Scarcity begets addiction

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Abstract: As prototypical incentive with biological meaning, food illustrates the distinction between money as tool and money as drug. However, consistent neuroscience results challenge this view of food as intrinsic value and opposite to drugs of abuse. The scarce availability over evolutionary time of both food and money may explain their similar drug-like non-satiability, suggesting an integrated mechanism for generalized reinforcers.

In their discussion of the reinforcement power of money, Lea & Webley (L&W) use the biological value of food to distinguish between tools (useful to eventually obtain a biological incentive) and drugs (parasitizing the biologically meaningful incentive system). This opposition between intrinsically valuable food and addictive drugs of abuse, however, may be less innocuous than it appears on the surface.

As a source of metabolic energy, regulation of food intake could be expected to be controlled by the hypothalamus, the brain region that monitors and manages the neuroendocrine system, ultimately modulating the blood concentration of glucose. Instead, the subjective feeling of "hunger," as meant in the industrialized world, does not seem to correlate primarily with hypothalamic activity. Brain imaging showed that, in human subjects craving food after skipping one or two meals, it is instead the dopamine system that lights up (along with the orbitofrontal cortex), with an activation pattern similar to that recorded in drug addicts awaiting their fix (e.g., Pelchat et al. 2004; Volkow & Wise 2005). However, in subjects fasting for 36 hours, the hypothalamus does show increased activation (Tataranni et al. 1999). This protracted fasting period correlates with considerable metabolic changes and subjective reports nearly opposite to the feelings of people waiting to be seated at restaurants (depressed state as opposed to unrest).

A converging (if on the face unrelated) line of evidence indicates that caloric restriction significantly increases longevity in laboratory animals. In particular, rats whose daily caloric intake is limited to approximately 60% of ad libitum controls have a life expectancy about 30% longer (Hadley et al. 2001; Mattson 2005). If confirmed in humans, these findings would complement the recent recognition of obesity as one of the most lethal preventable diseases in the United States (Allison et al. 2001; Goldin 2005; Volkow & Wise 2005). Moreover, irregular diet (normal meals alternated with fasting periods) is more beneficial in rats than regular feeding (consistently light meals). Several mechanisms have been proposed to explain these observations, including reduction of oxidative stress, strengthening of the shock-absorber systems, and stimulation of growth factors (Mattson 2002; 2005; Mobbs et al. 2001). Taken together, brain imaging and caloric restriction studies invite the provocative hypothesis that humans with virtually unlimited access to food do not normally eat to gain a biological advantage, but rather because they are addicted to food.

Now let us consider barter, which operates on the principle of mutual advantage (McCabe 2003): each party has something the other wants, and, by trading, both parties can be made better off. The tool theory of money emerges from the observation that the value from barter can be greatly expanded by using money to (1) reduce the search costs of finding a potential trading partner, (2) reduce the default risk of trading with a partner by getting money in return, (3) define the relative value of goods and services by pricing them in terms of money, and (4) allow greater specialization of human activity (North 1990). However, money can lose value either through oversupply, as when governments print money to cover their debts, or in competition with other monies, as seen in international exchange rate fluctuations.

In experiments, people continue to trade money (McCabe 1989) even when it is losing value, thus providing evidence that money itself is seen as valuable (consistent with the money as drug hypothesis). A plausible explanation is that even as money itself loses value, the barter it is producing continues to be valuable. So the built-in desire for money may be a secondary reinforcer for barter. The anticipation and realization of earning money is known to activate the same dopaminergic pathways as drugs and other rewards (Knutson et al. 2001b), and contingent management strategies use monetary rewards as a substitute for drugs in drug treatment programs (Higgins et al. 2000).

Food and barter exchange have interesting correlates in that both were scarce (meaning hard to obtain) over evolutionary time, and yet both contributed strongly to the inclusive fitness of humans. Because they were scarce, it is reasonable to assume that the biological system would recognize them as rewarding. As suggested by reinforcement learning models (Sutton & Barto 1998), it is important to encode these rewards (including money as a secondary reinforcer for barter) as values, which can then act as inputs into the actor-critic circuitry in order to learn experientially about better action sequences. Since the ecology makes the future availability of these rewards uncertain, it seems advantageous that the value systems associated with seeking behavior would evolve as non-homeostatic and non-satiable (i.e., linear or non-depreciated) and thus have drug-like properties.

