

Understanding alcohol motivation using the alcohol purchase task: A methodological systematic review

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ABSTRACT

Background: The Alcohol Purchase Task (APT) is a behavioral economic assessment of alcohol demand (i.e., motivation for consumption during escalating levels of response cost) using simulated marketplace survey techniques. While the APT is often used and widely cited, to date, there has yet to be a systematic review elucidating the variability in administering and analyzing the APT. The purpose of the current paper is to address this knowledge gap in the literature by cataloging the various purchase task methodologies and providing recommendations and future areas of inquiry.

Methods: The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) methodology was utilized (Prospero: No. CRD42017072159). Searches through Google Scholar, PsychINFO, PubMed, and SpringerLink databases identified 47 empirical articles referencing the use of an APT and published through the year 2016. Articles were coded for demographic and procedural characteristics, structural characteristics of the APT itself, and characteristics of data analysis.

Results: Results indicate substantial variation within categories and suggest that there is no standard approach to administering the APT or analyzing the responses generated from it. The results underscore the need for researchers to report as much information as possible related to administration, instructions, price structuring, and analytical approach, as we found that many articles did not provide these details.

Conclusion: Enhancing the transparency of APT methods and analyses in published reports will aid in reproducibility as well as future meta-analytic studies of alcohol demand that could lead to the development of best-practice recommendations for this procedure.

1. Introduction

Behavioral economics is a framework that integrates concepts from economics and operant psychology to understand seemingly irrational decision making (e.g., substance abuse, risky sexual behavior; Bickel and Vuchinich, 2000). The behavioral economic methodology encompasses several constructs that have proved especially useful in understanding alcohol use disorder (AUD; MacKillop, 2016). Among the most frequently used constructs are delay discounting, proportionate alcohol-related reinforcement, alcohol-savings discretionary expenditure, and demand. Delay discounting is characterized by relative valuation towards more immediate outcomes over delayed outcomes (Ainslie, 1975; Madden and Bickel, 2010). During the past decade,

research has shown that individuals with AUD tend to discount future outcomes to a greater extent than controls (e.g., Mitchell et al., 2005; Petry, 2001). The second construct, proportionate alcohol-related reinforcement, quantifies time and enjoyment associated with alcohol use relative to alcohol-free time and enjoyment (Morris et al., 2017; Murphy et al., 2005). With conceptual ties to the matching law (Herrnstein, 1961, 1970) and firmly rooted within the behavioral economic framework, measures of proportionate alcohol-related reinforcement have shown strong relations with AUD (Correia et al., 2003, 1998; Murphy et al., 2005). The third construct closely related to both delay discounting and proportionate alcohol-related reinforcement is the Alcohol-Savings Discretionary Expenditure (ASDE) index (e.g., Tucker et al., 2016a), which, instead of measuring participation

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and enjoyment, measures the allocation of discretionary spending patterns towards alcoholic beverages relative to spending patterns towards savings for the future. Thus, relative allocation may closely map onto a tradeoff between immediate (i.e., alcohol) and delayed (i.e., savings) rewards. Larger ASDE values indicate relatively greater alcohol valuation and these ASDE values have been shown to display incremental utility in predicting abstinence and relapse related outcomes (Tucker et al., 2009). The final construct is demand, which quantifies motivation towards obtaining some good (Hursh, 1980; Hursh and Silberberg, 2008; Reed et al., 2015, 2013). The demand curve, which quantifies changes in purchasing/consumption of a good as a function of changes in the price of that good, is thought to be reflective of reinforcer strength (Bickel et al., 2000; Hursh, 1984) or an organism's motivation to access the good. Put simply, demand curves and related analyses provide insights into the degree of resource allocation (effort, money) an organism will devote in order to obtain a commodity when costs associated with that commodity escalate.

Much headway has been made within the human operant approach to quantifying demand for reinforcers, especially within the drug self-administration literature (e.g., Bickel et al., 1991; Bickel and Madden, 1999; Higgins and Hughes, 2013; Spiga et al., 2005). In these human operant approaches, participants respond on manipulanda to earn access to the reinforcer (e.g., cigarette puffs, cocaine). Although there is little doubt that experiential drug self-administration studies have substantially advanced the field's understanding of the drug-behavior relationship, there are practical and ethical limitations associated with these paradigms. For example, it would not be feasible or ethical to have individuals who are underage or currently in treatment for AUD to complete an alcohol self-administration protocol, and social drinkers cannot ethically consume large quantities of alcohol they might consume in the natural environment when they are in a laboratory setting. Additionally, self-administration paradigms are time intensive, often requiring specialized equipment and safety training.

