What Would You Do for a Date?: Using a Conjugate Preparation to Validate the Outcomes of a Demand Task on Preference

By

Anna Kate Edgemon

A dissertation submitted to the Graduate Faculty of
Auburn University
in partial fulfillment of the
requirements for the Degree of
Doctor of Philosophy

Auburn, Alabama
August 3, 2024

Keywords: behavioral demand, conjugate schedules, purchasing task

Approved by

Dr. John T. Rapp, Chair, Professor of Psychology
Dr. M. Christopher Newland, Professor of Psychology
Dr. Samantha Fede, Assistant Professor of Psychology
Dr. Ben Hinnant, Associate Professor of Human Development & Family Science
Dr. Timothy Edgemon, Assistant Professor of Sociology

Abstract

Satterwhite et al. (2013) reported individuals aged 15-24 years account for nearly half of all sexually transmitted infections reported each year in the United States. This may be attributed to risky health decision-making such as sex without a condom, sex with multiple partners, injecting drugs, or some combination thereof. Behavior analytic and economic paradigms have been used to examine sexual demand and sexual health decision-making. To evaluate demand for commodities for which delivery of the commodity is not feasible ethically or logistically, researchers often use commodity purchase tasks (CPTs). Relatedly, schedules of covariation have been proposed as a method for evaluating behavior-environment relations wherein responses and reinforcers naturally covary, as the case may be with sexual behavior. Thus, the purpose of this series of translational studies was to replicate and extend previous research evaluating demand for hypothetical romantic partners. In both studies, participants completed rank order preference assessments using images of potential sexual partners and then completed corresponding CPTs for their high, median, and low preferred partner as identified in the preference assessment. Then, participants completed a conjugate preparation in which images on screen increased in clarity only when increasing forces are applied to a hand dynamometer. Using data from each study, the researcher evaluated correspondence between sexual demand and force exerted. Strong correlation between these two methods of assessment may improve the clinical utility of conjugate preparations. Limitations and implications for future research are discussed.

Acknowledgments

First and foremost, I thank my family, starting with my parents. As a child, I asked them a great many questions about how the world worked. *Every time*, they welcomed my questions. They fostered my creative thought by exposing me to exhibits, books, and lectures related to my various interests. They demonstrated the value of hard work and education by pursuing graduate degrees while working and raising me and my brother. I have pursued an academic career as a result of their careful, self-sacrificial parenting, for which I am immensely grateful. My parents learned these values, in part, from the women who raised them – my grandmothers. Each of whom were unconventional in their time for pursuing education, career, and a family. Undoubtedly, this example led my mother to become the first doctor in our family. It is only because of the strong women who raised me that I am able to pursue my education and career without hesitation.

I also thank the people who have been critical during my doctoral studies, especially my advisor, Dr. John T. Rapp. Throughout my time as a graduate student, Dr. Rapp has supported my development as a researcher, providing many opportunities for growth and independent thought. His research serving vulnerable populations and stalwart dedication to advancing behavioral sciences have challenged me to become a better behavior analyst and scholar. I also thank my committee, Drs. M. Christopher Newland, Samantha Fede, Ben Hinnant, and Timothy Edgemon for their mentorship and encouragement throughout this process. Dr. Newland has been instrumental in my development as an analytical researcher, often challenging me to be creative in data analysis. Dr. Fede has encouraged me to be thoughtful of underlying neural mechanisms which give rise to behavior. Dr. Hinnant has taught me the importance of careful research design and analysis. Dr. Edgemon kindly gave of his time as university reader and

encouraged me to consider the broader implications of my research. Importantly, I thank my lab mates, Daniel Sheridan and Ashley Anderson, who saw me through some of the most challenging seasons of my life during this journey. They spurred me on, made me laugh, wiped my tears, and inspire me to be a better person.

Finally, I thank my husband, Thomas. His love, patience, and encouragement never wavered throughout this journey. He allows me to become the best version of myself as a wife, mother, and scholar. During this dissertation, we have embarked on the most beautiful part of our lives: growing our son, Thomas Rivers. They both have inspired me every day of writing this dissertation.

Table of Contents

List of Tables

List of Figures

List of Abbreviations

CPT = Commodity Purchase Task

DPT = Date Purchasing Task

HIV = Human Immunodeficiency Virus

HRBS = HIV Risk Behavior Scale

HRTBS = HIV Risk Taking Behavior Scale

MSWO = Multiple Stimulus Without Replacement

RO = Rank Order

SDDT = Sexual Delay Discounting Task

SDI-2 = Sexual Desire Inventory - 2

STI = Sexually Transmitted Infection

Chapter 1

Literature Review

Statement of Problem

Each year in the United States, approximately 20 million new cases of sexually transmitted infections (STIs) are diagnosed (Satterwhite et al., 2013). Among these cases, individuals aged 15-24 years make up nearly half (Satterwhite et al., 2013). The World Health Organization (WHO; 2023a) estimated nearly 374 million new infections of STIs globally in 2020. In the US, the number of new human immunodeficiency virus (HIV) infections has remained above 30,000 annually since 2017 (Centers for Disease Control and Prevention, 2023; Song et al., 2017). STIs are linked to eight pathogens, of which only four are curable: (a) syphilis, (b) gonorrhea, (c) chlamydia, and (d) trichomoniasis (WHO, 2023a). These pathogens, among some 30 other bacteria, viruses, and parasites, are passed between individuals who have made sexual contact, including vaginal, anal, and oral sex. STIs are problematic because of their correlation with adverse health outcomes. Specifically, STIs have been linked to the development of sepsis, cirrhosis, and cancer (WHO, 2023a). In addition, some STIs can be transmitted from mother to child through pregnancy, childbirth, and breastfeeding (WHO, 2023a). When passed from mother to child, STIs can cause stillbirth, neonatal conjunctivitis, and congenital deformities (WHO, 2023a).

Some groups are uniquely affected by transmission of STIs and thus may be at greater risk. Geographic and demographic disparities exist within the ongoing US HIV epidemic such that the majority of new infections occur among young Black and Hispanic men who have sex with men, particularly in the South (Centers for Disease Control and Prevention, 2019; 2023). In

addition, the WHO has identified five key populations uniquely affected by STIs: (a) men who have sex with men, (b) people who inject drugs, (c) sex workers, (d) trans and gender diverse people, and (e) people in prisons (WHO, 2023b). Among key populations, this increased risk of STIs is attributed to (a) criminalization of one or more aspects of key population members' behavior, work, or sexual orientation, gender identity and gender expression, (b) punitive legislation and policing practices, and (c) stigma and discrimination (WHO, 2023b). Although these causes are systemic in nature, researchers have identified individual-level behavioral factors that may increase risks of STIs. Broadly, these researchers attribute the spread of STIs to risky sexual health decision-making such as sex without a condom, engagement in multiple transient sexual relationships, and impulsivity in sexual health decision-making. Each of these behaviors warrant further investigation to better understand underlying mechanisms and to develop evidence-based interventions.

In addition, the WHO (2023b) conduced a systematic review of eligible randomized control trials published between 2010 and 2021 and found counselling behavior interventions intended to alter risky health decision-making such as unprotected sex and injecting among key populations did not result in behavior change nor reduce new HIV, viral hepatitis, or STI diagnoses. Thus, research that seeks to improve health decision-making might begin with an evaluation of underlying psychological and behavioral mechanisms that drive risky sexual health decision-making. One useful framework for studying sexual health decision-making is behavioral economics.

Behavioral Economics

Behavioral economics, a term first coined by Kapel and Winkler (1972), refers to a framework born out of multidisciplinary collaboration between psychologists, behavioral

scientists, and economists. This approach to understanding behavior is informed by both behavioral and economic principles (Camerer et al., 2004). Different from traditional economic principles, the behavioral economics framework allows for the possibility that humans make irrational decisions (Thaler & Sunstein, 2008). This possibility is evident to the casual observer of human behavior. For example, some individuals may engage in sexual encounters with people for whom they are unaware of their STI risk probability, despite the adverse outcomes associated with transmission of STIs. An adult may attempt to drive home after an evening at the bar, regardless of the perils of driving while inebriated. Individuals engage in gambling, despite the financial risk associated with large losses. In each of these scenarios, behavioral economics may be useful in understanding human behavior in relation to its' consequences in a variety of highly contextual scenarios. In addition, behavioral scientists have called for findings from this research to inform public policy that seeks to promote desirable behavior change through environmental modification (Hansen & Jespersen, 2013; Reed et al, 2022; Thaler & Sunstein, 2008).

Law of Demand. The law of demand is a central tenet of behavioral economics. The law of demand explains consumption is inversely related to constraint (Samuelson & Nordhaus, 1985). That is, consumption of a commodity increases as constraints decrease (and vice versa). For example, if the price of a box of condoms is $5 and the price doubles, the law of demand would predict fewer boxes will be sold. Conversely, if boxes of condoms are on sale, two for the price of one, the law of demand predicts more boxes will be sold. Furthermore, depending on the fungibility of the commodity, the law of demand predicts consumption of a commodity will decrease to zero levels if unit price becomes excessively high.

In behavioral economics, the law of demand provides a conceptual framework for understanding behavioral demand. Behavioral demand refers to the extent to which an organism

will maintain baseline levels of consumption in the presence of increasing constraints (Reed et al., 2013). To evaluate behavioral demand, behavioral scientists often use commodity purchase tasks (CPTs), first developed by Jacobs and Bickel (1999).

