” (p. 151). Psychological science currently offers mainly functional explanations in the form of box and arrow diagrams which imply, but do not describe, causal sequences. We also use imaging methods to identify brain structures that subserve psychological functions but cannot explain how these neural networks produce their effects. An advantage of the network approach presented here is that computational models provide some of the missing mechanism information. Investigators can perform true experiments that support cause and effect conclusions, not merely associations because these models allow investigators to create and manipulate neural architectures, damage them in specific ways, and provide them with specific learning histories. Investigators can also examine developmental processes in ways that might otherwise be impractical or unethical. Theoretical synthesis is possible as when Read et al. (2010) combined personality structure and dynamics into a single model.

THE ILLUSION OF EXPLANATION²

The *Journal of Clinical Psychology* published six articles in 2006 about treating borderline personality disorder that carried the word “mechanism” in their title. Lynch, Chapman, Rosenthal, Kuo, and Linehan (2006) claimed that “**Mechanisms of change are *mediators*** (Baron & Kenny, 1986) ...” (p. 460, italics in the original, bold emphasis added). If mechanisms are mediators then why do we need the term mechanism? Why can’t we just stick with the word mediator? The main

² This section is reproduced from Tryon (2014) Chapter 13: Final Evaluation which was written after the book was published and is therefore only available at www.fordham.edu/psychology/tryon.

reason is because the word **mechanism implies causation** whereas the term mediator does not. Mediators are established by correlational methods. It is well known that causation cannot be consistently inferred from correlation. Hence, mediators do not, because they cannot, provide causal mechanism information. Mediators cannot explain anything. Claiming that mediators are mechanisms only provides the illusion of explanation. This **cognitive illusion** appears to be motivated by a strong desire to have mechanism information coupled by the inability of functional psychological theories to provide mechanism information. Wishing therefore results in believing, presuming, that mediators are mechanisms. A major problem with this illusion is that it prevents searching for causal mechanism information because such information seems to be already at hand.

Gigerenzer's (1998, 2009) definition of mechanism requires evidence of causation. Kazdin's (2007, 2008) definition of mechanism also includes causation. He requires that mechanisms must explain how causes produce their effects. He gave the example of smoking and cancer. Smoking causes cancer but DNA mechanisms explain how smoking causes cancer. **Explanation is the primary purpose of mechanism information.** Mediation does not explain how causes produce their effects. Interpreting mediation as mechanism is what members of immature sciences do because their functional theories cannot provide causal mechanism information. For example, box and arrow models identify functional relationships among variables. The arrows among boxes containing variable names impute causation but do not, because they cannot, explain how one variable actually causes another to change. Mature sciences provide principled causal explanations. Tryon's (2014) core and corollary principles constitute an initial attempt to provide the required causal explanations.

Psychologists also foster the illusion of explanation in their writings. Lynch, Chapman, Rosenthal, Kuo, and Linehan (2006) endeavored to explain how dialectical behavior therapy works as follows: "One **mechanism** associated with validation involves enhancing the stability of the patient's sense of self" (p. 467, bold emphasis added). Enhancing a patient's sense of self may be an effective clinical process/method but it is not a mechanism of any kind because it does not explain how anything about borderline personality disorder changes or comes to be. Explaining **how** to produce a clinical result does not explain **why** that treatment works. Never-the-less, the **cognitive illusion** that mechanism information has been presented is strong.

Wenzel, Chapman, Newman, Beck, and Brown (2006) claimed: "It is hypothesized that a change in dysfunctional beliefs is the primary mechanism of change associated with CT. However,

additional mechanisms of change are likely also at work in CT, including enhancement of skills, reduction in hopelessness, and improvement in attitude toward treatment” (p. 503). No explanation was provided for how beliefs, skills, attitudes and/or feelings of hopelessness actually change anything. But the illusion that mechanism information regarding cognitive therapy was presented is strong. This same analysis reveals that the presumed mechanisms presented by the other four articles in this special journal section are also not real. But these articles authoritatively state that explanatory mechanisms are known to clinical psychologists.

EXPLANATION VS. INTERPRETATION

While the twin objectives of science are prediction and explanation, the entire focus of theory is on explanation. The problem is that psychology can only provide interpretations due to its present immature status. Tryon (2014, p. 7) identified this matter as follows:

Teo (2012) revealed this explanatory problem when he commented upon a psychological explanation by a prominent psychologist. Teo said that “Lilienfeld (2012) could not rely on general laws or even statistical facts to provide a scientific *explanation* for this question. What is evident from all we know from the philosophy of science is that Lilienfeld offered us an *interpretation*” (p. 807, italics in the original). Psychology presently offers **interpretations** rather than **explanations** because, with a few exceptions, it lacks general principles upon which to base its explanations. If you want a psychological explanation, just ask a psychologist. Some interpretations will make more sense than others. Some explanations will be better grounded in research than others. But in the end, one is faced with choosing among interpretations by individuals because no principled explanation is available.

