

instinct to trade" (sect. 5.3). Without a biological (evolutionary) basis, such motivators would be seen as "scandalous" from certain subsets of psychology. However, empirically based theories of motivation, such as the Premack Principle, explicitly state that any desirable behavior or tangible item can serve as a basis for motivation. Within this framework what qualifies for a motivator does not depend on its biological or adaptive value, but rather on the item or behavior's value in relation to all other possible behaviors or items. This idea about primary and secondary reinforcement is consistent with Skinner's behavioral position and suggests that it is unnecessary to consider Skinner's view as Drug Theory. Money has an important place in the hierarchy of value because of its flexibility. Not only can it be used to make other reinforcers available, but—like a good tool—it extends their reach, making them available at future times when they may be even more desirable than they are at present. It can be argued that computers, too, are extremely desirable tools because of their extraordinary flexibility; one notebook computer can replace a roomful of equipment. And, like money, computers are the objects of a great deal of preoccupation on the part of their users.

L&W also assert that token reinforcers maintain their motivational power without explicit pairings with unconditioned reinforcers. Indeed, such reinforcers can exert motivational influence even when devalued or when presented in a different context (e.g., Fantino 2000; O'Daly et al., in press). However, such influence is typically fleeting. In fact, the authors point out that in many historical societies where rapid devaluation of currency occurred, the old devalued currency was abandoned and either money with a stable value was used or bartering ensued. This devalued money could then be used as a more literal "tool" as in Figure 1, which shows a woman in post-WWI Germany using a pile of devalued Marks as kindling.



Figure 1 (Romanowich et al.). Inflation – 1923. Devalued Marks are used as kindling in post-WWI Germany.

Extinction is a key component in the process of operant conditioning. When one tangible item or behavior leads to unconditioned or conditioned reinforcers, those tangible items or behaviors will be motivators. Other equally tangible items or behaviors that do not, or no longer, lead to reinforcers will not be motivators. This means-ends relationship is identical to Tool Theory. Drugs are no different in this respect. Once a drug no longer offers any physiological satisfaction, its use stops. This chemical action is biological, but obviously has no evolutionary advantage to the individual. In most cases, as the authors point out, the opposite effect can be observed. But, other conditioned stimuli may still elicit the craving for the drug. Presenting these conditioned stimuli without the drug also causes a decrease in that response. Therefore, drugs can also be thought of in a means-ends analysis when the concept of extinction is considered.

The proposition that seemingly ubiquitous human behavior can be explained in evolutionary terms (instincts) has led to gross overgeneralizations throughout the history of psychology (for a discussion, see Fantino & Logan 1979, pp. 297–301). There is no doubt that the ontological biology of a person will change in response to the use of money or tokens (i.e., changes in neural circuitry will occur). But neural changes accompanying conditioning do not require Drug Theory. Tools, be they money or computers, are likely to be powerful generalized reinforcers since, as discussed above, they are paired with so many good things. A broadened concept of generalized reinforcers together with the concept of extinction can go a long way to making a dependence on Drug Theory superfluous.

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## Evolutionary psychology and functionally empty metaphors

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**Abstract:** Lea & Webley's (L&W's) non-exclusive distinction between tool-like and drug-like motivators is insufficiently discriminating to say much about money that is useful, as the distinction's equivocal application to sex, food, and drugs shows. Further, it appears as though the motivations of problem gamblers are non-metaphorically like those of drug addicts.

Lea & Webley (L&W) make clear that their topic is a choice of metaphors for money. They take care to distance themselves from the idea that one of their two favoured metaphors could be altogether "correct" at the expense of the other. So, arguing against them that money is not a drug but (more like) a tool, might seem to miss their point. We instead raise doubts about the *value* of their dichotomy of metaphors in the first place. We then say *why* there is indeed an interesting, but non-metaphorical, relationship between drugs and money.

L&W's discussion depends on a distinction between motivators that directly subserve biological functions (tools) and what they call (in sect. 2.2.4) "functionless motivators" (drugs). They recognize that money serves some biological functions much of the time and so is, to that extent, a tool. But then they argue

that it doesn't *always* serve this function, and even systematically subverts fitness in some circumstances (e.g., when used to facilitate transactions within families), and so is also, to that extent, a drug.

This distinction applies to too many things too easily. Most sexual activities of modern humans are recreational and costly, and so do not support, and sometimes subvert, their expected fitness. In wealthy societies, the same goes for food. Psychoactive drugs, for that matter, are also tool-like; consider the familiar sequence that begins with a drink bought in a bar and leads to the production of children. Perhaps L&W would say that sex and food are both tool-like and drug-like, just as money is, while drugs are also tool-like. But metaphors are valuable only insofar as they discipline and structure thought. Contrasts that exclude nothing are (functionally) empty.

L&W say things that suggest the following response. Sex and food are pre-cultural motivators, but money is not. Therefore, sex and food *in general* must be tools for enhancing fitness, whereas in the case of money the jury is out until we devote theoretical reflection to the matter. But L&W have no independently stable ontology of types of motivators at their disposal. There is no human instinct for "sex in general"; there are just dispositions to particular sorts of sexual activity in particular sorts of circumstances and *not any one* of these dispositions is always fitness-promoting.