Jacobs and Bickel (1999) developed CPTs to evaluate demand for cigarettes and heroin among a sample of opioid-dependent outpatients. Using a series of tasks, Jacobs and Bickel instructed participants to self-report a hypothetical quantity of cigarettes or bags of heroin they would purchase at ascending prices from $0.01 to $1,120.00. Participants were instructed to assume the following hypothetical conditions as they completed the tasks: (a) they were not in treatment, (b) the only available drugs were those hypothetically purchased, (c) the cigarettes and heroin were for their consumption only, (d) cigarettes and heroin purchased could not be sold or traded, and (e) the cigarettes and heroin purchased were for personal consumption within a 24-hour period. Researchers delivered the task under three conditions: (a) when only cigarettes were hypothetically available, (b) when only bags of heroin were hypothetically available, and (c) when cigarettes and bags of heroin were concurrently, hypothetically available.

To evaluate the relation between hypothetical consumption and unit price, researchers fitted data from the CPTs to a model of demand. Demand curves for each condition conformed to a model proposed by Hursh et al. (1988):

$$\ln C = \ln L + b(\ln P) - aP \qquad (1)$$

Here, C is derived consumption of a commodity at price P and L is derived consumption at $P = 1.0$. To account for demand elasticity, parameters a and b indicate slope and acceleration, respectively.

Hursh and Silberberg (2008) improved upon this equation with the exponential equation of demand:

$$log_{10}Q = log_{10}Q_0 + k * (e^{-\alpha Q_0 C} - 1) \quad (2)$$

Here, Q is consumption, Q_0 is derived intensity (i.e., consumption when price is \$0.00), k is a constant of range of consumption in log units, C is price, and α is derived elasticity (i.e., slope of the demand curve). Although this equation has been used to evaluate demand data across a variety of commodities, procedures, and species, one main limitation exists. That is, the log functions necessarily preclude analysis of zero level consumption values. Thus, Koffarnus et al. (2015) improved upon this equation with the following exponentiated equation:

$$Q = Q_0 * 10^{k(e^{-\alpha Q_0 C} - 1)} \quad (3)$$

Two important features of this demand equation are derived intensity and derived elasticity. Both of these demand metrics may be used in inferential and descriptive statistics and are important for understanding two factors underlying demand: (a) amplitude and (b) persistence (Bidwell et al., 2012; Epstein et al., 2018; Skidmore et al., 2014). Amplitude, measured by intensity, is the absolute hypothetical consumption of a commodity (Acuff et al., 2019). Persistence is a measure of price sensitivity and can be measured by elasticity and breakpoint (Acuff et al., 2019). Maladaptive consumption has been characterized by the degree of amplitude, persistence, or both across a variety of substances and behaviors including heroin (Jacobs & Bickel, 1999), internet use (Broadbent & Dakki, 2015), gambling (Weinstock et al., 2016), and indoor tanning (Reed et al., 2016).

Jacobs and Bickel (1999) noted several advantages of CPTs over traditional methods for evaluating the behavioral effect of reinforcers. First, simulation experiments may be more convenient for researchers in contexts wherein logistical or ethical limits preclude traditional methods. For example, simulation experiments allow for evaluation of commodities for which it is illegal to deliver otherwise (e.g., illegal substances). In addition, simulation experiments allow

researchers to evaluate a variety of hypothetical conditions that may influence behavior such as large quantities of a commodity or long periods of time. Third, simulated procedures such as the CPT are conceptually systematic. The results of which can be interpreted using the same concepts for evaluating outcomes produced using traditional reinforcer assessment methods. These characteristics of CPTs proffer them as a useful tool for a variety of other clinical applications. Indeed, since their development in the late 20th century, CPTs have been used to evaluate a variety of commodities across a variety of clinical populations, including sexual health decision-making.

Translational Science

Translational science is the application of principles and procedures of basic science to understand socially relevant issues. Translational behavioral science researchers have suggested the future of our field may depend upon both basic and applied arms adopting translational methods to maintain social relevance (Critchfield, 2011, Mace & Critchfield, 2010).

Vollmer (2011) describes three variations of translational science: (a) application of basic principles, (b) laboratory research to solve applied problems, and (c) translating the logic of behavioral methodology. The first variation, application of basic principles, refers to the conceptualization of human behavior through principles first discovered through basic research (e.g., positive reinforcement, matching law). The second variation refers to using basic research methodology to better understand problems of social significance. For example, Vollmer (2011) refers to the discovery of a genetic anomaly that gives rise to developmental disorder. Finally, translating the logic of behavioral methodology involves creative application of basic procedures to address socially relevant issues. Vollmer suggested flexibility and creativity in approach will be required to achieve this final variation.

In recent years, behavior analytic procedures have become more efficient and effective due translation of the logic of behavioral methodology. For example, researchers have used CPTs to measure behavioral demand for a variety of items and activities of social relevance, including sexual health decision-making.

Clinical Utility. In 2020, Dolan and colleagues evaluated a CPT for a hotel room among individuals with disordered cocaine use and healthy controls. In their study, participants were first presented with an array of 60 color photographs of diverse, clothed people (30 male, 30 female) and were asked to identify the individual with whom they (a) most wanted to have sex and (b) least wanted to have sex. Then, participants were presented with a hotel purchase task. In this vignette, participants were instructed to assume the following: (a) the person in the photograph wants to have sex on a regular basis, (b) they are not currently in a committed relationship and this was the only opportunity to have sex, (c) there is no risk of pregnancy, and (d) they may only have sex in this hotel room after they have purchased access. Participants were instructed to respond with the number of nights they would purchase at a hotel over the next year at prices from $10 to $1,280 per night. Researchers also asked participants to complete the HIV Risk Behavior Scale (HRBS; Darke et al., 1991), an 11-item questionnaire evaluating risky health behaviors associated with HIV risk (e.g., drug use, sexual health decision-making). Researchers found (a) significant differences in demand intensity and elasticity between the most preferred and least preferred partner, (b) no differences in demand metrics between participant groups, and (c) males demonstrated greater demand intensity and less demand elasticity than females. Importantly, the authors noted this hotel purchase task was unique in that it allowed for evaluation of sexual health decision-making without implying hypothetical engagement in sex

work, a behavior that is illegal throughout the US. Other researchers have also evaluated sexual demand using tasks that avoid implicit hypothetical engagement in sex work.

Strickland and colleagues (2020) developed a CPT to evaluate hypothetical condom demand among adults recruited through crowdsourcing platform. In the task, participants were asked to indicate the hypothetical quantity of condoms they would purchase at increasing prices, to be used with hypothetical sexual partners with some level of STI risk. Participants read a vignette describing an STI that produced symptoms such as rash and painful urination. This hypothetical STI was curable and required 2-3 months of treatment. Across experimental task conditions, the probability of STI risk varied from 10-90%. Researchers also evaluated individual factors related to sexual health such as STI knowledge, income, relationship status, and alcohol use. Researchers fit data to the exponentiated demand equation (Koffarnus et al., 2015). Results indicated demand for condoms (a) decreased as price increased, (b) was less sensitive to changes in price as STI risk probability increased, and (c) varied in price sensitivity based on related individual factors. Findings supported similar research outcomes in public health indicating programs aimed at providing condoms at little or no cost may decrease transmission of STIs. Researchers suggested this work was an important first step in understanding sexual health decision-making to inform public policy.

In a similar study, Harsin and colleagues (2021) evaluated correlation between a condom purchase task and the Sexual Delay Discounting Task (SDDT; Johnson & Bruner, 2012) among adults recruited using a crowdsourcing platform. The condom purchase task used was different from that used by Strickland et al. (2020) in that this task evaluated whether or not participants would engage in a sexual encounter with or without a condom (as opposed to the number of condoms they would purchase). In this task, participants were first presented with a vignette in

which they were at a grocery store and received a message from their preferred sexual partner indicating they are home alone, would like the participant to come over to have sex, and the participant is very interested in having sex with this partner. Then, participants were presented with the option to purchase a box of their preferred brand of condoms at ascending prices from $1 to $233, following a Fibonacci sequence (i.e., each price was the sum of the last two prices presented). Participants could then select one of three options: (a) purchase the box of condoms and have protected sex, (b) not purchase the box of condoms and have unprotected sex, or (c) not purchase the box of condoms and not have sex. In the SDDT, participants were provided a vignette in which they were at home, invited a preferred sexual partner over, and both individuals were interested in having sex. Then, participants responded to questions indicating (a) the likelihood they would have sex with the partner when a condom was immediately available and (b) the likelihood they would wait for a condom across a series of six delays from 2 to 60 min. Then, participants completed the Sexual Desire Inventory-2 (SDI-2; Spector et al., 1996), a 14-item questionnaire measuring an individual's desire for sexual activity. Finally, participants completed the HIV Risk Taking Behavior Scale (HRTBS; Ward et al., 1990), a 16-item questionnaire that measures risky sexual behavior through the number of transient sexual relationships and unprotected sexual encounters the individual has engaged in over the last several months.

Harsin and colleagues (2021) evaluated data from the condom purchase task using demand metrics including breakpoint, and separated participants into two groups: (a) individuals who selected not to have sex at the first price at which they would not purchase the box of condoms (i.e., the abstinent group) and (b) individuals who selected unprotected sex at the first price at which they would not purchase the box of condoms (i.e., the unprotected group). Within

each group, researchers conducted a series of correlations between demand and responding on the other three experimental tasks. First, researchers identified significant differences in demand between these two groups across three demand metrics. Second, they found significant differences in the rate of delay discounting between these two groups, as measured by the SDDT. Finally, researchers found significant differences between these two groups on (a) the number of sexual partners over the last three months and (b) the number of unprotected sexual encounters over the last three months, as measured by the SDI-2. Taken together, researchers concluded these findings indicate risky sexual health decision-making may be best understood through a reinforcer pathology framework (Bickel et al., 2014).