Immature Sciences

Interpretations provided by immature preparadigmatic psychological science are characterized by: a) functional theories b) that are based on unrepliated findings c) about mental processes d) that operate on a hypothetical psychological substrate, e) according to rules, f) that lack mechanism information g) and can be fully described in words. These “explanations” frequently consist of: a) an assertion that some relationship exists, maybe in the form of a box and

arrow diagram, path or Structural Equation Model, and b) some form of correlational evidence to support this hypothesis. No real explanation is provided because no causal mechanisms are identified. Mediators are presented as causal mechanisms thereby fostering the illusion of explanation.

Immature sciences are based on personal preferences where participants selectively recognize methods and findings that they like. If you do not like some part of an immature science then you need not recognize it. Psychology is an immature science. Hence, psychologists are free to customize it according to their personal preferences. They can cherry pick that part of psychological science that they want to base their clinical practice on. Then they can argue with their colleagues regarding why everyone should want to think and practice as we do. Likeminded psychologists can and do form professional associations based on those parts of psychological science that they recognize and acknowledge. Such practices may be okay for the arts but they preclude the development of a mature science based on replicable findings and principles.

Preparadigmatic sciences are characterized by multiple schools and camps organized around leading psychologists because no generally agreed upon approach to their science, consensus, has not emerged. Each school/camp proposes its own definition of psychological science, definition of valid evidence, and preferred/acceptable methods of study. Behaviorists only recognize, acknowledge, and approve of behavioral interpretations because this is the perspective on psychological science that they believe everyone should adopt. Cognitive psychologists only recognize, acknowledge, and approve of cognitive interpretations because this is the perspective on psychological science that they believe everyone should adopt. Psychodynamic psychologists only recognize, acknowledge, and approve of psychodynamic interpretations because this is the perspective on psychological science that they believe everyone should adopt. Present day immature psychological science approves of and supports this parochial³ perspective.

The results of these diverse efforts are published in the official journals of professional societies that are read mainly, if not exclusively, by the members of these societies who seek to convert others, especially students, to their beliefs in ways that are similar to how religions and cults recruit new members. Religions and philosophies are organized around people. Sciences are organized around principles. The defensive need to justify a particular approach to psychology

³ The **define:parochial** command returned the following first definition: narrow-minded: concerned only with narrow local concerns without any regard for more general or wider issues.

precludes the consensus needed to enable psychological science to become cumulative. Hence, the public has every right to view psychology as a secondary science as Lilienfeld (2012) revealed. Take a minute to reflect and ponder the devastating implications of the above statements for a discipline that considers itself to be a science.

Mature Sciences

Mature sciences are based on principles that have been “validated” in ways that are accepted by the vast majority of those who practice that science. Personal preference no longer dictates what principles are recognized and accepted. The advantage here is that principles enable us to **explain** rather than give **interpretations**. Mature sciences explain well replicated facts and phenomena on the basis of accepted principles and/or laws, using a common vocabulary. Explanations provided by a mature paradigmatic psychological science are, or will be, characterized by: a) network theories that integrate psychology and biology, b) that are based on replicated neuroscience and psychological findings, c) involving physical processes, d) that operate on a real biological substrate, e) according to established principles, f) that provide causal mechanism information, g) and whose interaction requires simulation to be fully articulated.

LEGITIMATE MECHANISM INFORMATION

This section extends the discussion entitled “What Constitutes Legitimate Mechanism Information” on page 45 of Tryon (2014). An article by Liane Young that appeared in the February issue of the American Psychological Society *Observer* (pp 22-24) entitled “The Mechanics of Moral Judgment” is instructive. The byline in bold large font reads “Brain imaging technology is leading to new discoveries about the way people judge each other’s intentions and actions”. The use of the term “mechanics” in her title indicates that she is providing causal mechanism information.

Liane Young is an assistant professor in the Department of Psychology at **Boston College** where she is the director of the **Morality Lab**⁴ where she has fMRI resources . She reported that her fMRI research on neurotypical participants found that the Right Temporo-Parietal junction (RTPJ) is more active when evaluating unintended harm such as accidentally poisoning a friend with a substance that she thought was sugar and less active when harshly evaluating intended harm.

⁴ See <http://moralitylab.bc.edu/>

She correctly concluded that “This indicates that our ability to forgive **depends** on the neural mechanisms that allow us to consider, in the face of harmful consequences, another person’s innocent mistakes and benign intentions” (p. 23).

My question to you is has she provided mechanism information? Has she informed us regarding the **mechanics** of moral judgments? My answer is no because establishing that a psychological function **depends** upon a neural network, brain structure, does not qualify that neural network as a **mechanism**. Her reference to “**the mechanics of moral judgments**” requires her to explain how the neural networks that she identifies generate, implement, the associated psychological functions.

