

Review

Social Learning and Addiction

Mark A. Smith

Department of Psychology, Davidson College, Davidson, NC, 28035, United States

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ABSTRACT

Social learning theory, as originally proposed by Albert Bandura, followed 2000 years of intellectual inquiry into the determinants of human behavior. Reciprocal determinism is a central component of this theory and proposes that human behavior is determined by functional relationships between (1) personal factors, (2) the external environment, and (3) the behavior itself. Using this model, drug addiction can be viewed as resulting from the functional relationships between an individual's personal characteristics, social environment, and drug-centric behaviors. In other words, addiction can be viewed as a chronically evolving biopsychosocial disorder, encompassing dimensions that are both internal and external to the individual. Effective treatment interventions should thus target all nodes of the model and the functional relationships between them, and they must constantly evolve with the progression of the disorder. An argument is thus constructed that emphasizes the need for an organized structure of metacontingencies, operating within an individual's social environment, that targets the functional relationships between the factors that drive drug use. Optimally, these metacontingencies would operate within socially connected individuals who have the power to control the functional relationships that influence drug use, the vested interest to monitor individual and collective outcomes, the skills to determine what moment-to-moment decisions are needed to influence behavioral change, and the relative permanence necessary to carry through with the implementation of new strategies to produce outcomes that are cumulatively significant.

1. Introduction

Humankind has always been intellectually curious as to how we understand ourselves and how we relate to one another. The determinants of our behavior have been central to this fascination, and our understanding of these determinants has evolved significantly since the ancient Greek philosophers first proposed explanations for our actions as social organisms. In fact, our current understanding of human behavior has been influenced by a diverse range of observations, hypotheses, and theories over 2000 years of dialogue, introspection, and eventually, scientific testing.

The use of drugs as inebriants predates even the earliest writings of human behavior – one need only read to the 9th chapter of Genesis to learn about Noah's drunkenness. Anthropologists argue that humans first began consuming alcohol approximately 10,000 years ago after observing other animals selectively choosing fermented fruit over unfermented fruit when both were concurrently available. Our affinity for this inebriant was such that humans throughout most parts of the world had mastered the techniques of creating wine, beer, and distilled spirits 2000 years ago. Anthropological data further suggests that humans were

using other psychoactive substances derived from natural sources for similar periods of time, with cocaine use dating to 2500 BC, cannabis use dating to 2700 BC, and opioid use dating to 5000 BC [1]. Perhaps most significantly, once these substances made their appearance in the archeological record, they did not vanish, but remained a permanent fixture of society.

As humans became aware of psychoactive substances, they quickly discovered that these substances produced numerous effects of potential value. Once discovered, a compound was typically adapted for use as a medicine, as a tool for cultural preservation and advancement, and/or as a conduit to the spiritual world. For many of these compounds, their intoxicating effects were an end to itself – people would take these drugs to achieve the presumably pleasurable states of inebriation they produced when consumed [2]. These acute states of inebriation were not necessarily viewed as a problem, but even the earliest writings allude to the negative consequences of the repeated overconsumption of these substances (e.g., despite the ubiquitous presence of wine in many early religious texts, only drunkenness is depicted in a negative light). The Jekyll-and-Hyde-like dichotomy of drugs was thus apparent as early as 2500 years ago, with intoxicating agents seen as holding the potential

E-mail address: masmith@davidson.edu.

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for both personal and societal advancement, as well as personal and societal destruction.

The word addiction has its etymological roots in Latin and suggests a slave-like devotion to something or someone, but its application to drugs is a much more recent development. In the vernacular, drug addiction is considered a “loss of control” over drugs, resulting in the “pathological choice” of drugs over the wellbeing of oneself and others. The pathological component is significant, as it implies something physical in nature, with an organic cause and a behavioral consequence that is maladaptive to the health of the individual and to those affected by the individual’s behavior. Unlike many other pathological conditions with organic causes and behavioral consequences (e.g., Huntington’s Disease), there are no consistently reliable biological markers of drug addiction, either premortem or postmortem, that can be used as a diagnostic tool. Consequently, modern professionals operationally define drug addiction by a list of behavioral symptoms that primarily describe a person’s physical interactions with a substance (e.g., taking more of a substance than originally intended, unsuccessful efforts to quit using the substance). Most all biomedical societies have adopted the nomenclature for drug addiction from the American Psychiatric Association, which uses the term “substance use disorder” [3]. This nomenclature explicitly describes a pattern of use that is problematic, maladaptive, and harmful (Table 1); however, it does not provide an explanation as to why drug exposure can lead to pathological changes in behavior in some individuals. In other words, the label “substance use disorder” does not imply that a person seeks substances because she has a disorder; rather, a person has a disorder because she seeks drugs – it is merely descriptive and not explanatory. The purpose of this review is to develop a theoretical framework to explain the phenomenology of addiction that may then be used to develop effective interventions for its treatment.

2. Intellectual Antecedents to a Philosophy of Addiction

It is only natural that any discussion of human behavior regarding psychoactive drugs go back to some of the first recorded writings about how we allocate our behavior – particularly under conditions in which

Table 1
Diagnostic Criteria for Substance Use Disorder.

1. The substance is often taken in larger amounts or over a long period than was intended;
2. Users have a persistent desire or unsuccessful efforts to cut down or control use of the substance;
3. A great deal of time is spent in activities necessary to obtain the substance (e.g., visiting multiple doctors or driving long distances), to use the substance (e.g., chain-smoking), or to recover from its effects;
4. Users have cravings, or strong desires to use the substance;
5. Recurrent use of the substance results in a failure to fulfill major role obligations at work, school, or home;
6. Use of the substance is continued despite having persistent or recurrent social or interpersonal problems caused, or exacerbated, by the substance;
7. Use of the substance is recurrent so that important social, occupational, or recreational activities are given up or reduced;
8. Use of the substance is recurrent in situations in which it is physically hazardous;
9. Use of the substance is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by the substance; and
10. Tolerance has developed, as defined by either of the following:
 - a Need for markedly increased amounts of the substance to achieve intoxication or desired effect, or
 - b Markedly diminished effect with continued use of the same amount of the substance.
11. Withdrawal is experienced, as manifested by either of the following:
 - a The characteristics withdrawal syndrome for the substance, or
 - b The same (or closely related) substance is taken to relieve or avoid withdrawal symptoms.