To address some of these limitations, Griffiths et al. (1993) were among the first to develop a time-efficient method for assessing the relative reinforcing efficacy of drugs. In this multiple-choice procedure, participants are first exposed to different drugs (blinded) and after exposure choose between concurrently available pairs of the experienced drugs and between a unit of drug and an alternative monetary reinforcer. On each choice trial, participants indicate if they would prefer the drug or a variable amount of money. After completing the multiple-choice procedure, one randomly selected choice is provided during a reinforcement session. Although time-efficient, this approach has two primary limitations. First, the task requires multiple sessions for both exposure to and reinforcement of the drug. Second, the task is limited to simple dichotomous choices; it is not possible to obtain volumetric measures either of the drug itself or the total amount willing to be expended to obtain the drug. In other words, the multiple-choice procedure characterizes the breakpoint from an operant paradigm, but does not measure other indices of relative reinforcing efficacy.

Recently, efforts have been made to translate the behavioral economic demand approach to a framework that avoids the ethical and practical constraints of drug self-administration. The Hypothetical Purchase Task (Jacobs and Bickel, 1999; Murphy and MacKillop, 2006; Roma et al., 2017) adapts the behavioral economic demand methodology into a self-report measure. Before discussing this measure, we briefly describe the historical relation of behavioral economic demand to traditional concepts of relative reinforcing efficacy and the core aspects of the demand curve.

1.1. Relative reinforcing efficacy

In the late 1970's, Griffiths et al. (1979) proposed relative reinforcing efficacy (RRE), a theoretically homogeneous concept that integrated previous measures of reinforcer value (e.g., response rate, relative response rate, progressive-ratio breakpoint). Griffiths et al.

stipulated that RRE should refer to the "...behavior-maintenance potency of a dose of a drug..." (pg. 192) in which there is convergence across multiple outcome measures. For example, a drug that maintains a higher response rate compared to another drug should also maintain a higher progressive-ratio breakpoint (i.e., the point at which no amount of the drug is earned). The concept of RRE provides a seemingly face-valid measure of reinforcer value, that different measures of value converge into one higher-order construct. However, inconsistencies between these measures compromised the internal validity of the RRE construct. For example, Bickel and Madden (1999) compared the RRE of money versus cigarettes and found that whereas progressive-ratio breakpoints were consistently higher for cigarettes (as compared to money), preference between the two goods switched as response requirements increased and peak response rate varied across participants. To reconcile such inconsistencies between measures, behavioral scientists have found value in the concept of behavioral economic demand.

1.2. Demand curve

The concept of demand as an indicator of reinforcer strength is rooted in the behavioral economic framework. As alluded to earlier, one focus of the field of behavioral economics as it is applied to substance use and misuse is how environmental constraints affect consumption of reinforcers. Within this framework, demand is the amount of a reinforcer an organism consumes (or estimates consuming/purchasing) at a given price. The demand curve (see Fig. 1) is produced when a series of prices are assessed and the corresponding amounts of the commodity earned and consumed (or purchased) are plotted (Bickel et al., 2000). Such an analysis attempts to emphasize the "response-reinforcer" relation at the molar level (i.e., how the relation between costs and benefits dynamically changes across a spectrum of costs). Briefly returning to the notion of RRE, because the demand approach emphasizes evaluation across a range of prices and a number of different metrics arise from the demand curve analysis, the demand approach by definition stipulates that there is "...no single measure [that] can provide a definitive assessment of [RRE]" and "...suggest[s] that reinforcing efficacy is not a homogeneous phenomenon, but rather may be viewed as heterogeneous phenomena" (Bickel et al., 2000; p. 54). Importantly, we note that both RRE and demand indices can be thought of as conceptually related but quantitatively distinct. Recent research has begun to investigate the interrelationships between demand measures (Bidwell et al., 2012; MacKillop et al., 2009) and results of this work suggest these indices may reflect two underlying constructs:

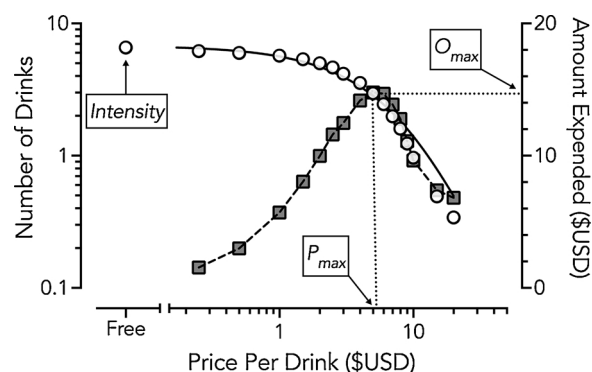


Fig. 1. Prototypical demand curve (circles; left y-axis) and expenditure curve (squares; right y-axis). Note the log-log axes of the demand curve. Intensity is the quantity of the good consumed (or purchased) at no price or very low price. P_{max} or unit-elasticity is the price where one relative unit change in price is equal to one relative unit change in consumption (or purchasing). O_{max} is the point of maximum expenditure. Elasticity (not labeled) is the sensitivity of consumption (or purchasing) to increases in price (e.g., the slope). Breakpoint (not depicted) is the first price at which no amount of the good is earned (or purchased).

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