She then reveals that no mechanism information was provided by asking “But *how* exactly does the RTPJ tell intentionally inflicted harm from accidental?” (italics in the original, p. 23). Her answer was to report on a more sophisticated technique for analyzing fMRI data called multi-voxel pattern analysis (MVPA). “Using this approach, we found that specific patterns in the RTPJ indeed allow a person to *identify* harmful actions as being either deliberate or inadvertent” (italics in the original, p. 23).

My next question to you is has she now provided mechanism information? My answer again is no because she has still not told us how the identified brain areas do what she says they do. Finding active biological structures is, sadly, what presently passes for acceptable mechanism information. At best her results further establishes **dependency** upon a brain structure which we saw above is not the same as providing causal mechanism information that explains how those neural networks implement the psychological functions imputed to them. Identifying relevant neural networks provides important information but this information does not entail brain mechanisms.

I ask readers to recall my discussion of the BioPsychoSocial model (Tryon, 2014, p. 37) where I pointed out that this model is just a list of ingredients and carries no more explanatory force than does the GlassMetalPetroleum model of how automobiles work. Demonstrating dependency establishes a list of biological structures but such lists do not constitute explanations. Such lists do not constitute brain mechanisms.

All fMRI research is correlational. Participants perform a task and fMRI records the active brain areas. How can this research be made experimental? How can the RTPJ be deactivated short

of surgery or directly injecting chemicals into the brain as Panskeep does⁵? The answer is Transcranial Magnetic Stimulation (TMS). Directing a focused strong magnetic field directly at the RTPJ will deactivate it. Results obtained by Liane and her colleagues revealed that in doing so participants "... formed more outcome-based rather than intent-based opinions" p. 23.

My next question to you is now that she has used manipulation to establish cause and effect has she finally provided mechanism information? My answer continues to be no because she has still not told us how the identified brain areas do what she says they do. Neither she nor the reviewers and editors of the *Observer* seem to be aware that **no explanatory causal mechanism** information has been provided. Hence, the title overstates the content of her article and it should have been modified to be more representative of the information provided.

Sugimoir, Mitchell, Raye, Greene, and Johnson (2014) published an article in *Psychological Science* entitled "Brain mechanisms underlying reality monitoring for heard and imagined words". Their results showed that Brodmann's Area 6 was found to be more active when encoding imagined items that were latter correctly recalled as imagined.

My next question to you is did the authors describe a brain mechanism? My answer is no because this is just another component finding. This and all other "brain mechanism" articles published by psychologists share a similar logical structure described in the following three arguments.

Argument 1: Your brain mediates your psychological experiences. This claim is known to be true statement because brain damage alters and brain death obliterates psychological experiences. We can confidently conclude that normal psychological function **depends upon** an intact brain. It is this dependency upon neural mechanisms that apparently authorizes the use of the words "neural mechanism" or "brain mechanism" in the title and text of articles written by psychologists. But this claim of **dependency** is not explanatory because it does not detail how the identified brain structures mediate the psychological functions that are attributed to them

Argument 2: This **particular part** of your brain is principally involved. This is a more **specific** version of Argument 1 but remains a **dependency argument** that is devoid of causal mechanism information because nothing causal about the identified brain structure clarifies why

⁵ See Chapter 5 of Tryon 2014 regarding Emotion

this brain part is **necessary or sufficient to cause** the psychological function that it is said to mediate.

Argument 3: This particular pattern of brain activity, e. g., the multi-voxel pattern analysis (MVPA) mentioned above, is crucial to the psychological function in question is an even more **specific** version of Argument 1 but remains devoid of causal mechanism information because nothing causal about the identified pattern clarifies why it is **necessary or sufficient to cause** the psychological function that it is said to mediate.

In conclusion, demonstrating **dependency** upon specific anatomical structures does not provide causal mechanism information because it does not clarify **HOW** those structures do what they do. The Google command “define:mechanism” returned the following definition: “1) A system of parts working together in a machine; a piece of machinery. 2) **A natural or established process by which something takes place or is brought about.**” Mechanisms explain in two ways. a) Mechanisms entail a sequence of causal events that can be used to show how an observed result came about. b) Mechanisms have properties that can vary across individuals and within a person over time. Kazdin (2008, pp. 151-152) argued that mechanism information goes well beyond demonstrating cause in that mechanism requires one to elaborate a sequence of causal events. Tryon (2012) concluded that “**A mechanism therefore consists of a sequence of causal events that are either necessary or sufficient to bring about the imputed result**” (p. 306). **Simulations** of how those structures function that **detail a causal sequence** are required in order to provide mechanism information capable of explaining how they generate psychology.