Note. Substance use disorder is operationally defined as a problematic pattern of substance use leading to clinically significant impairment or distress, as manifested by at least two of the above criteria, occurring within a 12-month period.

we can choose what is right, good, and virtuous versus what is misguided, evil, and self-defeating. These issues were central to many of the discussions contained in dialogues from ancient Greece.

2.1. Socrates, Plato, Aristotle and the origin of knowledge

Socrates, one of the ancient Greek philosophers, was intimately familiar with the effects of alcohol – it is said that he was impervious to its effects – suggesting that he not only consumed the beverage in what would normally be inebriating amounts, but that he had developed significant tolerance to its effects [4]. Whether his affinity for alcohol influenced his philosophy of behavior is not known, but it is worth noting that some of earliest contributors to Western philosophical traditions were familiar with substance-induced intoxication and other phenomena related to addiction. In his dialogues, Socrates argued that when faced with a choice between two alternatives, it is our nature to choose the alternative that is most right, most good, and most virtuous (Plato, as translated by Jowett, 2011). If so, then why addiction? Why do individuals choose the pathological choice of using drugs at the expense of taking care of oneself and loved ones, of sacrificing personal relationships, of destroying one’s social environment. According to Socrates, the answer is troubling – one must have bad judgement, bad priorities, or even worse – both (see excellent lay discussion by de Kenessey [5]).

Socrates was a nativist, as revealed by his insistence that it was human nature to select the virtuous option. In other words, we select what is good because we know it innately – not via interacting with our sensory world. This position would be elaborated further by his most famous student, Plato, who similarly argued that we are born with innate knowledge of everything within our world – from the physical to the ethical to the moral (Plato [6] as translated by Guthrie, 1973). This knowledge comes from the soul – which prior to taking residence in our physical bodies at birth – resides in the realm of infinite knowledge from time immemorial. It is the external environment that contaminates this innate knowledge and leads us to misinterpret our reality. For Plato, true knowledge came from introspection and by intentionally shutting out what our senses may fool us to believe. For both Plato and Socrates, knowledge was relevant because it played a causal role in the “potential” for behavior – guiding moral decisions in the choice between right and wrong. Moreover, the source of knowledge was ethereal and beyond the physical realm. The implications for addictive behavior are troubling – the individual who *chooses* to use drugs at the expense of what is good and virtuous has committed an act of moral depravity – an egregious act against the immortal soul itself.

Ironically, it was Plato’s student, Aristotle, that broke with tradition and argued for the importance of sensory information in knowledge. Aristotle, unlike his predecessors, was an empiricist, insisting that it was our interactions with the external environment that are responsible for our knowledge of the world. In perhaps his greatest contribution to what 2000 years later would become the psychology of learning, he laid the foundation for associationism, a mechanism by which knowledge is acquired (Aristotle [7] as translated by Ross, 1906). Specifically, Aristotle noted that our knowledge of the world comes about by associating environmental events that are similar to one another (law of similarity) and that appear in close temporal or physical proximity to one another (law of contiguity). All of a sudden, our knowledge of the physical world had another source, and that source has the ability to shape our behavior. Addiction, and the pathological choices that characterize it, may be influenced by the external environment after all.

2.2. Descartes, British empiricism, and determinism

It was over a millennium later before the Roman Catholic Church’s hold on Western thought declined sufficiently for the understanding of human behavior to advance significantly further. During the Renaissance, René Descartes would propose a theory of human existence that

would revolutionize scientific inquiry into the determinants of behavior. Descartes was interested in how organisms interact with their environment, believing that nonhuman animals were nothing more than biological machines. For Darwin, an animal's interaction with its environment was entirely reflexive – each and every behavior was an automatic response elicited by a specific stimulus in the environment. But humans were different – they had a soul, which was metaphysical, given by God, and outside the realm of simple elicited reflexes (Descartes [8] as translated by Cress, 1993).

Ignoring Descartes pseudoscientific explanation for how the soul controls the body (via the manipulation of the pineal gland in three-dimensional space to release pressurized animal spirits to inflate skeletal muscles), his critical contribution to the philosophy of the human experience was to split human behavior into two fundamentally different divisions: reflexive vs. nonreflexive, involuntary vs. voluntary, determined vs. free. Descartes thus provided those who succeeded him with two potential explanations for the pathological behavior of addiction, it could be performed freely and voluntarily, with the same moral repugnance suggested by other theories, or it could be entirely reflexive, determined in whole or in part as a response to environmental events that are beyond our voluntary control. Importantly, Descartes's explanations were mechanistic, which permitted hypotheses to be developed and tested empirically during the dawning of the Enlightenment.