Our objection would be churlish if money were, like cocaine but unlike most sex, *typically* pathological with respect to function (fitness-enhancing or otherwise; again, sex *is* typically pathological with respect to *fitness*). But this would be so only if true miserliness – sheer hoarding of money for the sake of having it and not for status, security, and so forth – were widespread. Such miserliness is in fact extremely rare. (When they mention it in support of their argument, L&W cite no prevalence studies, surprising or otherwise.)

The poverty of L&W's case here is a special case of the poverty of a whole species of evolutionary psychology. This species aims to identify a restricted set of basic pre-cultural motivators. Then it hypothesizes modules for seeking and evaluating instances of these motivators. The modules, being narrow specialists, can be fooled into misevaluation by things that mimic the targets for which the modules were selected; these are drug-like rewards.

Human cognitive architecture is probably modular to some extent. But hunting for definite, cross-environmental reward types that are *the* agents responsible for selection of the modules reflects a simplistic and naive view of evolutionary dynamics and complexity. Such hunts can sometimes have heuristic value if they are taken with a pinch of salt *and* if the explanatory target has very shallow cognitive interpenetration – for example, human preferences for sweets and fats, or male heterosexual preferences for curvaceous women, the prototype instances that show off evolutionary psychology in its best light. Money isn't very much like ripe fruit or rounded hips in *that* respect – very little of widespread attraction to people is. So money, like almost everything, is tool-like and drug-like. Is saying this really a helpful contribution to scientific understanding?

L&W twice allude to a truly powerful way of studying reward when they mention "neuroeconomics," including the study of differential brain responses to variances in reward types, frequencies, delays, and contexts. They are wrong, though, to cite neuroeconomics, specifically Glimcher (2003), as having identified a "trade module" or a distinctive neural response to trade-related stimuli. There is no such finding. What Glimcher and other neuroeconomists report are neural capacities to learn to predict values of rewards in *many* contexts, not in specifically *trade-related* contexts. In fact, the early progress in neuroeconomics is bad news for evolutionary psychology of L&W's type, for it shows that brains nimbly learn to compare rewards across whole ranges of settings and cultural manipulations of setting (e.g., McClure et al 2004), not that they are systems

that refer their input robotically back to a fixed stock of ancestral reward types and thereby get tricked in bars and casinos. Biological brains, that is, are multi-modal evaluation and resource allocation machines; it would be surprising if any creature capable of representing multiple such evaluations to itself proved incapable of latching onto money given the chance. Capuchin monkeys, for example, have been trained to use multiple fungible fiat currency (Chen et al., in press).

Study of the brains of problem gamblers suggests there is indeed an interesting relationship between drugs and money, but not one resembling L&W's metaphor (see, e.g., Potenza et al. 2003). Problem gamblers don't appear to value money for its own sake. But they *do* appear to be typical, perhaps even *prototypical*, addicts. Cocaine addicts may not value *cocaine* for its own sake. Rather, gamblers and cocaine addicts have more difficulty than other people convincing their brains that they are receiving enough reward, at a fast enough rate, as a *generalized* target. Here reward just means: anything that mobilizes neural attention. Thus, as Rachlin (2000) has stressed, gambling and chemical stimulants are close substitutes for social interaction. Behavior with respect to money is just like behavior with respect to stereotypical drugs *because* money is such a reliable tool for getting what the brain is always looking for, namely, relief from boredom. But it isn't money itself that is the drug, it is gambling. Money in the gambling addict is – literally – a tool for getting drugged.

## Tools, drugs, and signals in the road from evolution to money

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**Abstract:** The problem of the biology of money is twofold: It subsumes both the identification of behavioral mechanisms that account for the power of money as an incentive, and the elucidation of the phylogeny of such mechanisms. The drugs–tool distinction, as articulated by Lea & Webley (L&W) in their fascinating synthesis, is a welcome step toward their solution. Compared to the direct invocation of instinctual drives, however, conditioning processes provide a conceptually and empirically clearer road from evolution to money.

The nearly absolute displacement of weaker non-monetary modes of production by the global expansion of capitalist economies, begs the question that the authors ask: Why are people so interested in money? The answer is less trivial than it appears. The obvious answer is not incorrect, but rather, as is made crystalline in the target article, it is incomplete. To explore the shortcomings of that explanation, the authors have christened it as "Tool Theory," characterized its means-to-end connotations, and moved forward to evaluate one exciting possibility: that there is a biological rationale, beyond the mere utilitarian, for the rewarding character of money. For motivation theorists, the reality of a connection between biological functions and motives is as obvious as Tool Theory (e.g., Maslow 1943); nevertheless, biological explanations are, at best, a growing but still marginal element of economic discourse. The science of money is still disconnected from the science of life, and the target article insightfully points at issues that may bridge this gap.

The question of the biology of money is meaningful only if it inquires about how a *specific* motivated behavior (money seeking) is mapped to *specific* evolutionary demands. The conventional character of money and its short natural history, however, preclude any direct connection between money and nature. This point is well argued by the authors, who conclude that there cannot be a "money instinct." Consequently, the research question is only viable through a roundabout: Money