An example of real causal mechanism information was provided in the Tuesday March 4, 2014 Science Times article by Andrew Pollack entitled “A Powerful New Way to Edit DNA”. Clustered Regularly Interspaced Short Palindromic Repeats (Crispr) is a virus recognition and destruction system found in bacteria that consists of DNA excerpts of infecting viruses called “spacers”. Each spacer is a virus “mug shot” that is appended to a Crispr DNA chain. A match between a spacer and a current viral infection activates the Enzyme Cas9 that cuts a piece out of the invading virus. This kills the virus and adds another spacer to the Crispr DNA chain. Here we have mechanism information.

The dyslexia simulation reviewed by Tryon (2014) in Chapter 6 suggests to some readers that people with dyslexia have experienced some form of traumatic brain injury. I think that the

authors of the article meant something more like “**brain integrity**”⁶. Simulations that animate how brain function produces specific symptoms such as surface and deep dyslexia do provide mechanism information. A book of some interest is by Michio Kaku who has authored *The Future of the Mind*⁷.

MUTUAL IRRELEVANCE OR SPECIALIZATION?

Our lack of consensus constitutes an implicit recognition that psychologists are mainly irrelevant to one another. You ignore me and I will ignore you but we will continue to call ourselves psychologists even though we share little or nothing in common and forcefully resist doing so. Tryon (2014, p. 23) noted that psychologists who publish in their official American Psychological Association division journal rarely cite articles published in any of the division journals. Take any article published in an APA division journal and count the number of references from journals sponsored by other APA divisions. The modal number is probably zero. Our lack of consensus provides mutual permission to continue to ignore each other and to work in mutual isolation. This observation was presented as evidence that psychologists have largely become irrelevant to most of their colleagues.

Alternatively, it can be argued that APA division journals are specialty journals. Just as cardiologists do not cite articles published by oncologists and vice versa, we should not expect articles published in one psychological specialty journal to appear in other specialty journals. This argument fails for at least two reasons.

First, specialization implies a common science core that is mastered prior to specialization. There is precious little evidence of a common core for psychological science. The common core training that psychologists receive is largely limited to Introductory Psychology, statistics, ethics, and history. Psychology has nowhere near the common core that medical training provides. If APA division journals reflect only specialization then the articles that appear in these journals should reflect some of this common training. But close inspection would likely reveal any such evidence that division journals are drawing on core concepts of a shared general psychology.

⁶ See Caspi et al. (2014)

⁷ See <http://www.amazon.com/The-Future-Mind-Scientific-Understand/dp/038553082X>

Second, the absence of shared vocabulary and basic concepts supports the view that these divisions are mutually irrelevant rather than psychological specializations. Many of our journals reflect qualitatively different approaches to psychology. Some of these approaches favor viewing psychology as a human science whereas others favor viewing psychology as a natural science. This is not specialization in the way that physicians specialize. Each division approaches psychology in its own unique way with its own adherents; some of whom belong to other divisions that may be better characterized as psychology clubs. Graduate students in clinical psychology begin to “specialize” when they apply to programs with a particular theoretical orientation. Their “specialized” study begins with the first day of their first semester. Their coursework reinforces the selected orientation.

Our lack of consensus contributes to our dissemination problem because our immature science authorizes clinicians to treat their clients any way that they care to because there is no consensus regarding what should be done. Hence, everybody can continue to go their own way, cherry pick psychological science according to their personal preferences, and do whatever they please as long as they do not violate professional ethics or the law.

MATURE SCIENCE AND CLINICAL ART

Personal preference plays no part in establishing principles in mature sciences. But artistic judgments are necessarily involved when scientific principles are applied in healthcare settings due to all of the uncontrolled variables involved. Many health centers carry signage referring to the Medical Arts. It is true that therapists probably implement one form of therapy with greater feeling, enthusiasm, and subtlety than another form of therapy and that this is a legitimate reason for allowing psychologists to select/develop a therapeutic approach that fits their personal style and preference. This would be fine if all therapeutic approaches had the same outcome evidence. Clinical psychologists tend to prefer eclectic practice even if they mainly subscribe to one clinical orientation. The recommended Applied Psychological Science (APS) clinical orientation authorizes personalized ways of implementing the network principles.

EXPLANATORY SYSTEM

The proposed **Bio↔Psychology Network Theory**⁸ is not a new theory in the ordinary sense of needing to be tested to see if it can be empirically supported. It consists of the unanticipated, unarticulated, and unacknowledged implications of well replicated psychological phenomenon that can be explained by accepted neuroscience and connectionist mechanisms plus multivariate statistics. If the facts contained in the more than 1,400 references in Tryon (2014) are understood to be dots, then the proposed Bio↔Psychology Network theory is just a new way to connect these dots. Only their organization into four core and eight corollary principles is new. Hence, this theory is ready to be used with confidence today.