If Descartes cracked open the door of causal determinism, then an argument could be made that Thomas Hobbes blew it off its hinges. Hobbes argued that all human behavior, even the unobservable behaviors of the mind, was subject to mechanical laws. Motions of the body were preceded by motions of the mind, which he called “endeavors”, and these endeavors were physical in nature and subject to the same natural laws that governed the activity of reflexes [9,10]. Such writings would later inspire the work of several British Empiricists, who took Aristotle's emphasis on sensory experience and associationism to its logical extremes. For instance, John Locke argued that we are born a “blank slate”, and that knowledge is based exclusively on direct experience with the sensory world. David Hume would take this a step further and argue that even the laws of causation were subject to the mental associations created by the “habitual order of ideas”, meaning that causation itself may only be a product of the mind [9]. Thomas Brown outlined many of the supposed associations that determine our behavior, describing the importance of similarity, recency, and frequency in associating the events that serve to direct our actions. Coincident with these developments, Jeremy Bentham emphasized the utilitarian consequences of these associations, particularly of those that brought happiness. He argued that psychological hedonism determines our behavior – we act in ways to maximize pleasure and minimize pain. The “pleasure principal”, the logical progression of psychological hedonism, was later embraced by Sigmund Freud [10], who identified it as a critical component of the id and causing people to act in ways that satisfy their biological needs. In contrast to ethical hedonism, psychological hedonism did not define what is “good” and what is “evil”, it simply argued that we act in ways that satisfy our hedonistic needs. The pleasure principal, in effect, provided an explanation of behavior that was devoid of moral judgement – we no longer needed to chastise the behavior of the drunkard – drug use is a natural consequence of its ability to tap into our natural hedonic drives.

2.3. Darwin and natural selection

But why do mechanisms such as associationism and hedonism exist? A potential answer to this question was uncovered during a fortuitous ocean voyage to the Galapagos Islands. Charles Darwin would use that voyage as inspiration for his transformative theory to explain the origins of the species. For Darwin, the mechanisms that drove the evolution of a species were not contained within the organism (i.e., giraffes didn't grow long necks in order to reach leaves high in trees) but were located

outside the organism, in nature itself [11]. Nature selects those traits and characteristics that best enable a species to survive and reproduce in its environment (i.e., long necks are biologically adaptive for giraffes – or at least phenotypically connected to another trait that holds survival/reproductive value). Darwin's theory of natural selection would go on to become the organizing principle behind all the biological sciences. But what about the behavioral sciences? Why do we operate in ways to maximize pleasure and minimize pain as the Empiricists proposed?

Nature selects with great promiscuity. Just as nature selects physical traits that promote the survival of the species, so does it select behavioral traits, such as the aggressive behavior most mammals exhibit when protecting their young. Psychologists would later argue that this type of selection works primarily at the level of the individual. It is adaptive for both the species and the individual to act in ways that bring pleasure – such as approaching palatable food or a sexually receptive mate. Moreover, it is adaptive at both the species and individual level for the organism to avoid those situations that can cause illness, anxiety, or despair. If the premises on which the pleasure principal and natural selection are both true, then it is absolutely essential to our survival that we follow the pleasure principal – to act in any other way would bring about our certain demise (thus leaving our remains to be found by future anthropologists next to our less evolutionarily fit ancestors).

By the time of Darwin's death, we had the building blocks for a new science of behavior – a science based on sensory experience, a science based on learning associations, and a science based on the notion that learning associations between relevant events in our environment is necessary for our survival. In other words, we had the beginnings of a scientific discipline that argues human behavior is determined by functional relationships with biologically relevant events that impact our survival. With the emergence of psychology as an independent discipline, scientists could now begin asking empirical questions of how these events elicit biologically relevant responses that promote our survival.

2.4. Pavlov, Skinner, and behaviorism

It was a physiologist who serendipitously discovered the importance of learned associations in biologically relevant responses. Ivan Pavlov, who was researching digestive processes in dogs, discovered that dogs would start salivating at previously neutral stimuli that were predictive of food presentation. In this first demonstration of Pavlovian conditioning (also known as “classical” or “respondent” conditioning), Pavlov showed that a previously neutral stimulus could come to elicit a biologically relevant response if it was paired with a biologically relevant stimulus [12]. Such “conditioned reflexes” are ubiquitous in our environment, and they range from the autonomic arousal elicited by the shriek of a fire alarm to the engorgement of our sexual organs when seeing an intimate partner in various stages of undress. In most cases, these types of associations are biologically adaptive to the organism, preparing the organism to respond to events in the environment that are critical for its survival.

Not all associations are adaptive, and nowhere is that clearer than the maladaptive associations that develop over the course of addiction. For the individual who uses drugs, each drug administration is associated with an environmental context containing a host of stimuli that become functionally related to the drug via Pavlovian processes. These stimuli may include the paraphernalia needed to prepare/administer the drug, the physical location in which the drug is administered, and the people immediately present who may or may not be engaging in drug use. These Pavlovian associations can drive drug use by increasing the incentive salience of cues that are predictive of drug administration [13]. These stimuli also contribute to relapse by inducing craving in the individual, even after extended periods of abstinence. Indeed, “cue-induced craving” is considered a persistent obstacle to long-term recovery and sustained abstinence [14,15]. But individuals do more than respond to drugs and drug-related stimuli. They seek out drugs, they experiment

with drugs, and they try drugs without any prior pharmacological histories. How is drug use established in previously naïve individuals?

Organisms with central nervous systems *behave* – they emit behavior even in the absence of eliciting stimuli. It was B.F. Skinner who would eventually argue that it was contingencies in the environment that ultimately serve to select and maintain emitted behavior [16]. Skinner noted that humans do not simply respond to the environment, they behave in ways to operate on the environment to generate consequences. Skinner thus introduced a new type of conditioning – operant conditioning (also known as “instrumental” conditioning) – in which behavior is determined by the consequences that follow it, rather than the antecedent stimuli that precede it. Through reinforcement and punishment, behavior is selected by its consequences. In other words, each and every goal-directed action is determined by an individual’s history with environmental contingencies similar to those that are operating in the environment at that precise moment [17]. Skinner was critical in pointing out the importance of determining the functional relationships that control behavior – particularly those that operate in the environment. Consequently, any explanation of addiction must uncover the functional relationships that control drug use, including those that contribute to its pathological use at the expense of other behaviors.

3. A Philosophy of Social Learning

Of all the stimuli in our environment, it is other people – particularly those people with whom we maintain our most intimate relationships – that arguably have the largest impact on our behavior. Beginning at birth, most of the knowledge we acquire about our world is obtained via our interactions with others, and it is other individuals who determine many, if not most, of the environmental contingencies that control our behavior. It wasn’t until the middle of the 20th century before the impact of social learning on our behavior was fully recognized.