A reinforcer pathology framework acknowledges (a) temporal sensitivity, (b) excessive demand, and (c) their interaction as the underlying mechanism responsible for risky decision-making across a variety of contexts (Harsin et al., 2021). Moreover, this framework conceptualizes risky decision-making as a trans-disease process, meaning it influences a range of behavioral phenomena (e.g., delay discounting of illicit substances, monetary outcomes, sexual health decisions; Amlung et al., 2019; Bickel et al., 2016; Strickland et al., 2017). This framework is novel in its conceptualization and useful for both understanding and treating maladaptive decision-making behavior (Bickel et al., 2016).

Indeed, risky sexual health decision-making behavior has been characterized as impulsive in nature (Hayaki et al., 2006; Jarmolowicz et al., 2015). That is, consistent with delay discounting research conducted with other commodities, humans systematically devalue delayed sex (Lawyer et al., 2010; Johnson & Bruner, 2012; Jarmolowicz et al., 2013) and this relation appears more prominent in males than in females (Jarmolowicz et al., 2014). Specifically, in males, Jarmolowicz et al. (2014) attributed this phenomenon to devaluation of delayed sex rather

than high valuation of immediate sex. Delay discounting has been conceptualized as a "trans-disease" process, meaning the process is prevalent across a variety of disorders, thereby relating advances in one disorder to other disorders (Bickel et al., 2012, 2016). Indeed, individuals with substance use disorders such as alcohol-dependence appear to discount delayed sex more steeply than healthy controls (Jarmolowicz et al., 2013). Thus, emerging research has focused on behavioral processes that give rise to or characterize risky sexual health decision-making to inform efforts to decrease this type of behavior.

For example, Jarmolowicz et al. (2016) conducted a study in which they evaluated correspondence between a multiple stimulus without replacement (MSWO; DeLeon & Iwata, 1996) preference assessment and CPTs among undergraduates at a large university. Participants completed all experimental tasks using computerized arrangements. First, they completed an MSWO with 16 images (head and face only) of individuals with whom they would like to have sex. These images of potential sexual partners corresponded to their self-reported gender and sexual preference. Then, they were presented with three CPTs, one each for their high, median, and low preferred sexual partner. For each CPT, the participant was asked to indicate the number of sexual acts they would purchase with that individual across a set of ascending prices from $1 to $1,000,000. Findings indicated sexual demand, as measured by the CPT, was significantly different based on condition. In addition, researchers found correspondence between the condition in which the highest number of sexual acts was purchased and the highest preferred partner. This level of hypothetical purchase then decreased as preference decreased across CPT conditions.

Importantly, Jarmolowicz et al. (2016) noted that behavioral paradigms of risky sexual health decision-making have been used to predict risky sexual health behaviors such as the

number of sexual partners (Jarmolowicz et al., 2015) and unprotected intercourse (Herrmann et al., 2014). Substantial sexual discounting has also been identified as a predictor of high risk for transmission of STIs (Collado et al., 2017). Based on the reinforcer pathology framework, Jarmolowicz et al. (2016) noted excessive demand and discounting of a commodity of interest, such as sexual encounters, may be indicative of maladaptive decision-making. Thus, individuals who display excessive demand in CPTs evaluating sexual demand may be at risk of developing risky sexual health decision-making. This extreme valuation of sex as a reinforcer may be similar to preference for extremes of stimulation.

To evaluate behavioral features that characterize behavioral disorders, such as preference for extremes of stimulation, Rapp (2008) proposed conjugate schedules of reinforcement (i.e., a schedule of covariation). Given extreme demand and discounting of sex are features that may be indicative of risky sexual health decision-making, schedules of covariation may be useful for understanding underlying behavioral mechanisms of risky sexual health decision-making.

Schedules of Covariation. Historically, behavioral sciences have evaluated behavior-environment relations using discontinuous schedules of reinforcement (viz., ratio, interval schedules) wherein both the response and stimulus are characterized as separate, discrete events (Saunders et al., in preparation; Williams & Johnston, 1992). By contrast, non-discrete, continuous events are characterized as relations wherein response and stimulus co-vary and are best evaluated through schedules of covariation (Saunders et al., in preparation). Unlike discrete schedules of reinforcement, a paucity of research exists regarding schedules of covariation (Jones et al., 2024; MacAleese et al., 2015; Saunders et al., in preparation).

Schedules of covariation are those in which the "dimension of responding determines the amount of the consequent stimulus dimension from moment-to-moment" (Williams & Johnston,

1992; p. 207). In their seminal paper, Williams and Johnston described three types of schedules of covariation: (a) correlated, (b) synchronous, and (c) conjugate. Correlated schedules specify the magnitude of reinforcement contingent upon the sum of responses. Synchronous schedules specify access to reinforcement is synced with a response criterion (e.g., Diaz de Villegas et al., 2020; Leslie et al., 2023; McHugh et al., 2022). Specifically, the stimulus is only delivered when the response occurs at or above some criterion, continuously. Conjugate schedules specify a contingency in which "the rate, amplitude, or intensity of the reinforcer is proportional to the target response properties of a response-reinforcer relation being directly proportional to each other" (Rapp, 2008, p. 113).

Conjugate and synchronous schedules of covariation can be further distinguished from each other. In a synchronous schedule, continuous access to a reinforcer is provided only when response occurs continuously and at or above some specified criterion. Access to the reinforcer ceases when the response is below the specified criterion (McHugh et al., 2022). In a conjugate schedule, delivery of the stimulus is proportionate to some dimension of the target response (Rapp, 2008). That is, stimulus delivery varies based on moment-to-moment variations in responding wherein responding meets the criterion for full magnitude stimulus delivery or responding occurs below the criterion, resulting in delivery of a proportionately lower magnitude of the stimulus.

Schedules of covariation have been proposed as a method for evaluating behavior-environment relations for which (a) response and reinforcer naturally covary, (b) perceptual events serve as reinforcement for repetitive body movements, and (c) sensitivity to extreme forms of stimulation may be indicative of underlying behavioral disorder (Rapp, 2008). These features of schedules of covariation also make them appropriate for evaluating sexual demand. In

addition, preparations using schedules of covariation have four important features that make them useful for evaluating risky sexual health decision-making.

First, behavior under conjugate and synchronous schedules is rapidly acquired by human participants. In studies with undergraduate students with little to no experience with the preparation, researchers have demonstrated rapid response acquisition across a variety of response topographies and conditions. MacAleese et al. (2015) evaluated key pressing among undergraduates conjugately reinforced or punished by changes in clarity of an image presented on a computer screen. Findings from Experiment 1 indicated participants were sensitive to changes in intensity of clarity changes produced by their response, an important feature of conjugate schedules. In addition, data from Experiments 2 and 3 indicated participants' responding decreased in extinction and conjugate punishment phases, respectively.

Falligant et al. (2018) extended findings from MacAleese et al. by evaluating responding on a force transducer that was conjugately reinforced by changes in volume of audiovisual stimuli. Similar to MacAleese et al., findings indicated responding among undergraduate participants was sensitive to changes in intensity of volume on a conjugate schedule. In addition, in Experiment 2, researchers evaluated changes in responding in the conjugate schedule when a high-preferred (HP) audiovisual stimulus was presented versus when a low-preferred (LP) audiovisual stimulus was presented, indicating HP stimuli were more conjugately reinforcing than LP stimuli. In Experiment 3, researchers introduced a two-component mixed schedule including extinction components wherein LP stimuli were presented. Given data from Experiment 2 indicated LP stimuli supported low levels of responding, researchers attributed increases in responding during extinction components to extinction-induced variability. Indeed, results indicated variability in responding occurred during extinction components, suggesting

responding in conjugate schedules is (a) sensitive to changes in the environment and (b) produces extinction-induced variability in responding, similar to discontinuous schedules of reinforcement.

To extend upon these findings, Falligant et al. (2020) used a similar preparation, but evaluated different experimental conditions. In Experiment 1, researchers evaluated responding during extinction components following dense versus lean conjugate schedules. Specifically, researchers modified the dimensions of the force-multiplier in the conjugate components such that an inverse relation appeared between response force and force-multiplier values. Findings indicated that response force was greater in extinction components following conjugate components with low force-multiplier values as compared to components with high force-multiplier values. In Experiment 2, researchers arranged for participants to experience one of two conjugate components: (a) response-independent delivery of the HP audiovisual stimulus or (b) response-dependent, conjugately reinforced delivery of the HP audiovisual stimulus. Then, researchers evaluated responding in subsequent extinction components. Data from four participants indicated that mean response force was higher in the extinction component following the response-independent reinforcer delivery condition. Taken together, findings from these three studies indicate that responding in conjugate schedules is rapidly acquired, sensitive to changes in stimulus conditions, and sensitive to changes in the response-reinforcer proportional relation.

Second, conjugate and synchronous schedules maintain a steady rate or level of behavior. Deochand et al. (2020) used an audiovisual intervention to improve punching speed and force among adult recreational boxers. For each participant, speed of punching a punching bag was conjugately reinforced by HP music speed *and* punching force was conjugately reinforced by music volume. When participants met the criterion for punching speed or force, a feedback

screen turned green. When participants did not meet the criterion for punching speed or force, the feedback screen turned red. Thus, participants received audiovisual feedback based on their performance. Data were evaluated using multiple baseline designs with embedded changing criterion designs. Across eight participants, punching speed and force increased for five in the conjugate audiovisual intervention phase. Moreover, data indicated little variation in responding within sessions in this phase. Thus, the conjugate preparation maintained steady rate and level of punching speed and force.

Third, behavior maintained by conjugate schedules appears to transition rapidly based on stimulus conditions and thus some studies have conceptualized these preparations as a form of reinforcer assessment. For example, Davis et al. (2021) evaluated responding among undergraduate students in a conjugate preparation. First, researchers conducted a multiple stimulus without replacement preference assessment (MSWO; DeLeon & Iwata, 1996) to identify rank order preference of five images. Then, researchers presented the images on screen and participants were instructed to apply force to a hand dynamometer as the image reduced in clarity by 10% every second until it became 100% transparent. Researchers evaluated correspondence between rank order based on MSWO data and rank order based on mean and peak force exerted in the conjugate preparation. Based on Chi-square tests of independence, data indicated strong correspondence between MSWO rank order and both mean and peak force rank order, especially for the high-preferred visual stimulus. In a similar study, Cook et al. (in press) replicated and extended these findings using a similar preparation with auditory stimuli only.