Tryon (2014, p. 6) refers to the Bio↔Psychology Network theory as a hybrid theory because it combines neuroscience and connectionism. I continue to emphasize the hybrid nature of this approach but now prefer to think of it as an **explanatory system** rather than as a theory for at least the following two reasons. First, it consists of four core and eight corollary principles. Principles per se do not constitute a theory. Second, theories typically involve more than just principles. Tryon (2014) aimed to provide this additional information throughout the book but that was a highly distributed presentation. I cannot condense the core and corollary principles into a paragraph or one page presentation of the proposed “theory”. What I can say is that these core and corollary principles constitute an explanatory system that consists of neuroscience and connectionist mechanisms and well replicated psychological phenomena.

TRIANGULATION AND CROSS-VALIDATION

The research meaning of triangulation⁹ entails using multiple sources of information to test hypotheses. Cross-validation is a related concept but typically entails splitting a data set in half, developing a statistical model on the first half, and testing it on the second half. Here I use the terms triangulation and cross-validation interchangeably to mean using neuroscience information to check on the validity of psychological concepts and putative mechanisms.

⁸ Tryon (2014) consistently capitalizes the “T” in **Bio↔Psychology Network Theory** and abbreviates it as BPNT. For reasons presented below, I now prefer to identify it as the **Bio↔Psychology Network** theory and abbreviate it as BPN which is more in line with typical abbreviations such as CBT for cognitive behavior therapy.

⁹ See <http://psychologydictionary.org/triangulation/>

Disciplines tend to operate in isolation from one another. A classic example is theology where the Bible makes specific claims about how the earth is. Left alone, theologians can discuss/argue indefinitely about this point. Geology has informed this discussion and found that radio-carbon dating has shown that the earth is much older than 6,000 years. Astronomy has informed this discussion by reporting that the night sky would contain very few stars if creation was 6,000 years old because only a few stars are within 6,000 light years of us.

Psychology began as a science in isolation from other sciences when it formally split from philosophy. Neuroscience was in its infancy when Wundt established experimental psychology as a science in 1879. Consequently, neuroscience could not constrain psychology in any useful way. Psychological science had no choice then but to stand on its own. Neuroscience has now developed to a point where it can inform psychological science. Modern brain imaging enables one to observe the living brain in action. Such evidence is clearly capable of constraining psychological conjecture. Consider the following concern about color vision. One might think that color vision is entirely due to the retina and its neural projections to the visual cortex. But Bird, Berens, Hornen, and Franklin (2014) reported that color categories are generated by the frontal lobes. Color categories are not completely built into the visual system as one might have thought. Here we have a case where phenomenological psychology is informed by neuroscience.

Educators have questioned the utility of teaching handwriting including both printing and cursive writing. A preference for keyboard facility presently exists among many educators. Neuroscience is now able to inform this discussion. For example, Kersey and James (2013) have shown that actively producing letters by printing or cursive writing facilitates reading more than letter tracing or responding by keyboard does. The front page of the June 3, 2014 *Science Times* of *The New York Times* carried an article by Maria Konnikova entitled “What’s Lost as Handwriting Fades”. The answer is a lot. Learning to print and write appears to facilitate learning to read and to generate ideas.

Saey (2014) reported that DNA from a 7,000 year old Spanish hunter-gatherer revealed that he had blue eyes and dark skin. These are details that could never have been known by looking at his bones. Here we have an example of biology informing archeology.

The advent of connectionism and computational simulation have created a bridge between neuroscience and psychology that Tryon (2014) exploits for purposes of theoretical unification and psychotherapy integration.

BRAIN MAPPING

The January 7th issue of the *Science Times (The New York Times)* carried an article entitled “The Brain, in Exquisite Detail”? It reported on progress being made by the Human Connectome Project and Europe’s Human Brain Project towards mapping the major circuits of the human brain. The National Institutes of Health alone spends 5.5 billion dollars on neuroscience research alone. Private foundations such as the Allen Institute for Brain Science and the Howard Hughes Medical Institute spend hundreds of millions more on brain imaging.

How are traditional psychological theories going to participate in this big science research? How are they going to incorporate these brain mapping results into their formal theories? Does clinical psychology, or for that matter psychological science, have any formal theories? How will psychology meaningfully participate in neuroscience research? Or will psychology remain complacent and replaced by neuroscience which is to say psychiatry?

UNCONSCIOUS PROCESSING

The main article in the January 2014 issue of *Scientific American* by John Bargh is entitled “**Our Unconscious Mind**”. It provides a brief overview of evidence supporting unconscious processing.

The January issue of *Scientific American* also carries an article entitled “**Simulating a Living Cell**” in which computer simulations are used to model the functional properties of a living cell. These models are then used in experiments. Tryon (2014) promotes a similar approach to simulating neural networks in order to better understand how unconscious and conscious cognition and affect produce behavior.

Tryon (2014, p. 146) discusses Automatic Unconscious System 1 features as cognitive biases. Here I would like to add the **Introspection Illusion**¹⁰ to the list. This illusion is that people feel that their introspective reports are more accurate and reliable than those of other people.