Any student of Introductory Psychology knows the groundbreaking experiments performed by Albert Bandura, who examined the effects of modeling and imitation on childhood aggression [18]. Following decades of studies of observational learning in laboratory animals, Bandura demonstrated that much of human behavior is determined by observing and imitating the behavior of others, particularly if we observe that the behavior is reinforced by positive consequences. Moreover, other people allow an individual to be part of a verbal community – a community in which the rules of behavior may be relayed across individuals without the need for each and every person to experience directly the contingencies operating in the environment. Bandura, in essence, provided an explanation of behavior that greatly expanded the ways in which people can learn about their environment, and greatly expanded the conditions under which behavior may be selected and maintained.

The number of mechanisms by which the social environment can influence behavior is remarkable. In addition to observing and imitating the behavior of others, other people can directly reinforce an individual’s behavior, either through social praise, contact, or inclusion. Similarly, other people can directly punish an individual’s behavior, either through social ostracism, rejection, or exclusion. Moreover, simply the presence of other people can increase the rate, likelihood, or magnitude of behavior through a process called social facilitation. In addition, other well-characterized social learning processes such as stimulus enhancement, emulation, and socially induced reinforcement enhancement can impact behavior by altering the functional relationships between the individual and stimuli within the environment. Importantly, all of these social learning processes can impact the initiation and maintenance of drug use, including maladaptive patterns of drug use that are characteristic of addiction [19].

Bandura was professionally active during the cognitive revolution – an intellectual movement that took place in the 1950’s within psychology that emphasized the importance of mental processes in behavior. Consequently, his theory of social learning added a critical

role for cognitive appraisal in the selection of behavior. Bandura argued that cognitive factors internal to the individual largely determined which environmental events will be considered relevant, how they will be interpreted, whether they will be used to modify behavior, and the degree to which they will be used to guide future behavior [20]. Importantly, the cognitive component was functionally connected to both the behavior performed and the external environment on which the behavior operated, even though their physical forms were different, and they operated at different levels. Bandura’s theory was novel in arguing that (1) behavior, (2) the environment, and (3) personal factors internal to the individual (including biological characteristics and abilities), have reciprocal influences on one another – events that impact one of these components will also impact the others. For Bandura, the causes of behavior are both internal and external to the individual, and they are functionally related to one another. Similar to Skinner, he argued that behavior was goal-directed – and from a teleological perspective, the “goal” was both the consequence and end purpose of the behavior. Following a behavior analytic tradition, Bandura argued the purpose of behavior was to produce a functional change in the external environment. Unlike Skinner, however, Bandura argued the goal is *cognitively* formed and thus an outgrowth of the internal desires and values of the individual. Because of its cognitive origins, the goal did not necessarily have to benefit the individual or even have survival value [21].

In his model of reciprocal determinism, Bandura argues that behavior, personal factors, and the environment are functionally related to one another (Fig. 1A). Echoing the assertions of Pavlov and Skinner, he argues that an environmental event will influence behavior through traditional conditioning processes, but that event will change personal factors internal to the individual as well, such that a similar event might influence behavior in an entirely different manner because a new organism has been created. Indeed, according to this model, the individual is in a constant state of evolution. Changes to the functional relationships between the three components of the model can occur at any point within the model, leading to continually evolving functional relationships between personal factors, the environment, and behavior. If we consider these relationships in the context of drug addiction, a framework that exposes the complexity of addiction and its resistance to treatment readily becomes apparent.

4. Reciprocal Determinism as a Philosophical Model of Drug Addiction

Borrowing from Bandura’s model, “drug use” can be considered the critical behavior of interest. Both personal factors internal to the individual and environmental factors external to the individual directly impact the likelihood of using drugs. Moreover, all three of these factors mutually influence one another, leading to continually evolving functional relationships that both directly and indirectly influence the use of drugs (Fig. 1B). Using this model, four fundamental questions that are central to the phenomenology of addiction can be addressed.

4.1. What are the non-eliminable dimensions of addiction?

According to this model, the non-eliminable dimensions of addiction are those that relate to the act of using drugs, the personal characteristics of the user, and the contingencies operating in the environment, particularly the social environment. These dimensions, which operate at different levels, interact with one another to produce differences in drug use across individuals. For instance, a person’s genetic background [22, 23], exposure to childhood trauma [24–26], psychiatric comorbidities [27,28], and early exposure to drugs [29,30] can all work in a causal fashion to influence drug use during all phases of addiction and recovery. In a similar fashion, a person’s current environment directly impacts the likelihood of using drugs by setting the contingencies that influence drug use. These contingencies include laws and regulations that restrict or relax drug access [31–33], the price of both licit and illicit drugs

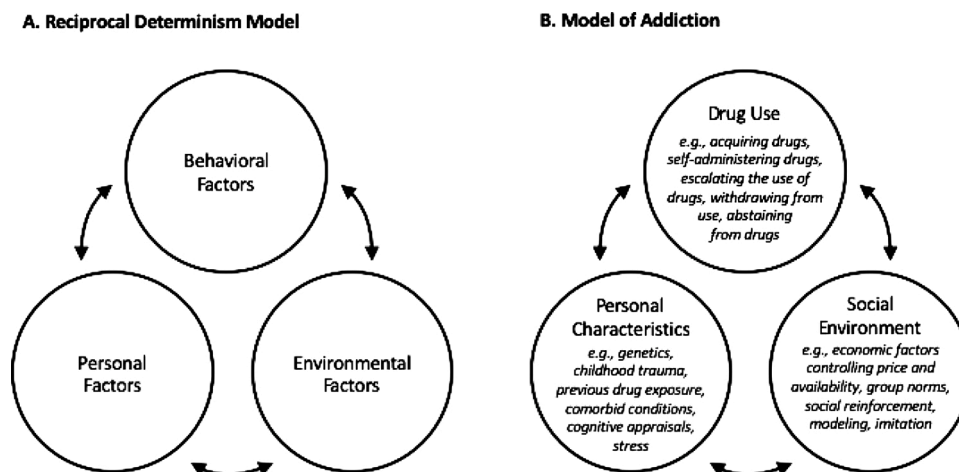


Fig. 1. A. Model of reciprocal determinism as proposed by Bandura. B. Model of Addiction based on reciprocal determinism.