In another study that used a conjugate preparation, Curiel et al. (2023) evaluated button pressing conjugately reinforced by audiovisual stimuli among seven school-aged children. First, researchers used a computer-based program to identify preferred audiovisual stimuli using a

MSWO arrangement. Then, using a computer-based program, researchers evaluated button pressing responses to HP, LP, and control stimuli in a concurrent-chains arrangement. That is, participants' button pressing was conjugately reinforced by delivery of the HP audiovisual stimulus, LP audiovisual stimulus, or a control stimulus (i.e., a black screen with no sound).

Similar to Davis et al. (2021), data indicated strong correspondence between responding in the conjugate preparation and the rank order identified through the MSWO. Notably, in both of these studies, due to (a) the rapid transition in responding that occurred between phases and (b) strong correspondence between MSWO and subsequent conjugate preparations, researchers conceptualize these preparations as a form of reinforcer assessment. Thus, conjugate preparations may serve as an alternative option for evaluating the relative value of stimulus events when traditional reinforcer assessment methods may not be feasible.

Translation of Behavioral Methodology. Although different in topography, preparations using schedules of covariation may offer an alternative for evaluating correspondence between responding in a CPT and responding in an observable task. Notably, Jarmolowicz et al. (2016) identified two important limitations of their study. First, participants in their study had little to no experience purchasing sexual acts and may have found the task uncomfortable since the study was conducted in a geographic location in which purchasing sexual acts was illegal. By contrast, conjugate preparations require no previous experience with the preparation nor do they involve hypothetical questions involving illegal behavior. In addition, studies have indicated rapid acquisition of responding with conjugate reinforcement procedures (e.g., Falligant et al., 2018; 2020) making them an ideal method of response evaluation for contexts in which participants may have limited learning history.

Second, Jarmolowicz et al. (2016) indicated that CPTs are limited insofar as they do not evaluate real-world behavior. Although CPTs have been validated in studies in which real-world consumption of the commodity is subsequently observed in experimental settings (e.g., Amlung et al., 2012; Berry et al., 2023), this is not feasible for risky sexual health decision-making. This is an important consideration because risky sexual health decision-making is socially important due to its many, far-reaching consequences. In addition, although these CPTs and their respective validation studies involve discrete behavior-environment relations, sexual encounters may be more accurately described as a non-discrete, continuous event.

Purpose and Hypotheses

The present series of translational studies seeks to replicate and extend previous research evaluating demand for hypothetical romantic partners. In the first study, we replicated and extended a study by Jarmolowicz et al. (2016). First, using a survey presented via Qualtrics, participants completed a rank order preference assessment for sexual partners. For each of their high-, moderate-, and low-preferred sexual partners, they completed a CPT for the number of sexual acts they would purchase at ascending prices. Then, participant responding was evaluated using a conjugate preparation.

In the second study, we modified procedures to improve accuracy of participant responding in the preference assessment, CPT, and conjugate schedule procedures. The purpose of both studies was to determine if sexual demand, as measured by the CPT, corresponded to the amount of force participants exerted in the conjugate preparation.

Consistent with findings from Jarmolowicz et al. (2016) and Davis et al. (2021), I hypothesized:

(a) Hypothesis 1 (H1): Demand would be significantly different across CPT conditions with greatest demand exhibited in the high preferred partner condition.

(b) Hypothesis 2 (H2): Force exerted in the conjugate preparation would correspond with preference indicated by the preference assessment, with the greatest force exerted for high preferred partners.

(c) Hypothesis 3 (H3): Demand metrics would correlate with force exerted in the conjugate preparation such that participants demonstrate greatest demand and exert greatest force for the high preferred partner.

Chapter 2

Experiment I

Purpose

The purpose of Experiment I was to replicate and extend Jarmolowicz et al. (2016) and Davis et al. (2021) by evaluating correspondence between participant responding on a CPT and subsequent responding in a conjugate preparation.

Methods

Project Design and Implementation

First, participants completed a rank order (RO) preference assessment for potential sexual partners (Davis et al., 2021). Note, Davis et al. (2021) found strong correspondence between RO and MSWO preference assessments and that RO preference assessments may be more efficient for identifying stimulus preferences. Then, participants completed a CPT for sexual acts with partners identified by the RO as high, median, and low preference. Finally, participants completed a conjugate preparation for each of their high, median, and low preferred partners.

Participants and Setting

Participants were undergraduate students enrolled in a psychology course at a local, state university. Participants were recruited using SONA, an online platform for undergraduate recruitment and participation in research. Consistent with departmental undergraduate research procedures, participants were compensated with credit toward their respective psychology course for participation. All experimental tasks were computerized and were completed in a small lab room equipped with a desk, two laptop computers, two chairs, and a conjugate preparation apparatus. This study was approved by the Institutional Review Board at the university and all

research staff were compliant with procedures to assure that the treatment of participants was in accordance with established ethical guidelines.

Stimulus Selection

To maximize replicability of this study, I selected stimuli from the racially diverse affective expression (RADIATE) face stimulus set, a publicly available internet database of headshots of Black, White, Hispanic, and Asian adult models (Conley et al., 2018; Tottenham et al., 2009). The RADIATE stimulus set improves diversity in race and ethnicity in the stimulus set used in the present study thereby minimizing confounds that may limit understanding of psychological processes (Conley et al., 2018), such as sexual preference and demand. In addition, using images from this stimulus set controls for background color, facial expression, luminosity, head size, and head position, and clothing. Thus, I selected eight images, one female and one male from each of four racial/ethnicity groups. These images can be found in Appendix A.

Data Collection and Response Measurement

Rank Order Preference Assessment

First, participants were instructed to complete a digitized standard demographics form (e.g., age, grade point average, race/ethnicity) that included self-reported sexual orientation and gender. Then, participants completed a rank order preference assessment (RO; Davis et al., 2021). On-screen instructions prompted the participant to rank order images of individuals with whom they would most like to have sex by clicking and dragging the images into numbered spaces. That is, the individual in the first-ranked position was the individual with whom they would most like to have sex. The individual in eighth position was the individual with whom they would least like to have sex.

Commodity Purchasing Task (CPT)

Each participant then completed a CPT for the following conditions: (a) high preferred (ranked first), (b) median preferred (ranked fourth), and (c) low preferred (ranked eighth) sexual partner. Thus, participants completed three CPTs in total. The order of CPTs was randomized across participants. The three CPTs assessed the same prices, in ascending order, as used in Jarmolowicz et al. (2016). Prices ranged from $1 to $1,000,000. The same on-screen instructions used in Jarmolowicz et al. were used: “How many times would you have sex with this person, beginning today, if each sex act cost __?” A complete list of questions presented in each CPT can be found in Appendix B.

Conjugate Preparation

We used a conjugate preparation similar to that described by Davis et al. (2021) and Sheridan (2023). This preparation included custom software written in Labview™ (NI, Austin, TX, USA) for programming events and data collection. For the measurement of force, researchers connected a hand dynamometer (Vernier, Beaverton, OR, USA) to a custom interface and data acquisition card equipped with a 14-bit A/D converter (USB-6009, NI, Austin, TX, USA). During three trials of the experimental task, participants were presented with images on a computer screen of their high, median, and low preferred partners as identified by the RO. The order of pictures (i.e., trials) was randomized across participants. The researcher instructed the participant to hold the hand dynamometer in their dominant hand. On-screen instructions prompted the participant to squeeze gently to begin the task. The software collected force readings from the dynamometer at 20 samples per second and produced data on the average force obtained for each 1-s interval. The operative range of the dynamometer is 0 to 60 kg. The smallest change that can be detected in this preparation is approximately 0.004 kg. In pilot trials,

the dynamometer appeared to fluctuate by 0.1 kg above zero when at rest (i.e., no force applied). This can be considered residual error in the measurement system (Cook et al., in press; Davis et al., 2021).

Each second of the experimental task, the software used force recordings to determine the percentage of clarity of the image. If the participant did not apply force to the dynamometer, the image faded from 100% clarity, at a rate of 10% per second, until it reached 0% clarity (i.e., the image is transparent in 10 s). Participants could restore the image to 100% clarity by applying increasing force to the dynamometer. That is, participants were required to apply force to the dynamometer to meet the progressive ratio schedule of +1 kg force per 10% decrease in clarity. Participants repeated this process for each of the following conditions: (a) high preferred (ranked first), (b) median preferred (ranked fourth), and (c) low preferred (ranked eighth) sexual partner.

Analytical Plan

First, the researcher exported de-identified data from the Qualtrics™ survey to encrypted files on a password-protected laptop computer. Then, the researcher evaluated data using statistical analyses. All statistical analyses were conducted using RStudio (Version 1.4.1717). Specifically, the researcher used the R package *beezdemand* (v0.1.0; Kaplan et al., 2019) to (a) screen for nonsystematic responding, (b) fit data to the exponentiated demand curve, and (c) derive demand metrics from the exponentiated model. Data were screened for unsystematic responding using the criteria outlined by Stein et al. (2015). The *beezdemand* package uses a three-criterion algorithm based on (a) relative change scores (i.e., requires changes in consumption to remain relative to changes in price), (b) bounce (i.e., increases in consumption may not exceed 25% of initial consumption as prices increase by less than or equal to 10%), and (c) reversals from zero (i.e., two consecutive zero consumption values may not be followed by a

nonzero consumption value). After screening data, I (a) winsorized consumption values (Blaine, 2018; Wu & Zuo, 2009) and (b) used the exponentiated model (Koffarnus et al., 2015) to derive demand metrics. Model fit was evaluated using r^2 values produced by *beezdemand*. Given behavioral demand is a multifaceted phenomenon, I evaluated demand using several demand metrics including (a) derived intensity, (b) derived elasticity, and (c) derived breakpoint. Descriptions of each of these demand metrics are listed in Table 1. These metrics account for amplitude and persistence. Finally, to correct for skew in distribution, measures of demand were log-transformed prior to analyses.