Choice blindness¹¹ is another cognitive bias. It occurs when people fail to detect conspicuous differences between what they thought was their choice and the actual outcome.

Johansson, Hall, Sikström, and Olsson, (2005) have conducted a pertinent study.

¹⁰ See http://en.wikipedia.org/wiki/Introspection_illusion

¹¹ See the following link regarding choice blindness
http://taggedwiki.zubiaga.org/new_content/0bf2880d3fdc5b2702fcb178ab208615.

DEVELOPING CONSENSUS

In Chapter 1 Tryon (2014) laments the essentially exclusive focus of psychological science on being unique in theory, method, and practice. In Chapter 1 I take the nearly unique approach of attempting to develop **consensus** regarding theory, method, and practice. I develop consensus in multiple ways throughout the book. I begin by taking the natural science perspective that 98% of psychologists who belong to the American Psychological Association appear to share. I continue to build consensus by focusing on well replicated psychological phenomenon that most psychologists will endorse if asked. I also build consensus by focusing on neuroscience mechanisms that most psychologists will endorse if asked. I formulate these matters along with multivariate statistics into principles that psychologists will likely acknowledge are true. In this way I aim to show that psychologists already share a great deal and that this shared consensus is sufficient to organize their theory, research, and clinical practice. The result of focusing explanation on mechanisms is a paradigm shift that enables psychology to transition from an immature to a mature science. This consensus provides meaningful psychotherapy integration because psychologists who share an understanding of psychopathology are likely to treat it in similar ways.

NARCISSISTIC WOUND

The natural science orientation and approach to psychological science requires one to think physically about psychology rather than mentally. This inflicts what might be called a narcissistic wound in that people want to believe that we are somehow qualitatively special. Seeking the required mechanism information requires one to forgo this illusion.

PARADIGM SHIFT

Let's now begin to think differently about cognition, affect, and behavior. Let's consider the **paradigm shift** that I summarized last year on T-shirts as follows:

Bio↔Psychology

Think Physical

Not Mental

CLINICAL SCIENCE TRAINING

On page 9 of Chapter 1 I claimed that there are about 500 psychotherapies. I now give the better reference in support of this fact of Eisner (2000). Lilienfeld (2014) claimed that there are about 300 diagnosable conditions. Hence there are about 15,000 treatment by diagnostic conditions for clinicians to worry about. This number is clearly too large for any training program to adequately address.

The January 2014 edition of *Clinical Psychological Science* contains a special series on revising clinical science training. The article by Levenson (2014) entitled “The Future of Clinical Science Training: New Challenges and Opportunities” reports on the Delaware Project on Clinical Science Training held at the University of Delaware in October 2011. The two main themes concerned diagnosis and treatment.

Diagnostic training is expected to change as follows. The DSM series is to be replaced by Research Domain Criteria (RDoC). They focus on behavior and neurobiology. Levenson (2014) stipulated “Thus, for a behavior to be included in RDoc, there must be a plausibly associated brain circuit” (p. 39). This emphasis fits nicely with Tryon’s (2014) focus on neural networks. In particular, it fits especially well with the connectionist simulation of personality by Read and Miller (2002) and Read et al. (2010).

Treatment training is to emphasize problem solving over learning empirically supported treatment packages. Levenson (2014) wrote:

Ultimately, all procedures in clinical science come with an expiration date. Whether it is therapeutic practices, assessment techniques, research questions, research measures, or data analytic approaches, all have their moment on center stage and then the spotlight moves elsewhere. If this observation is correct, then we do our students a great disservice by training them primarily to be **proceduralists**, regardless of whether that involves training them to administer a particular set of empirically supported treatments or to apply a particular set of research methods to a particular set of research questions. In both clinical practice and research, our students are best served if we prepare them to identify problems, synthesize available knowledge, develop solutions, test those solutions, and inspire others to use and advance what they have learned. This is certainly not to say that training should be content or procedure free but, rather, that learning content and mastering procedures

should not be the primary goals of doctoral-level clinical science training (p 37, bold emphasis added).

What tools will graduates of this new training model use to solve problems and advance clinical science besides the ability to think critically and logically? I suggest that all psychologists base their clinical problem solving on their understanding of psychology; on their foundations in theory because the primary function of theory is to help us understand our discipline. The Delaware Project is an official recognition that current clinical training programs are long on facts and procedures but short on understanding. For example, we have many empirically supported treatments but cannot explain how any of them work. And yet we want clinicians to incorporate these treatments into their professional practice and are puzzled by their lack of interest. Why are we surprised at their refusal?

I did not know about the Delaware Project until January 2014. I therefore find it amazing that I have been implementing their recommendations in my graduate Cognition & Affect course since 2004; for the past 10 years. Tryon (2014) anticipated and informs the Delaware training model.