determined by government-imposed taxes or street availability [34,35], and exposure to information that promotes or discourages the use of drugs [36–38]. Of most importance, however, is the social environment, which acts to either encourage or discourage drug use. Indeed, one of the strongest prognosticators of drug use is the drug-use behavior of peers [39,40], and numerous epidemiological studies have identified functional relationships between the behavior of peers and an individual's drug use [41,42]. Drug use may be transmitted socially by a number of mechanisms [19,82], and several of these mechanisms have received empirical support. For instance, an abundance of data indicate that modeling and imitation play a strong role in both the amount and pattern of drug use [43–45], and there is some evidence that social reinforcement can maintain and escalate drug use [46,47]. The impact that other people have on an individual's drug use is directly related to their physical proximity – with intimate partners, family members, and close friends having the largest impact on drug use [48–50].

Drug use also feeds back to influence both the individual and the broader environment. For instance, drugs with high addictive liability produce their effects by interacting with the central nervous system. Prolonged exposure to addictive drugs leads to functional changes within the neural circuits controlling motivated behavior, including those related specifically to drug use [51,52]. Consequently, drug use functionally changes the organism, leading to an increase in the likelihood the individual will use drugs in the future, even at the risk of negative consequences. Similarly, repeated drug use profoundly influences an individual's social environment. For instance, substance use and addiction have negative effects on the quality of intimate relationships, domestic partnerships, and family dynamics [53,54,81]. Moreover, substance use leads to changes in group affiliation as the person exits native groups and enters groups that are more open to drug use by their members [55–57]. When the social environment changes in ways that lead the individual to affiliate with social groups that promote drug use over abstinence, there is a further increase in the likelihood that a person will escalate their drug use over time.

4.2. Can these different dimensions be integrated into a properly comprehensive, integrated programme of inquiry?

Social learning theory and reciprocal determinism allow the critical dimensions of addiction to be integrated into a properly comprehensive, integrated model for further study. In addition to the direct effects that personal factors and the environment have on drug use, the model proposes indirect pathways by which each of these factors can also influence drug use. For instance, stressful events in the environment, including stressful events that are directly caused by drug use (e.g., loss of a close relationship), can directly impact personal factors (e.g.,

precipitating a depressive episode), which in turn increases drug use further. In a similar manner, personal factors, including personal factors that are directly caused by drug use (e.g., substance-induced intoxication), can directly impact the environment (e.g., loss of a job), which further escalates drug intake. Previous investigators have directly addressed the applicability of reciprocal determinism for addictive behavior and reported empirical support for the model in regard to alcohol drinking among college students [58].

This model of addiction is comprehensive in that it incorporates the critical determinants of drug use and acknowledges their causal role in addictive behavior. The model is integrative in that it explains how each of these determinants mutually interact with one another to further drive drug use and increase the likelihood or severity of addiction. In some ways, this model contradicts the prevailing characteristic of addiction as a “chronically relapsing brain disease” [59] in that it is neither relapsing nor limited to the brain. In this model, addiction is a chronically *evolving* disorder, in which the probability of drug use is constantly increasing or decreasing based on multiple internal and external determinants. It is not quantal in the sense that the person is or is not currently in relapse, but it is graded in the sense that the probability of drug use is always at a moment-to-moment value based on the total of direct and indirect factors that are determining its occurrence. Moreover, it is not exclusively a brain disease because many of the pathological determinants of drug use are located *outside* the individual in the external environment. Indeed, the immediate social environment has at least an equal if not greater impact on the probability of using drugs than any pre-existing neuropsychiatric condition [60]. The basic premises offered by this model thus provide a foundation to better understand the phenomenology of addiction and develop approaches for its prevention and treatment.

4.3. What is the best way to achieve integration?

Social learning theory and Bandura's model of reciprocal determinism provide a framework to integrate the critical dimensions that play causal roles in the addictive process. This model has unique advantages in that it acknowledges that each component not only plays a direct and causal role in addiction but interacts directly with each of the other two components to increase or decrease the likelihood of addiction. Consequently, interventions that target one component impact all other components of the model, which in turn feedback in a reciprocal manner to impact the original component targeted by the intervention. This model is a dynamic model that recognizes that addiction is a continually evolving disorder whose critical features are constantly being modified and reorganized in response to a continuously changing environment and organism.

The unique value provided by the triadic model of reciprocal determinism for addiction lies in its characterization of the functional relationships that exist across nodes that operate at different levels. Personal factors are ultimately biological in nature, but they give rise to complex cognitive processes that both interpret and evaluate potential behavioral outcomes. Overt behaviors are physical in nature and function by mechanical force, and they operate on the external environment to functionally change the consequences of future behaviors, increasing or decreasing the probability that the same behavior will occur in the future. The external environment spans the physical world, which includes drugs and the people who use them. Drugs have the ability to change the neurobiological milieu, which in turn influences the cognitive processes that interpret and evaluate the value of their use, especially in relation to other entities that inhabit the external environment, not the least of which are other people. Other individuals are arguably unique, in that they reside in their own network of reciprocal determinism. When two individual networks collide during social contact, both individuals are forever changed because they now share a mutual environment functionally determining the behavior of one another.