Correspondence Between RO and CPT

Similar to Jarmolowicz et al. (2016), I evaluated correspondence between responding on the RO and the CPTs by comparing differences in demand metrics across conditions. To accomplish this, the researcher compared log-transformed demand metrics between conditions using a repeated measures ANOVA. The analysis allowed the researcher to evaluate the first hypothesis (i.e., demand would be significantly different across CPT conditions with greatest demand exhibited in the high preferred partner condition).

Correspondence Between RO Assessment and Conjugate Preparation

The researcher used a Spearman's Rank-Order test to evaluate correlation between participants' responding on the RO assessment and force exerted in the conjugate preparation. This evaluation was similar to that described in Davis et al. (2021) and Sheridan (2023). Specifically, the researcher compared rankings from the RO assessment to the mean and peak force rank orders from the conjugate assessment across three conditions: (a) high preferred (ranked first), (b) median preferred (ranked fourth), and (c) low preferred (ranked eighth) sexual partner. This allowed the researcher to evaluate the second hypothesis (i.e., force exerted in the

conjugate preparation would correspond with preference indicated by the preference assessment).

Correspondence Between CPT and Conjugate Preparation

Finally, the researcher used a Spearman's Rank-Order test to evaluate the relation between participants' responding on the CPT and force exerted in the conjugate preparation. To the researcher's knowledge, this is the first time responding on CPTs was compared to responding in a conjugate preparation. Specifically, the researcher compared each of the three demand metrics (i.e., derived intensity, elasticity, and breakpoint) in the CPT to mean and peak force (kg) in the conjugate preparation, across conditions. This allowed the researcher to evaluate the third hypothesis (i.e., demand metrics would correlate with force exerted in the conjugate preparation).

Results

We recruited a total of 46 participants for this study. Due to cancellations, only 30 participants completed their reserved research appointments. All subsequent analyses are based on data for these 30 participants. Table 2 displays demographic data for these participants. Overall, the majority of participants identified as female, heterosexual, White, and non-Hispanic.

Correspondence Between RO and CPT

After winsorizing data and screening for unsystematic responding, only 26 datasets were included in this analysis for the high, medium, and low preferred CPT conditions. In addition, data were log-transformed to correct for skewedness. These demand curves are depicted graphically in Figure 1. The researcher conducted a repeated measures ANOVA to compare the effect of CPT condition on demand metrics (i.e., intensity, breakpoint, and elasticity).

The ANOVA revealed that there was a statistically significant difference in intensity between at least two groups ($F(2, 50) = 12.27$, $p = <.0001$, $\eta^2 = 0.19$). A post-hoc Bonferroni Test for pairwise comparisons found that the mean value of intensity was significantly different between the median preferred condition ($M = -1.616$, $SD = 0.923$) and the high preferred ($M = -0.983$, $SD = 1.231$) condition ($p = 0.013$). In addition, the mean value of intensity was significantly different between the low preferred ($M = -2.0$, $SD = 0.00$) condition and the high preferred condition ($p < 0.0001$). There were no other significant pairwise comparisons. Results of this analysis are depicted graphically in Figure 2.

The second repeated measures ANOVA indicated there was a significant difference in breakpoint between at least two groups ($F(2, 50) = 10.54$, $p <.0001$, $\eta^2 = 0.17$). A post-hoc Bonferroni Test for pairwise comparisons found that the mean value of breakpoint was significantly different between the median preferred ($M = 0.19$, $SD = 0.47$) condition and the high preferred ($M = 0.51$, $SD = 0.68$) condition ($p < 0.001$). The mean value of breakpoint was also significantly different between the low preferred ($M = 0.00$, $SD = 0.00$) condition and the high preferred condition ($p < .001$). There were no other significant pairwise comparisons. Results of this analysis are depicted graphically in Figure 3.

The third repeated measures ANOVA indicated there was a significant difference in elasticity between at least two conditions ($F(2, 50) = 353.13$, $p <.001$, $\eta^2 = 0.9$). A post-hoc Bonferroni Test for pairwise comparisons indicated that the mean value of elasticity was significantly different between the median preferred ($M = -2.01$, $SD = 0.12$) condition and the high preferred ($M = -1.81$, $SD = 0.35$) condition ($p < 0.01$). The mean value of elasticity was also significantly different between the low preferred ($M = -0.63$, $SD = 0.00$) condition and the high preferred condition ($p < .001$). Finally, the mean value of elasticity was also significantly

different between the low preferred condition and the median preferred condition ($p < .001$). Results of this analysis are depicted graphically in Figure 4.

Correspondence Between RO and Force Exertion

Unfortunately, due to software and hardware malfunctions, only eleven participants completed the conjugate preparation. Due to researcher error, only data for nine of these participants could be included in subsequent analyses. To evaluate correspondence between responding on the RO assessment and responding in the conjugate preparation, I replicated statistical and visual analysis procedures used by Sheridan (2023).

Statistical Analysis

Results of statistical analyses are depicted in Table 3. To evaluate the second hypothesis (i.e., force exerted in the conjugate preparation would correspond with preference indicated by the preference assessment), the researcher conducted χ^2 Tests of Independence to evaluate the correlation between participants' responding on the RO assessment and mean and peak force rank order. There were no significant correlations between the RO assessment and either mean or peak force rank orders. In addition, there was *not* a significant correlation between stimulus presentation order and (a) peak force, (b) mean force, or (c) rank order.

Visual Analysis of Individual Participant Data

Finally, researchers created graphs for each participant displaying (a) RO assessment data, (b) mean and peak force ranks from the conjugate preparation, and (c) stimulus presentation order in the conjugate preparation. Based on visual inspection, the researcher then categorized participant responding based on response categories developed by Davis et al. (2021) and repeated by Sheridan (2023). Table 4 defines each of these categories. The greatest percentage of participants engaged in responding that met criteria for the Undifferentiated category (44%),

followed by HP and LP Correspondence (33%), HP Only (22%), and Decreasing Trend (11%) categories. No participants displayed responding that met criteria for the LP Only or Nonresponse categories.

Correspondence Between CPT and Force Exertion

To evaluate correspondence between responding on the CPT assessment and responding in the conjugate preparation, I extended statistical analysis procedures used by Sheridan et al. (2024). This allowed for evaluation of the third hypothesis (i.e., demand metrics would correlate with force exerted in the conjugate preparation).

Statistical Analysis

Results of statistical analyses are depicted in Table 5. First, the researcher conducted χ^2 Tests of Independence to evaluate the correlation between participants' RO assessment and responding in the CPT assessment. There were no significant correlations. Second, the researcher conducted χ^2 Tests of Independence to evaluate a potential correlation between participants' responding on the CPT assessment and mean force ranks. There were no significant correlations. Third, the researcher conducted χ^2 Tests of Independence to evaluate a potential correlation between participants' responding on the CPT assessment and peak force ranks. Again, there were no significant correlations.

Conclusions from Experiment I

Overall, results from Experiment I only partially replicate previous research. Specifically, our findings from the CPT assessment replicate findings produced by Jarmolowicz et al. (2016) insofar as participants demonstrated differential demand across CPT conditions with the greatest demand displayed in the high preferred condition. However, this study did not replicate results from previous studies using conjugate preparations.

Results from Experiment I did not replicate findings from either Davis et al. (2021) or Sheridan (2023). The researcher found no significant relation between mean or peak force and responding on the RO assessment. In addition, data indicated no significant relation between mean or peak force ranks and demand metric ranks. Consistent with Sheridan (2023), I suspect the novelty of the synchronous preparation, with which most participants likely have no learning history, may have influenced responding. Also, very minimal context or instruction was provided to participants in the conjugate preparation. Thus, in attempting to contact the preparation contingency, they may have behaved without respect to the images presented (i.e., faulty stimulus control). In addition, the images used in Experiment I may have lacked contextual information relevant to determining preference for a sexual partner (e.g., clothing choice, body language, etc.). Notably, these findings are based on data from a small sample size (n = 9) as compared to other, similar studies (e.g., Cook et al., in press; Davis et al., 2021; Sheridan et al., under review). Thus, it is likely these analyses are under powered.

Moreover, as noted by Jarmolowicz et al. (2016), given this study took place in a geographic location in which purchasing sexual acts is currently illegal. Thus, participants may (a) have no experience paying for sexual acts, (b) be hesitant to respond to questions suggesting engagement in illegal behavior, or both. As a solution to each of these limitations, we developed Experiment II to include (a) different images with more contextual information, (b) a modified CPT, (c) explicit instruction in the conjugate preparation, and (d) an improved apparatus.

Experiment II

Purpose

The purpose of Experiment II was to evaluate the same research questions as Experiment I using improved procedures. Specifically, we designed Experiment II to address the limitations

of Experiment I by (a) evaluating different images, (b) modifying the CPT, (c) providing instructions in the conjugate preparation, and (d) using an improved apparatus. These modifications were approved by the Institutional Review Board at the university and all research staff were compliant with procedures to assure that the treatment of participants was in accordance with established ethical guidelines.

Method

Project Design and Implementation

First, participants completed a modified rank order (modified RO) preference assessment for potential sexual partners using procedures similar to those described by Johnson and Bruner (2012). Then, participants completed a CPT for going on dates with partners identified by the modified RO as high, median, and low preference. Finally, participants completed a modified conjugate preparation for each of their high, median, and low preferred partners.