Like all **paradigm shifts**, the proposed paradigm shift is motivated by the existence of **two anomalies** that were revealed by taking seriously the calls by Kazdin and others for mechanism information. Anomalies are crucial motivators of paradigm shifts because once you see and understand an anomaly and can't find a conventional way to resolve it, you must either live uncomfortably with it or change your perspective. Students will almost certainly adopt the new perspective rather than struggle with the problems associated with the previous paradigm.

The **first** anomaly is that psychological science only offers functional theories. By definition, functional theories lack causal mechanism information and therefore cannot actually explain how anything works. The **second** anomaly stems from a **double denial**. Tryon (2014, p. 14) reports:

On the one hand, psychologists deny that psychological mechanisms are entirely mental. Psychologists argue this way to preserve their identity as natural scientists. Otherwise, their psychological mechanisms could be viewed as mere metaphor or philosophical musing if they were purely mental mechanisms. On the other hand, psychologists deny that

psychological mechanisms are entirely biological. They do this to avoid, and guard against what Dennett (1995, p. 82) described and Lilienfeld (2007) referred to as **greedy reductionism**; the systematic effort to replace psychology with neuroscience (see Miller, 2010; Miller & Keller, 2000). The alternative less aggressive form of reductionism identified by Dennett (1995, p. 82) is **eliminative reductionism**; a nebulous claim that somehow all psychological events are biological events. Notice the absence of proximal causal mechanism information for how biology gives rise to psychology.

HOW TO TEACH COGNITION & AFFECT

The Committee on Accreditation (CoA) of the American Psychological Association requires that all accredited programs provide instruction in the cognitive and affective bases of behavior¹² as follows:

In achieving its objectives, the program has and implements a clear and coherent curriculum plan that provides the means whereby all students can acquire and demonstrate substantial understanding of and competence in the following areas: (a) The breadth of scientific psychology, its history of thought and development, its research methods, and its applications.

To achieve this end, the students shall be exposed to the current body of knowledge in at least the following areas: biological aspects of behavior; **cognitive and affective aspects of behavior**; social aspects of behavior; history and systems of psychology; psychological measurement; research methodology; and techniques of data analysis;" (G&P p 7).

Notice their use of the term aspects vs. bases. Aspects are much more vague, disorganized, and less causal than are bases.

How is this training mandate understood? Just about every psychological article pertains to one or more **cognitive and affective aspects of behavior**. So almost any course with a general reading list will suffice. The aim of my course is to understand how conscious and unconscious

¹² See <http://www.apa.org/ed/accreditation/about/policies/guiding-principles.pdf>

processing of cognition and affect interact to produce behavior. Hence, my course aims to explain the cognitive and affective **bases** of behavior.

How is the Cognition and Affect requirement met elsewhere? There seem to be three ways to teach this course: a) Straight neuroscience, b) A mixture of psychology and neuroscience, and c) As a theory-based course.

Straight Neuroscience: CUNY

CUNY interprets **cognitive and affective aspects of behavior** to mean the neurobiological aspects or bases of cognition and emotion. Their straight neuroscience approach seems redundant with the **biological aspects of behavior** requirement as the following course description shows.

71100: **Cognitive and Affective Aspects of Behavior** (Prerequisites: 70801): This course examines the **behavioral and brain mechanisms** and functions associated with cognitive and affective aspects of behavior. The course focuses on historic and current behavioral and neuroscience research to understand cognitive and affective processes in the human brain related to attention, executive processes, working- and long-term memory, language, stress and memory, affective regulation, affective disorders, and emotion and cognition interactions¹³.

Mechanisms are more than aspects. Mechanisms are causal bases. I am not sure what CUNY means by brain mechanisms. We shall see that there are no behavioral mechanisms per se. The following prerequisite course suggests that their cognition and affect course focuses exclusively on the neural networks that mediate cognition and emotion.

70801: Neuroanatomy: The course introduces students to the organizational structure of the human brain, including slide material of gross neuroanatomy, cerebral vasculature, spinal organization, and internal structure from medulla to cortex. Functional system mini-lectures are also provided for the sensory and motor systems, the thalamus, hypothalamus,

¹³ See <http://www.gc.cuny.edu/Page-Elements/Academics-Research-Centers-Initiatives/Doctoral-Programs/Psychology/Training-Areas/Clinical-Psychology-@-Queens-College/Program-Requirements/Course-Descriptions#sthash.1XWoscR6.dpuf>

basal ganglia, limbic system, cerebellum and cortex. Neuroanatomical mapping of major neurochemical systems and their receptors is also provided. Course expectations include both visuo-spatial and written fluency of the material¹⁴.

Straight Neuroscience: Ferkauf / Yeshiva

They also interpret **cognitive and affective aspects of behavior** to mean the neurobiological bases of cognition and affect. They also take a straight neuroscience approach. Their training in the Neuropsychology of Cognition and Affect by Dr. Holtzer is through a course entitled **Cognitive and Affective Bases of Behavior** (PSC 6472). Dr. Holtzer does not seem to mean how cognition and affect cause behavior because he focuses on brain areas.