The external environment may act directly on the behavior (e.g., both sunlight and morphine directly induce miosis) or it may act indirectly on behavior following cognitive processing. The reciprocal determinism model allows motivational aspects of behavior to be determined by its consequences – a behavior that is positively reinforced is strengthened – reflected by increases in its probability, frequency, rate, and/or intensity in the future. However, the model argues that choice occurs at a more intimate level, as cognitive factors interpret and evaluate different possible outcomes. The individual may choose to initially use drugs for a variety of reasons (e.g., cultural practice, social inclusion, curiosity). In the absence of any obvious negative outcomes, the momentary consequences of using drugs may outweigh the momentary consequences of not using drugs. Drugs are unique as reinforcers in that they act directly (and in this sense, biochemically) on the biological systems that control motivated behavior. Consequently, if drug use continues unabated, cognitive processes that evaluate behavioral outcomes are progressively diminished relative to the motivational aspects of behavior that lead to drug administration. This explanation is similar to those outlined in incentive-motivational theories of drug addiction (e.g., [61,62]) and are generally consistent with other contemporary theories of addiction that incorporate anhedonia and stress into their explanation (e.g., [63,64]). In a reciprocal determinism model, behavior is still determined by factors both internal and external to the individual, but the functional relationships controlling behavior become pathological during addiction, leading to adverse consequences for the individual and others who occupy his or her social environment.

Placing addiction at the center of this model reveals how addiction is greater than the sum of its parts. The factors that have causal influences on addictive behavior do not operate independently but are part of a complex network that both directly and indirectly influence addictive behavior ad infinitum. The spiral of addiction is real. Once these factors begin to set the occasion for addictive behavior, a series of interdependent events begin to unfold, with each event further increasing drug intake, and making the other events all the more effective at increasing drug use further. Reciprocal determinism is causal determinism run amuck. Once an individual enters this addiction spiral, there are very few offramps. A new individual is created with each additional drug experience – an individual that is progressively more likely to make pathological choices for drugs over other reinforcers, even at great personal and social costs.

This is not to say that agency is abandoned in addiction. Indeed, Bandura elaborated extensively on the role of agency in his model of receivable determinism. Specifically, he argued that agency is defined by intentionality, forethought, self-reactiveness, and self-reflectiveness. Moreover, agency operates at the level of the individual (i.e., a person brings her own influence on the environment directly), proxy (i.e., a person influences his environment indirectly via communication with

another person), and collective (i.e., a group of people pool their resources to influence their environment). Agency should not be equated with “free will”, which Bandura argued was a throwback to medieval terminology. In fact, Bandura stated unequivocally that “there is no absolute freedom” and “people do not operate as autonomous agents” [65]. The internal homunculus is a fallacy – it has no role in either the production or evaluation of behavior or its consequences. Rather, social learning theory argues that personal factors, including the cognitively derived “self”, play a deterministic role in the production of behavior. Thus, behavior is fully determined, but personal factors in the form of intentionality, forethought, self-reactiveness, and self-reflectiveness are just as causal determinants of behavior as contingencies that operate in the environment.

Bandura, harkening back to John Locke, argued that “the newborn arrives without any sense of selfhood and personal agency” [66]. Personal agency is acquired very early in life, as the infant observes the consequences of his actions and the consequences of others. The consequences of other’s action on the infant take on particular salience, and the infant develops a sense of self that is both separate from and interdependent on others. This sense of self is thus an emergent product of the functional relationships that connect self-awareness (a cognitive attribute) to both behavior and the social environment. As an emergent product, agency is not reducible to its individual elements, nor does it operate at the same level. Agency is greater than a simple summation of the personal, behavioral, and environmental factors that contribute to its development and can only be explained by the functional and reciprocal interactions they have with one another. The traditional role of “free will” in Bandura’s theory is recast as the contribution of personal factors in the constellation of determinants operating within the triadic model.

Over the course of addiction, a new individual is created because agency evolves with continuing drug use, such that cognitive factors that serve to inhibit behavior are weakened and drug-related factors (including drug-related cues, see Section 2.4) are strengthened. Bandura never argued the nodes within the triadic model are co-equal; rather, their relative influence is determined by their relative salience at any point in time. In a disorder defined by pathological choice, agency isn’t lost, but the relative determinants of behavior change from personal factors to environmental factors. Functional relationships change, but freedom is neither gained nor lost.

4.4. What are the unique expected benefits of achieving integration?

Reciprocal determinism also provides a way out of the spiral of addiction. The most obvious benefit of this model is that it helps to explain the phenomenology of addiction as a biopsychosocial disorder. Like other disorders, addiction is caused by multiple internal and external determinants, which interact with one another in an interdependent manner. The model need not necessarily be confined to addictive behavior; indeed, Bandura would argue that it applies to the totality of human experience. However, applying this model to addictive behavior provides a clearer understanding of the functional relationships in addiction to chart a path forward.

Treatment interventions are typically targeted to only one node of the network. For instance, medications designed specifically for substance use disorders target the central nervous system in ways to minimize the effectiveness of the addictive substance (e.g., buprenorphine/naloxone for opioid use disorder). Other medications impact the nervous system to decrease the influence of comorbid psychiatric conditions that drive addictive behavior (e.g., antidepressants, anxiolytics). In similar ways, psychotherapy addresses past traumatic experiences (e.g., childhood abuse) and current psychological stressors (e.g., loss of job) that are determinants of both drug use and pathological relationships with other individuals in the social environment. Policy interventions influence the external environment to make drugs more expensive, less available, and less socially desirable in ways that impact both the

individual and the drug using community. All of these interventions feed forward to impact all other nodes of network, but they are typically implemented in ways that do not consider the downstream consequences that ultimately impact addictive behavior over time.