Participants and Setting

Participant recruitment procedures were identical to those described in Experiment I. All experimental tasks were computerized and took place in the same small lab room described in Experiment I.

Stimulus Selection

To improve procedures while maximizing replicability of this study, I used the same stimuli used in Johnson and Bruner (2012). The stimulus set includes 60 images (30 male, 30 female) of various ages, races/ethnicities, clothing choices, weights, and attractiveness. These images can be found in Appendix C.

Data Collection and Response Measurement

Rank Order Preference Assessment

Just as in Experiment I, participants were instructed to complete a demographics questionnaire (e.g., age, grade point average, race/ethnicity) on Qualtrics™ that included self-reported sexual orientation and gender. Then, participants completed a modified RO preference assessment, also on Qualtrics™. The following instructions were adapted from Johnson and Bruner (2012) and presented to the participant on-screen:

> For this task, we will ask you hypothetical or pretend questions about your willingness to have sex in various situations. For the purpose of this task, please pretend that you are not currently in a committed sexual relationship if you are. In other words, please pretend that you are single and available, and that you are not cheating on anybody if you indicate you would have sex with somebody in this task. On the next page, you will be presented with pictures of many people. For each person, I would like you to think about how attractive that person is. Based on physical appearance alone, please think about whether each person is someone that you would consider having sex within the right environment and if you liked the person's personality. Please select pictures of the people you would have sex with by checking the box next to the picture.

The next screen displayed the 60 images and participants were prompted to select images. Following image selection, participants responded to questions about the images. These questions were modified from Johnson and Bruner (2012). The computer presented only the selected images and on-screen instructions prompted the participant to indicate the person: (a) they most wanted to have sex with, (b) they might have sex with, and (c) they least wanted to have sex with. Participants could select the same image for multiple responses.

Date Purchasing Task (DPT)

Next, participants completed a Date Purchasing Task (DPT) on Qualtrics™. This modified CPT was adapted from the hotel purchase task described by Dolan et al. (2020). This task first presented the following on-screen instructions:

> In the questions that follow we would like you to pretend that the person in the photograph wants to date you on a regular basis. Neither of you are currently in a relationship. However, even though you can go on dates with this person whenever you want, you must always purchase a date first. In the questions that follow, you will be asked to purchase individual dates (daytime, nighttime, weekdays, weekends) for the upcoming year. Please answer the questions honestly and thoughtfully. Pretend that this is the only opportunity go on dates that is available to you. You cannot date anyone else except for the dates you choose to purchase in the following questions. Also assume you have no other potential dating partners. In other words, if you want to go on a date at any time during the course of the upcoming year, you must do so only on dates that you purchase today. Prices for the dates you may buy are listed below. You may buy as many as 365 dates (1 year's worth) or as few as 0 dates. Also, assume that the dates you are about to purchase are for your personal use only for dating the photographed individual. The dates cannot be used for any other reasons. You can't sell the dates or give them to anyone else to use for any reason. All of the dates you buy are, therefore, for your own personal, dating use with the photographed individual within the year. Below is a list of various prices for the dates. In the space provided please indicate how many of these dates you would purchase at each of the prices listed in the column on the left. Please complete the entire table. If you wouldn't purchase any dates at a particular price, please

put “0.” Remember, only buy dates you would personally use over the next year. If you have any questions, please ask us for help.

Each participant completed a DPT for the following conditions: (a) high preferred (i.e., the person they most wanted to have sex with), (b) median preferred (i.e., the person they might have sex with), and (c) low preferred (i.e., the person they least wanted to have sex with) partner. Similar to Experiment I, participants completed three DPTs in total and the order of DPTs was randomized. The DPTs assessed various prices, in ascending order, ranging from $0 to $300. The on-screen instructions were adapted from Dolan et al. (2020): “How many times would you date this person, over the course of the next year, if each date cost___?” A complete list of prices presented in each DPT can be found in Appendix D.

Conjugate Preparation

Finally, participants completed the conjugate preparation. The software preparation was identical to Experiment I. However, to improve the procedures, researchers delivered the following instructions aloud:

> Next, you will be shown three pictures of the people from the first task in random order. Using a handle device, you will need to squeeze the grip to increase or maintain clarity of the pictures. Please hold the device in your dominant hand and only use one hand. You should remain at the computer for the entire time the program is running. Try to keep the person you find most attractive on the screen the longest. Do you have any questions?

In addition to these instructions, researchers used an improved apparatus. As in Experiment I, this preparation included custom software written in Labview™ (NI, Austin, TX, USA) for programming events and data collection. For the measurement of force, researchers

connected a hand dynamometer (BioPac Systems, Inc., Goleta, CA, USA) to a custom interface and general purpose transducer amplifier (BioPac Systems, Inc., Goleta, CA, USA) equipped with an isolated power supply (BioPac Systems, Inc., Goleta, CA, USA). The operative range of the dynamometer was 0 to 100 kg.

During three trials of the experimental task, participants were presented with images on a computer screen of their high, median, and low preferred partners as identified by the modified RO. The order of pictures (i.e., trials) was randomized across participants. Just as in Experiment I, on-screen instructions prompted the participant to squeeze gently to begin the task. Again, the software collected force readings from the dynamometer at 20 samples per second and produced data on the average force obtained for each 1-s interval.

Just as in Experiment I, the software used force recordings to determine the percentage of clarity of the image. If the participant did not apply force to the dynamometer, the image faded from 100% clarity, at a rate of 10% per second, until it reached 0% clarity (i.e., the image was transparent in 10 s). Participants could restore the image to 100% clarity by applying increasing force to meet the progressive ratio schedule of +1 kg force per 10% decrease in clarity.

Analytical Plan

Data were processed and screened for unsystematic responding using *beezdemand* (v0.1.0; Kaplan et al., 2019) in RStudio (Version 1.4.1717). Similar to Experiment I, the researcher (a) winsorized consumption values (Blaine, 2018; Wu & Zuo, 2009), (b) used the exponentiated model (Koffarnus et al., 2015) to derive demand metrics, and (c) evaluated model fit using r^2 values produced by *beezdemand*. Again, the researcher evaluated demand using (a) derived intensity, (b) derived elasticity, and (c) breakpoint. Descriptions of each of these demand

metrics are listed in Table 1. Again, to correct for skew in distribution, demand values were log-transformed prior to analyses.

To evaluate my hypotheses, I repeated the same analysis procedures described in Experiment I for (a) correspondence between the modified RO and responding on the DPT, (b) correspondence between modified RO and responding on the conjugate preparation (i.e., peak force, mean force, or both), and (c) correspondence between responding on the DPT and responding on the conjugate preparation (i.e., peak force, mean force, or both).

Results

We recruited a total of 42 participants for this study. Due to cancellations, only 35 participants completed their reserved research appointments. In addition, data for seven participants were excluded due to insufficient responding on the modified RO assessment. When instructed to select pictures of individuals with whom the participant would have sex, these participants only selected one image. Thus, their responding on the subsequent DPT and conjugate preparation were not compatible with the preparations. All subsequent analyses are based on data for the remaining 28 participants. Table 6 displays demographic data for these participants. The majority of participants identified as female, heterosexual, White, and non-Hispanic.

Correspondence Between RO and DPT

After winsorizing data and screening for unsystematic responding, only 25 datasets were included in this analysis for the high, median, and low preferred DPT conditions. In addition, data were log-transformed to correct for skewedness. These demand curves are depicted graphically in Figure 5. The researcher conducted a repeated measures ANOVA to compare the effect of DPT condition on demand indices (i.e., intensity, breakpoint, and elasticity).

A repeated measures ANOVA revealed that there was a statistically significant difference in intensity between at least two groups ($F(2, 48) = 9.71$, $p = <.01$, $\eta^2 = 0.04$). A post-hoc Bonferroni Test for pairwise comparisons found that the mean value of intensity was *not* significantly different between the median preferred condition ($M = 1.94$, $SD = 0.60$) and the high preferred condition ($M = 2.05$, $SD = 0.51$). The mean value of intensity was significantly different between the low preferred condition ($M = 1.78$, $SD = 0.67$) and the high preferred condition ($p < 0.01$). There was also a significant difference between the median preferred and low preferred conditions ($p < .01$). Results of this analysis are depicted graphically in Figure 6.

The second repeated measures ANOVA indicated there was a significant difference in breakpoint between at least two groups ($F(2, 48) = 7.827$, $p <.01$, $\eta^2 = 0.04$). A post-hoc Bonferroni Test for pairwise comparisons found that the mean value of breakpoint was *not* significantly different between the median preferred condition ($M = 2.10$, $SD = 0.58$) and the high preferred condition ($M = 2.17$, $SD = 0.51$). The mean value of breakpoint was significantly different between the low preferred condition ($M = 1.88$, $SD = 0.7$) and the high preferred condition ($p < .05$). There was also a significant difference between the mean value of breakpoint between the median preferred condition and the low preferred condition ($p < .05$). Results of this analysis are depicted graphically in Figure 7.

The third repeated measures ANOVA indicated there was *no* significant difference in elasticity between at least conditions ($F(2, 48) = 0.833$, $p =.39$). Results of this analysis are depicted graphically in Figure 8.

Correspondence Between RO and Force Exertion

Unfortunately, due to repeated software and hardware malfunctions, only 15 participants completed the conjugate preparation. To evaluate correspondence between responding on the RO

assessment and responding in the conjugate preparation, I replicated statistical and visual analysis procedures used in Experiment I.