Paradoxically, then, the dopaminergic system underlying drug addiction might have evolved precisely to incentivize mammals, whenever possible, to eat above and beyond the minimal, and in fact ideal, amount of food. Offsetting this impulse must then be inhibitory systems of control, which seem to be more variable across humans. Scarcity thus constitutes a powerful evolutionary explanation for the addictive feature of money, food, and in fact any scarcely available generalized reinforcer.

Research suggests that there are two systems competing for behavioral control. The first system locks in behavioral responses to predicted rewards using temporal difference learning (Shultz et al. 1997). This system allows for habituation and may be the primary route for a drug theory of money. Much of the processing in this system involves the dopaminergic neurons in the striatum (O'Doherty et al. 2004). The second system uses contingent goals to build the value of representative pathways for decision-making, and may be the primary route for a tool theory of money. Much of this processing occurs in the prefrontal cortex (Cohen et al. 2000). Recent theories attempt to explain the arbitration of these two reinforcement learning systems (prefrontal and striatal) in terms of the cost/benefit ratio of each system in different circumstances. Such models can help clarify the neurobiological bases of the tool–drug distinction (or at this point, integration), and at the same time extend it to the broader domain of reinforcement learning with scarce resources.

The desire to obtain money: A culturally ritualised expression of the aggressive instinct

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Abstract: Social behaviour is but an expression of instinctive mechanisms whereby the aggressive instinct is of particular importance, having given rise to most of the complexity of social behaviour through processes of phylogenetic and cultural ritualisation. The role of the aggressive

instinct is to dynamically maintain the ranking order in a group, and much of social interaction is concerned with this, including monetary exchange.

> What is certain, is that with the elimination of aggression, ... the tackling of a task or problem, the self-respect [in] everything that a man does from morning till evening, from the morning shave to the sublimest artistic or scientific creation, would lose all impetus; everything associated with ambition, ranking order, and countless other equally indispensable behaviour patterns would probably also disappear from human life.
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> — Konrad Lorenz (1963/2002, p. 269)

One can agree with Lea & Webley (L&W) insofar as "we must explain how money gets its incentive power through its action on other instincts" (sect. 5.4). Of course, money has "a value and an emotional charge that are not predicted by its economic use" (sect. 4.11), but affect and cognition that accompany the pursuit of money do not testify to an underlying trading or altruistic instinct, if ever one existed, but portray an attitude of envy, greed, or quest for status or security. Money is indeed "an indicator of achievement, respect, and freedom or power" (sect. 4.4) and a potent symbol of "power relationships" (sect. 4.6). It may be money's ability to mediate satisfaction of the instinct of intraspecific aggression in a culturally conditioned way, not its supposed "strongly drug-like quality" (sect. 4.6), that explains some of what Belk and Wallendorf (1990) describe as the "puzzling ways in which people behave towards money" (as quoted by L&W in their sect. 4.7) and why it is "taken up irresistibly by any human society that encounters it" (sect. 5.4).

Lorenz (1963) observed that adaptive behaviour is commonly determined by impulses of several instincts, often one inhibiting the other. Phylogenetically, ritualisation creates new instinctive motor coordinations by welding together conflicting impulses. Social behaviour is dominated from a drive-motivational point of view by successive impulses of "aggression, fear, protection-seeking and renewed aggressiveness" (Lorenz 1963, p. 55). Norms of social behaviour that developed by cultural ritualisation started to play an important part in human society "when invention of tools was beginning to upset the equilibrium of phylogenetically evolved patterns of social behaviour" (p. 249), the "equilibrium between the ability and the inhibition to kill" (p. 242). As Lorenz remarked, on the basis of "the instincts of animals," "human culture has erected all the enormous superstructure of social norms and rites whose function is so closely analogous to that of phylogenetic ritualization" (Lorenz 1963, p. 240).