PROBLEMS WITH THE STRAIGHT NEUROSCIENCE APPROACH

A major problem with and fatal flaw of the straight neuroscience approach is that it offers only a biological understanding how the brain mediates cognition and emotion. It does not explain how the brain generates psychology. It does not explain how cognition and emotion interact to produce behavior. This approach carries the same explanatory power as phrenology does.

Phrenology involves much more than examining skull bumps. Phrenologists, like modern neuroscientists, understood that the brain controls behavior. They wanted to create a brain-behavior map but were limited by their inability to monitor the living brain. So they went with the assumption that the skull fit the brain like a tight leather glove fits the hand. Hence, careful skull measurements became proxy brain lobe measurements. Then they created a composite brain-behavior map. Modern brain imaging yields the same level of understanding. Functional MRI reveals interacting brain areas that mediate psychology and behavior but can't explain how any of this actually works. Brain imaging cannot explain how neural networks produce psychology. Consequently, the straight neuroscience approach to teaching Cognition & Affect carries few if any applications to clinical practice.

¹⁴ See more at: <http://www.gc.cuny.edu/Page-Elements/Academics-Research-Centers-Initiatives/Doctoral-Programs/Psychology/Training-Areas/Clinical-Psychology-@-Queens-College/Program-Requirements/Course-Descriptions#sthash.1XWoscR6.Qmft7cnZ.dpuf>

By the way, dream analysis is another flawed assumption-based enterprise. The crucial but false assumption is that the conventions used to interpret literature can be applied to dreams to determine their meaning. I do not know of any evidence that supports this assumption.

MIXED BUT MOSTLY PSYCHOLOGY

A mixed but mostly psychological approach is exemplified by the University of Indianapolis and by the Graduate School of Education at Fordham University. No theoretical basis is presented to integrate these findings. No real explanation is provided for how cognition and affect interact to produce behavior. Few if any applications to clinical practice are provided.

AS A THEORY-BASED COURSE

As a clinical psychologist who bases clinical practice on psychological science I take the C&A mandate to mean that students should have a **theory-based understanding** of how conscious and unconscious processing of cognition and affect interact to generate behavior in ways that inform clinical practice as well as advance psychological science. This is a much more challenging but desirable goal that is featured in the Delaware Project on Clinical Science Training that appeared in the January 2014 edition of *Clinical Psychological Science*.

My reasons for going this extra distance are as follows. **a)** We are seriously divided as to how best to treat patients. Clay (2014) reported in the January *Monitor on Psychology* that “APA President Nadine J. Kaslow, PhD, has diagnosed psychology with a serious problem: **fragmentation**” (p. 38). This is not good for consumers or the profession of clinical psychology. Kaslow has dedicated her term of office to decreasing our fragmentation. **b)** Most clinicians are eclectic but there is currently no theoretical basis for such practice. Contradictory theories suggest that eclectic practice puts clients at risk given that a clinical mistake is likely to be made at some point. What basis does one have for switching theoretical orientations to accommodate eclectic practice? Clinicians always fall back on some theoretical orientation when they problem solve.

We need **psychotherapy integration**. But that requires **theoretical unification**. And that can only be done through a **paradigm shift** that transitions psychology from an immature to a mature science. Mature and immature sciences have always and will always continue to accumulate facts. It is how these facts are explained that distinguishes mature from immature

sciences. Mature sciences explain their facts differently than immature sciences do. How facts are explain changes as sciences mature.

Kuhn labeled immature sciences preparadigmatic because they lack **consensus**, a **paradigm**, for how proper, genuine, satisfactory explanations are to be constructed. This consensus also applies to agreement about what the basic concepts of psychology are and what the preferred methods of study are. The required **consensus** constitutes a **beginning** rather than ending point. Consensus enables science to become **cumulative** instead of **competitive**.

Tryon (2014) seeks consensus for several reasons. a) Consensus often reflects the positive elements of diverse perspectives. We seek a comprehensive understanding of the conscious and unconscious cognitive and affective processes that generate behavior and therefore are open to being informed by multiple perspectives. b) Agreement, is crucial for theoretical unification. Given enough consensus, theoretical unification will exist. c) Psychologists are more likely to treat patients alike if they share a common understanding of psychopathology. Hence, consensus is crucial for psychotherapy integration. d) Consensus provides us with a paradigm and that will transform psychology from an immature to a mature science.

POST SCRIPT

Plate tectonics was a new theory designed to explain existing facts. It needed to be tested because it proposed a new mechanism, seafloor spreading, to explain continental drift. The BPN theory does not propose any new mechanisms and therefore does not need to be tested. Priming, Part-Whole Pattern Completion, and the desire to reduce dissonance are not new, etc. Instead, they are well established psychological phenomena. Tryon (2014) reports that mathematical proof of the adequacy of the proposed network model has already been provided.

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