Statistical Analysis

Results of statistical analyses are depicted in Table 7. First, the researcher conducted $\chi 2$ Tests of Independence to evaluate the correlation between participants' responding on the modified RO assessment and mean and peak force rank order. There was a significant correlation between the modified RO and mean force rank order (p = .010) and peak force rank order (p =.010). To ensure this correlation was not due to stimulus presentation order, the researcher conducted a Spearman's Rank-Order test to evaluate the correlation between stimulus presentation order and mean and peak force rank order. Results indicated there was no significant correlation between mean nor peak force ranks and the stimulus presentation order. In addition, there was no significant correlation between participant responding on the modified RO and stimulus presentation order. These results replicate findings from Sheridan et al. (2024).

Visual Analysis of Individual Participant Data

The researcher created graphs for each participant displaying (a) modified RO data, (b) mean and peak force ranks from the conjugate preparation, and (c) stimulus presentation order in the conjugate preparation. Based on visual inspection, the researcher categorized participant responding based on response categories developed by Davis et al. (2021) and repeated by Cook et al. (in press) and Sheridan (2023). See Table 4 for descriptions of each category. The greatest percentage of participants engaged in responding which met criteria for the HP and LP Correspondence (26.67%) and the HP Only Correspondence (26.67%) categories, followed by Undifferentiated (20%), and Decreasing Trend (13.3%), and LP Only (13.3%) categories. No participants displayed responding that met criteria for the Nonresponse category.

Correspondence Between DPT and Force Exertion

To evaluate the third hypothesis (i.e., demand metrics would correlate with force exerted in the conjugate preparation), I repeated statistical analyses from Experiment I, conducting $\chi 2$ Tests of Independence with participant responding in the DPT and conjugate preparation. Of the 15 participants who completed the conjugate preparation, three demonstrated unsystematic responding in the DPT and were thus excluded from analyses involving demand metrics. Thus, these analyses include data for 12 participants who (a) completed the conjugate preparation and (b) demonstrated systematic responding in the DPT.

Statistical Analysis

Results of statistical analyses are depicted in Table 8. First, the researcher conducted $\chi 2$ Tests of Independence to evaluate the correlation between participant responding on the modified RO assessment and in the DPT. There were significant correlations between modified RO assessment ranks and (a) DPT intensity ranks and (b) DPT breakpoint ranks, and (c) DPT elasticity ranks. These findings corroborate the results of the repeated measures ANOVAs.

Second, the researcher conducted $\chi 2$ Tests of Independence to evaluate correlation between participants' responding on the DPT and mean force ranks. There was a significant positive correlation between mean force ranks and DPT intensity ranks. Third, the researcher conducted a $\chi 2$ Tests of Independence to evaluate correlation between participants' responding on the DPT and peak force ranks. Again, there was a significant positive correlation between peak force ranks and DPT intensity ranks.

Taken together, the positive correlations between mean and peak force ranks for DPT intensity and elasticity ranks indicate participants demonstrated the greatest forces for the same images they demonstrated greatest demand. Finally, to confirm these findings were not artifacts

related to fatigue, the researcher conducted $\chi 2$ Tests of Independence between stimulus presentation order and DPT demand metrics. There were no significant correlations.

Chapter 3

Discussion

The purpose of this series of translational studies was to extend previous research evaluating demand and preference using CPTs by validating these results with a conjugate preparation. To the researcher's knowledge, this is the first series of studies to compare responding on a CPT to responding in a conjugate preparation. Findings from Experiment I at least partially replicated previous research indicating individuals demonstrate differential demand based on preference. However, data from Experiment I did not replicate previous research using conjugate preparations that demonstrate correspondence between force exerted and responding in preference assessments.

The research team attributed this lack of replication to (a) small sample size, (b) limited stimulus selection, (c) lack of context in the conjugate preparation, (d) implied illegal behavior in the CPT, and (e) hardware malfunction. To address these limitations, Experiment II was designed with improved stimuli, procedures, and hardware. As a result, findings from Experiment II replicated and extended previous research. That is, in the DPT, participants demonstrated differential demand based on preference (i.e., replication of Dolan et al., 2020; Jarmolowicz et al., 2016) and force exerted in the conjugate preparation corresponded with preference (i.e., replication of Cook et al., in press; Davis et al., 2021; and Sheridan, 2023). In addition, findings from Experiment II indicated participant responding in the conjugate preparation corresponded with responding on the DPT on two demand metrics (i.e., intensity and elasticity).

Taken together, findings from these studies improve the clinical utility of preparations using schedules of covariation in at least four ways. First, findings from the present studies

further extend the generality of preference and reinforcer assessment frameworks to potential sexual partners. Jarmolowicz et al. (2016) used responding on CPTs to validate the use of an MSWO preference assessment for evaluating preferred sexual partners. Rapp (2008) also suggested conjugate preparations may be useful for assessing stimulus preference using active responding as compared to passive responding evaluated in traditional preference assessment methods. That is, traditional methods of assessing preference only require the individual to make a selection response. By contrast, conjugate preparations require the individual to emit continuous responding, especially when a progressive schedule is added. In addition, Rapp suggested conjugate preparations offer stronger demonstrations of experimental control than traditional methods.

Previous studies evaluating correspondence between traditional preference assessment methods and conjugate preparations indicate correspondence between the two assessment methods. For example, Cook et al. (in press) demonstrated this correspondence with auditory stimuli. Davis et al. (2021) demonstrated this correspondence with visual stimuli and Sheridan (2023) extended the Davis et al. findings to images of humans. In addition, previous studies have demonstrated this correspondence with conjugate preparations using other types of stimuli (e.g., Falligant et al., 2018, 2020; Jones et al., 2024; Saunders et al., in preparation). However, no previous research using conjugate preparations has demonstrated this correspondence in the explicit context of physical attraction. Findings from Experiment I failed to support this application extension. However, findings from Experiment II support (a) the need for explicit instruction to ensure appropriate stimulus control and (b) the use of conjugate preparations to assess preferred sexual partners using both active responding and a reversal (i.e., high preferred to low preferred partner). In short, when evaluating responding in preparations using conjugate

preparations, context matters. Future research should continue to evaluate the clinical utility of conjugate preparations and the effect of context on participant responding (e.g., through delivery of instructions or rules).

Second, Rapp (2008) suggested conjugate preparations may be useful for identifying patterns of responding indicative of sensitivity to extreme forms of stimulation. Similarly, it has been suggested that excessive demand for and discounting of a commodity may covary with maladaptive behavior, such as risky sexual health decision-making (Jarmolowicz et al., 2015). Jarmolowicz et al. (2016) suggested individuals with high demand for median preferred sexual partners may be at greater risk of developing risky sexual health decision-making later. Thus, findings from the present study may support the use of conjugate preparations to identify responding consistent with risky sexual health decision-making, such as high force exerted to view the picture of the median preferred partner. Indeed, findings from Experiment II indicated there was no significant difference between participant responding in the high versus median preferred partner conditions in the DPT. Future research should evaluate correspondence between responding on conjugate preparations and responding on validated assessments of sexual health decision-making (e.g., HRBS [Drake et al., 1991], SDDT [Johnson & Bruner, 2012], SDI-2 [Spector et al., 1996], and HRTBS [Ward et al., 1990]). Although college students are typically within the age range with the highest transmission of STIs (as were participants of this study), future research should seek to evaluate demand with clinical populations, such as the five key populations the WHO identified as being uniquely affected by STIs.

Third, findings from Experiment II support the conceptualization of synchronous and conjugate preparations with progressive schedules as a form of reinforcer assessment. Within reinforcer assessment methodology, it is generally accepted that by increasing the response effort

required to gain access to a stimulus, continued responding indicates greater relative reinforcer value. Similarly, CPTs evaluating behavioral demand explicitly assay this inverse relation between constraint and consumption (i.e., the Law of Demand). This conceptualization is supported by other studies using these preparations, such as Curiel et al. (2024). In their study, Curiel et al. used a conjugate preparation to validate the outcomes of an MSWO preference assessment for videos with children and found strong correlation between the two assessment methods. Given findings from Experiment II indicated significant correlation between force exerted in the conjugate preparation and demand metrics in the DPT, this study supports conceptualizing these preparations as reinforcer assessments. Moreover, these preparations may offer more efficient identification of reinforcers as compared to traditional reinforcer assessment methods due to the automaticity of the task. This could be useful in settings with (a) individuals with limited skill repertoires, (b) limited staff, or both (Sheridan, 2023).

Finally, conjugate preparations may offer a solution to validation of CPTs for behavior that is not ethical or legal to evoke, even in laboratory settings. Historically, CPTs were developed out of the need to evaluate demand for commodities for which it was not feasible ethically or legally to deliver the commodity. As the regulatory environment for research has improved, recent research has specifically evaluated correspondence between responding on CPTs and demand for commodities in a laboratory environment (e.g., Amlung et al., 2012; Berry et al., 2023). Although sexual behavior remains illegal to evaluate in a laboratory environment, conjugate preparations may offer real world behavioral outcome measures with which to validate responding on hypothetical sexual demand tasks. This would be an important first step in understanding psychological mechanisms underlying risky sexual health decision-making and thus developing improved interventions. Moreover, conjugate preparations may be useful for

evaluating behavior with populations who may not respond accurately on CPTs. For example, for individuals who demonstrate contextually inappropriate or illegal sexual behavior, these preparations may offer an alternative form of assessment that (a) does not imply contextually inappropriate or illegal sexual behavior and (b) is sensitive to differential responding. Future research should seek to evaluate the use of these preparations with such populations.