Ranking order is an essential principle of organisation of social life in higher vertebrates; it is maintained dynamically by individuals' aggressive impulses, although it has the effect of inhibiting aggression within a society and limiting fighting between its members (Lorenz 1963). Interaction between members of a group, particularly in highly fluid forms of society, like ours, involves frequent symbolic and paralinguistic display of each individual's potential for aggression and submission. Money is but one symbol for self-esteem and self-respect, which are reflections of social ranking, particularly in modern society. Money has become an increasingly important mediator of social organisation as traditional networks of social reference became fragmented and transient in modernity. As L&W summarise Simmel (1900/1978) in section 3.3.1 of the target article: "Money is both the means and the symbol of the process by which in modern society impersonal, quantitative social relations between autonomous individuals replace the determinant relations imposed by traditional society." L&W themselves acknowledge "the importance of money as a marker of status within modern societies" and recognise that references to wealth or income "are a common part of discourse about status" (sect. 4.8). Indeed, money is a *tool* to obtain social status, allowing the aggressive instinct to be expressed in accordance with our culture.

Psychoanalysis provides another vantage point. As the infant starts to crave a particular mental state that he senses in his caregiver ("object"), namely admiration and devoted interest, he starts to become sensitive to any threat to the exclusivity of this relationship. To the competitive presence of a third person, the infant starts to respond with a particular kind of anger – that is, envy directed at the third person's admirable qualities that attract the caregiver (Oedipus complex). The origins of envy and jealousy lie in the infant's loss of complete control over his object. It is the realisation of his dependence on his object and the development of object-relations that turns constitutional anger and aggression into envy, hate, and jealousy. Not only may envy arise when there is a threat to the exclusivity of one's object-relation, but also when others' qualities, being perceived to be more attractive than one's own, prevent one from establishing such a relation. Competitive aggressiveness derived from the Oedipal complex is a nonpathological and constructive force in human relations (e.g., Wolf 1988, p. 78). Competitiveness is a defence against unacceptable feelings of envy (e.g., Joseph 1986; Spillius 1993), which accords with Lorenz's notion of cultural ritualisation of conflicting impulses. Thus, the function of money may be related to suppressed but unconsciously omnipresent envy (being an expression of the aggressive or "death" instinct).

Much of psychopathology can be related in one way or another to failings of this ritualised interplay of aggressive impulses and reciprocal fear impulses that normally maintains us in social hierarchies, including compulsive gambling, hoarding, and other problems subsumed by the authors under "addiction to money" but with which money essentially has very little to do. The "miser's hoarding" and the "spendthrift's self-destructive carelessness" are both ways of dealing with interpersonal anxieties that abound in groups and societies organised by ritualised aggression with the omnipresent threat of rejection.

What is there to suggest that money "seems to be capable of giving the illusion of trade and reciprocation even when it is absent" or that money "acts like a drug on that centre, activating it even when there is no real possibility of trading" (sect. 5.2, para. 5)? In its social dimension, trade may not be altruistic but yet another culturally ritualised expression of intraspecific aggression aimed at organising hierarchies in social groups. McDougall (1924) argued that the parental instinct is the only truly altruistic instinct in man. One should not postulate a "trading instinct" just because trading is ancient and adaptive, in as little as one can speak of a tool-making instinct. We are not endowed biologically with a specific disposition to trade, although we do have various physiological needs for which trading is primarily a culturally conditioned strategy through which to ensure their satisfaction. There is no difference in principle between trading and foraging.

If Tool Theory suggests that money "is an incentive only because and only insofar as it can be exchanged for goods and services" (sect. 2.1), then this should be true for its social function too: Money is an incentive because it can be exchanged for social status (if only in one's fantasy), thus satisfying intraspecific aggression in a culturally ritualised manner. As L&W acknowledge: "the possibility that money is used for purposes such as social display, social communication ..., or social protection ... merely extends the range of uses for money as a tool" (sect. 2.1). It seems the drug metaphor had to be invoked to make acceptable the otherwise unfeasible argument that our desire to obtain money is related to a trading instinct. The fact that money acquisition is *not* obviously adaptive to such instinct had to be reframed as deceit ("parasitic action on a functional evolutionarily adaptive system"; sect. 2.2.4). In contrast to the authors' assertion that money "gives direct access to the systems that subserve ... rewards ... in an illusionary, nonfunctional way" (sect. 2.3) (money as a "functionless" drug), it can be summarised here that, *unlike* drugs of abuse, money's access to these systems is real and *functional* because it is linked to the culturally adaptive satisfaction of an instinct – that of intraspecific aggression.