Reciprocal determinism acknowledges the value of wholistic treatments for addictive behavior, but it goes further by arguing for a need for evolving treatment strategies in response to a chronically evolving disorder. Treatment requires not only a multimodal approach but a multilevel approach that considers both the direct and indirect effects of an intervention, including those indirect effects that feed back to impact the original intervention. Interventions that target a single node of the model (e.g., methadone for opioid use disorder) are sometimes effective because they have the ability to “feed forward” to produce positive changes in the functional relationships between other nodes of the model; however, they fail to take full advantage of the interrelationships between nodes to maximize their effectiveness. In contrast, network-level interventions that target the interactive processes between nodes take advantage of the positive feedback loops inherent to the system to produce effects that are greater than a simple summation of its individual parts. Reciprocal determinism demands not only a multifaceted approach, but an approach with constantly changing decision trees, if-then statements, and go/no-go decisions. This task is monumental but not impossible, and social learning theory points to a possible solution.

To solve the problem of addiction, reciprocal determinism demands metacontingencies, interlocking sets of contingencies between two or more individuals that produce an outcome greater than (or at least more efficiently than) that which can be obtained by any one individual [67]. In a metacontingency, the behavior established and maintained by one individual determines the contingencies for others. These interdependent contingencies thus control the behavior of both individuals and the broader social network. The term, metacontingency, was not used by either Skinner or Bandura, but it places operant contingencies squarely in the middle of a social context. Since the term was introduced, metacontingencies have been used to explain the evolution of cultures and organizations, and have even been touted as a possible third kind of selection that operates at the societal level (with Darwin and Skinner proposing the first two kinds of selection). Specifically, metacontingencies, whether arising spontaneously in the environment or designed intentionally within an organizational structure, reveal how group dynamics within social networks facilitate behavioral outcomes. These are the types of contingencies that are on the mind of any chief executive officer who wants to develop an organization composed of high-performance teams – teams in which individuals are motivated to work until the project is complete, regardless of the time clock, with a sense of pride in their work, and with a sincere appreciation to their colleagues that made it all possible. This is exactly what is often missing in traditional addiction treatment programs.

Metacontingencies represent an important approach to addiction because their behavior analytic origins emphasize the role of functional relationships that determine behavior. Unlike other approaches that consider personal factors as imbedded within and inseparable from the social context (e.g., relational autonomy), metacontingencies recognize the separateness yet interdependence of these factors. Bandura argued that social systems are not the products of immaculate conception – they are products of human activity that are designed to influence human development and human functioning [65]. In the collective agency described above, people pool their knowledge, skills and resources to shape their future. Metacontingencies provide an organized structure within which social systems operate and allow collective agency to emerge. As a mechanistic process, a metacontingency may provide explanatory value for understanding behavioral change, but it doesn't differentiate between positive and negative outcomes. For instance, metacontingencies could operate within substance-abusing social networks to drive drug use or within therapeutic social networks to promote abstinence and abstinence-related behaviors.

Reciprocal determinism recognizes that positive behaviors can feed

forward to create a new social environment with new social contingencies. These new contingencies, in turn, impact the behavior of all individuals within the social network. They also influence the individual by influencing cognitive appraisals of both their behavior and their social network. Over time, behaviors within a social group are selectively imitated and reinforced, which in turn increases similarity within the group, which in turn increases group cohesion, which in turn increases affiliation between group members, and which in turn furthers the influence of the group on individual behavior.

Addiction treatment needs a set of metacontingencies, operating within an individual's social environment, that brings organizational structure to the multitude of individual contingencies determining behavior. This doesn't preclude the use of medication, individual psychotherapy, or policy initiatives – all of these interventions directly impact the important dimensions of addiction as defined by reciprocal determinism. Social interventions such as group counseling and family therapy recognize the importance of social dynamics as both causes of drug use and mechanisms of recovery, but they alone are not sufficient. What is needed is an organization of individuals that has control over the functional relationships that influence drug use, the vested interest to monitor individual and collective outcomes, the skills to determine what moment-to-moment decisions are needed to influence behavioral change, and the relative permanence necessary to carry through with the implementation of new strategies to produce outcomes that are cumulatively significant. In essence, a chronically evolving biopsychosocial disorder needs a chronically evolving biopsychosocial treatment – a set of metacontingencies operating in the social environment that targets all dimensions of addiction and the functional relationships between them. Specifically, metacontingencies can serve as effective interventions because they can be applied within an environmental context to control the interlocking contingencies that determine behavior – especially pathological behaviors that emerge over the course of addiction as the role of personal factors (e.g., cognitive considerations of the negative consequences of drug use) are weakened at the expense of environmental factors related to obtaining and using drugs.

5. Addiction, Social Learning, and the Path Forward

A theory of addiction that borrows principles from social learning and reciprocal determinism provides an approach to addictive behavior that has both philosophical and practical utility. Addiction professionals tend to partition complex phenomena according to their own self-interests – the neuroscientist sees only neuropathology, the psychologist sees only broken relationships, the bureaucrat sees only ineffective laws and regulations. All of these individuals are correct in their observations, but they are only seeing part of the picture – a picture that is exceedingly complex because it's in a constant state of motion.

From a philosophical standpoint, a model based on reciprocal determinism is attractive because it considers addiction as determined by factors both internal and external to the individual. It acknowledges the importance of an individual's personal characteristics – including past experiences and current “mindset”. It acknowledges the social environment – including both proximal and distal individuals. It also acknowledges the role of the individual's behavior – including behaviors involved in the acquisition of drugs, the use of drugs, and ultimately, the abstinence from drugs. Most importantly, it recognizes the functional relationships and interdependence between these factors. It's a model that is both comprehensive and integrative. It's a model that also points an accusatory finger at the specialty scientists and clinicians (the present author included!) who are interested in only one aspect of the phenomenon. Addiction is bigger than the person who needs help and the person who offers it – organizing principles are needed to describe it and organized structures are needed to heal it.

Intensive, inpatient treatment programs provide an organized set of metacontingencies that function across similarly affected individuals to

promote an abstinence-based lifestyle; however, these programs are limited, they are transient, and they remove the individuals from both the target of their pathological behavior and the social networks within which they interact (inpatients are typically deprived of both their drugs and phones immediately upon admission). Even the most intensive treatment programs do not sufficiently prepare their recovering patients to reintegrate into society as a sober person. For evidence, just look at relapse rates after inpatient treatment – especially for those individuals who do not continue with any form of aftercare [68].

But what of aftercare? The most common form of aftercare is regular attendance at Alcoholics/Narcotics Anonymous meetings (AA and NA, respectively). These treatment programs have vexed addiction scientists and clinicians for decades, owing partly to their difficulty for systematic scientific evaluation [69]. AA is the largest recovery group in the world by a wide margin. Those who attend meetings regularly are much less likely to relapse both in the short term and long term than those who do not attend meetings [70–75]. Importantly, the efficacy of these organizations cannot be attributed to self-selection bias [76]. Most amazingly, the basic principles of these organizations have not changed in over 8 decades. The “Big Book” (i.e., *Alcoholics Anonymous: The Story of How More Than One Hundred Men Have Recovered from Alcoholism*) is virtually unchanged since its original publication in 1939. These organizations have had the same 12 steps and the same 12 traditions that were first described almost a century ago. No one should be waiting for, “*Alcoholics Anonymous, Volume Two: NOW WITH TEN ALL NEW-AND-IMPROVED STEPS*” anytime soon.

One reason that AA and NA have been so remarkably effective, for so many individuals, for such a long time is because they provide a relatively permanent set of organized metacontingencies for socially engaged individuals who have vested interests in achieving positive individual and collective outcomes. Indeed, the positive social networks found within AA and NA have consistently been shown to be an important mediator of their efficacy to maintain abstinence over extended periods of time [77–79]. Although the individuals and individual meetings may change, the permanence of the organizational infrastructure assures that each new individual seeking help will be placed immediately within a social network that directly addresses their drug use, their personal characteristics (i.e., their “psyche”, “mind”, “heart”, “soul”, or however it is self-defined), and their broader social environment. The 12 steps recognize the functional relationships between these nodes that contribute to addiction (e.g., Step 1: powerless over *drug use*; Step 5: honesty with *oneself*; Step 9: making amends to *others*). Moreover, the social network provided by these organizations do not remove the individual from his or her existing social network – the individual in recovery remains socially, physically, and intimately connected to friends and family. Perhaps most importantly, the structure provided by these organizations is permanent, which is exactly what is needed for a continually evolving disorder. No one will be pushed out because a new bed is needed, because a personal check bounced, or because insurance ran out. This organized society of engaged individuals will always be there to address new issues as the underlying disorder continues to evolve ad infinitum.

AA and NA are not for everyone, and a number of reasons have been given by individuals who left these programs voluntarily while still in recovery (e.g., the emphasis on religiosity; [80]). Fortunately, many other continuing care programs are available that provide similar sets of social-network-based metacontingencies to promote long-term abstinence (e.g., SMART, LifeRing, Refuge Recovery/Recovery Dharma, SOS, Women for Sobriety). All of these organizations have taken the basic principles of recovery used by AA and NA and adapted them to targeted populations, giving individuals additional options when making the transition to recovery.

Translating the principals of social learning theory into actionable practices for addiction does not mean that inpatient treatment should cease – indeed, some components of inpatient treatment are absolutely critical (e.g., detoxification). It also does not mean that the solution for

addiction is already at hand in the church basements and community centers across the country where 12-step programs meet. Rather, successful translation of social learning principals into clinical practice involves creating treatments that are socially and environmentally invasive – in much the same way that new treatments for pancreatic cancer and valvular heart disease are physiologically invasive. Addiction treatment must move from the isolated hospital wing to the individual's social environment – and the professionally certified team of physicians, nurses, therapists, and administrators must make way for a well-trained team of parents, children, coworkers, and peers who control the contingencies controlling the behavior of the individual in recovery.

All support groups guided by the 12-step principles address the functional relationships that determine drug use. Going forward, these same principles can be used to guide the development of metacontingency-based interventions to aid recovery. The sponsor/coach/guide with a vested interest in sobriety is a critical component of any treatment intervention involving addiction. Indeed, this person is absolutely necessary for the establishment of a metacontingency in which the behavior of one individual determines the contingencies for another. A sponsor with a history of addiction (i.e., a peer) but also a history of long-term abstinence controls the contingencies that control the drug use of the individual just beginning recovery – this person models and reinforces abstinence-related behaviors while redirecting drug-centric behaviors to those that are conducive to recovery. Because both individuals are in long-term recovery – these behaviors both feedback and feed forward to maintain the abstinence of both individuals. Moreover, the larger social network of former users – all of whom are in various stages of recovery – encourage one another via modeling and reinforcement to take “personal inventory” and to identify the personal factors that play a causal role in their drug use. In closed meetings, these factors are shared with others – not as an exercise in vulnerability – but to draw attention to the personal factors that contribute to addiction across individuals. The commonality of these personal factors is often unknown to a person just beginning treatment (hence the commonly invoked phrase, “*Thank you for sharing*”). Finally, the individual in recovery is encouraged to “make amends” to those harmed, expanding the social network beyond the support group so that new metacontingencies can be established in novel environments. These practices borrowed from 12-step programs are just a few of the turn-key strategies that can be employed when developing new metacontingency- and network-based interventions for drug addiction.

Social learning theory makes the argument that treatment programs should follow the examples originally provided by Dr. Bill W., who authored the “Big Book” and laid the foundation for AA and all other organizations that evolved from the 12-step philosophy. As noted in the second sentence of the Big Book, the main purpose of these groups is “... to show other alcoholics *precisely how we have recovered*” (emphasis in original). More than 80 years after their founding, the metacontingencies that evolve within these organized social systems still reflect some of the most effective strategies we have to confront the problems of addiction and the maladaptive behaviors associated with it.

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