A few limitations of this series of studies are worth noting. First, findings may lack generality to other populations because both studies recruited (a) undergraduate students as participants and (b) a relatively small sample size. With respect to the former, undergraduates are typically within the age group evaluated to contribute substantially to the transmission of STIs (Satterwhite et al., 2013). In addition, given these were translational studies, undergraduates are often an acceptable population with which to evaluate novel preparations. With respect to the latter, small sample sizes often result in underpowered analyses. Indeed, the repeated measures ANOVAs conducted in this series of studies produced power values ranging from 0.05 – 0.9, based on post hoc analyses. When power is low, the risk of Type II error increases (Serdar et al., 2020). That is, underpowered studies are at risk of incorrectly rejecting the alternative hypothesis and accepting the null hypothesis (i.e., false negative). Notably, Type I and Type II errors are inversely related. By increasing the risk of Type II error, underpowered studies decrease the risk of Type I error (i.e., incorrectly rejecting the null hypothesis; false positive). The results of five out of six repeated measures ANOVAs in this series of studies indicated a significant finding, leading the researcher to reject the null hypotheses. This decision is thus supported despite the small sample size, based on reduced risk of Type I error. Nonetheless, future studies should seek to replicate these findings with larger sample sizes. This might be achieved by using

crowdsourcing data acquisition platforms, such as Amazon Mechanical Turk (Litman et al., 2017) and Prolific.

Second, similar to Jarmolowicz et al. (2016), questions in the CPT in Experiment I refer specifically to behavior that is currently illegal in the state in which the study was conducted. Thus, it is possible participants felt uncomfortable while completing the task. In addition, sociocultural norms in the US South have historically impacted (a) access to STI prevention and care (Scott et al., 2021) and (b) sexual identity stigma (Frey et al., 2021). Thus, asking participants to self-report sexual orientation and gender may have caused participants to feel uncomfortable while completing the demographic questionnaire. However, these discomforts were minimized by (a) having only one research staff in the room during the experiment and (b) physically distancing the research staff from the participant during the task to maintain privacy.

Third, similar to Sheridan (2023), the researcher did not evaluate within-subject replication of force exerted in the conjugate preparation. However, stimulus presentation order was not significantly correlated with RO ranks, peak force ranks, nor mean force ranks in either experiment. Moreover, the significant findings from Experiment II support the validation of the conjugate preparation through responding that corresponded with RO responding, similar to previous studies (Cook et al., in press; Davis et al., 2021; Sheridan, 2023). The researcher specifically limited the number of stimuli assessed in the conjugate preparation to three because it has been suggested this preparation *may* lead to muscle fatigue (Cook et al., in press; Sheridan, 2023). Thus, within-subject replication may be challenging to accomplish without sufficient rest time for participants. Moreover, this preparation is designed to be brief and not require replications to provide strong predictive validity. Future research should seek to evaluate the

upper limit of stimulus quantity for various synchronous and conjugate preparations which utilize force exertion as the dependent variable.

For studies using conjugate preparations, results of Experiment II suggest context matters. Although the results from Experiment II replicate findings from Sheridan (2023) in that there was significant correlation between modified RO ranks and mean and peak force ranks from the conjugate preparation, the instructions presented to participants were distinctly different. That is, Sheridan (2023) provided limited instruction to participants regarding how the stimuli presented should affect their behavior in the preference assessment and conjugate preparation. By contrast, in Experiment II, participants were explicitly instructed to select images of people with whom they would have sex and to exert greater force for the image of the person they found most attractive. It is unclear the source of stimulus control in the Sheridan (2023) study. However, in the present study, researchers labeled the correct source of stimulus control for participants. Thus, we are better able to make conclusions about the relation between the image and force exerted. Other studies using conjugate preparations have examined the effect of context on participant responding (e.g., Jones et al., 2024). However, more research is warranted. Future studies should specifically examine the moderating or mediating effect of context (e.g., instructions, rules) on behavior in conjugate preparations. This work will improve our understanding of schedules of covariation.

In addition, given historically minoritized groups (e.g., men who have sex with men, people in prisons, trans and gender diverse people) may be at increased risk of and disproportionately affected by STIs, continued research on sexual demand may improve our understanding of risky sexual health decision-making. Doing so may lead to evidence-based interventions to decrease risky sexual behavior. Conjugate preparations may be an important tool

in better understanding the psychological mechanisms underlying risky sexual health decision-making. Moreover, given the limited amount of research using these preparations, future studies should seek to replicate and extend these findings, specifically to clinical populations.

Such clinical populations may be impacted by transmission of STIs such that this health disparity is correlated with other disparities such as socioeconomic or educational disparities. As such, involving these populations in research requires careful consideration of the risks and benefits, including the efficiency and efficacy of preparations. Given the relative efficiency of conjugate preparations and ease of use, they may be especially relevant for use in this context. Future studies should evaluate the social validity of conjugate preparations as compared to traditional assessment methods (e.g., CPTs) among clinical populations. By doing so, we may improve health and quality of life for the most vulnerable individuals of society.

References

Acuff, S. F., Amlung, M., Dennhardt, A. A., MacKillop, J., & Murphy, J. G. (2020). Experimental manipulations of behavioral economic demand for addictive commodities: A meta-analysis. *Addiction*, *115*(5), 817-831. https://doi.org/10.1111/add.14865

Amlung, M. T., Acker, J., Stojek, M. K., Murphy, J. G., & MacKillop, J. (2012). Is talk "cheap"? An initial investigation of the equivalence of alcohol purchase task performance for hypothetical and actual rewards. *Alcoholism: Clinical and Experimental Research*, *36*(4), 716-724. https://doi.org/10.1111/j.1530-0277.2011.01656.xopen_in_new

Amlung, M., Marsden, E., Holshausen, K., Morris, V., Patel, H., Vedelago, L., Naish, K. R., Reed, D. D.. & McCabe, R. E. (2019). Delay discounting as a transdiagnostic process in psychiatric disorders: A meta-analysis. *JAMA psychiatry*, *76*(11), 1176-1186. doi:10.1001/jamapsychiatry.2019.2102

Berry, M. S., Naudé, G. P., Johnson, P. S., & Johnson, M. W. (2023). The Blinded-Dose Purchase Task: assessing hypothetical demand based on cocaine, methamphetamine, and alcohol administration. *Psychopharmacology*, *240*(4), 921-933. https://doi.org/10.1007/s00213-023-06334-6

Bickel, W. K., Jarmolowicz, D. P., Mueller, E. T., Koffarnus, M. N., & Gatchalian, K. M. (2012). Excessive discounting of delayed reinforcers as a trans-disease process contributing to addiction and other disease-related vulnerabilities: emerging evidence. *Pharmacology & therapeutics*, *134*(3), 287-297. https://doi.org/10.1016/j.pharmthera.2012.02.004

Bickel, W. K., Johnson, M. W., Koffarnus, M. N., MacKillop, J., & Murphy, J. G. (2014). The behavioral economics of substance use disorders: Reinforcement pathologies and their

repair. *Annual Review of Clinical Psychology*, 10, 641-677. https://doi.org/10.1146/annurev-clinpsy-032813-153724

Bickel, W. K., Moody, L., & Higgins, S. T. (2016). Some current dimensions of the behavioral economics of health-related behavior change. *Preventive Medicine*, 92, 16-23. https://doi.org/10.1016/j.ypmed.2016.06.002

Bidwell, L. C., MacKillop, J., Murphy, J. G., Tidey, J. W., & Colby, S. M. (2012). Latent factor structure of a behavioral economic cigarette demand curve in adolescent smokers. *Addictive behaviors*, *37*(11), 1257-1263. https://doi.org/10.1016/j.addbeh.2012.06.009

Blaine, B. E. (2018). "Winsorizing." *The SAGE Encyclopedia of Educational Research, Measurement, and Evaluation,* 1817-1818.

Broadbent, J., & Dakki, M. A. (2015). How much is too much to pay for internet access? A behavioral economic analysis of internet use. *Cyberpsychology, Behavior, and Social Networking*, *18*(8), 457-461. https://doi.org/10.1089/cyber.2014.0367

Camerer, C. F., Loewensein, G., & Rabin, M. (2004). Advances in behavioral economics. Princeton, NJ: Princeton University Press & Russell Sage Foundation.

Centers for Disease Control and Prevention (2023). Estimated HIV incidence and prevalence in the United States, 2017–2021. HIV Surveillance Supplemental Report. Retrieved from https://www.cdc.gov/hiv/library/reports/hiv-surveillance/vol-28-no-3/index.html#print

Centers for Disease Control and Prevention (2019). HIV infection, risk, prevention, and testing behaviors among men who have sex with men—national HIV behavioral surveillance, 23 U.S. Cities, 2017. HIV Surveillance Special Report. Retrieved from

https://www.cdc.gov/hiv/pdf/library/reports/surveillance/cdc-hiv-surveillance-special-report-number-22.pdf

Collado, A., Johnson, P. S., Loya, J. M., Johnson, M. W., & Yi, R. (2017). Discounting of condom-protected sex as a measure of high risk for sexually transmitted infection among college students. *Archives of sexual behavior*, *46*, 2187-2195. https://doi.org/10.1007/s10508-016-0836-x

Conley, M. I., Dellarco, D. V., Rubien-Thomas, E., Cohen, A. O., Cervera, A., Tottenham, N., & Casey, B. J. (2018). The racially diverse affective expression (RADIATE) face stimulus set. *Psychiatry Research, 270,* 1059 – 1067. https://doi.org/10.1016/j.psychres.2018.04.066

Cook, J. L., Baruni, R. R., Pinkston, J. W., Rapp, J. T., Miltenberger, R. G., Deshmukh, S., Walker, E., & Tai, S. (in press). Comparing stimulus preference and response force in a conjugate preparation: A replication with auditory stimulation. *Journal of the Experimental Analysis of Behavior.*

Critchfield, T. S. (2011). Translational contributions of the experimental analysis of behavior. *The Behavior Analyst*, *34*(1), 3-17. https://doi.org/10.1007/BF03392227

Curiel, H., Curiel, E.S., Villanueva, S., Ayala, C., & Cadigan, A. The multiple-stimulus-without-replacement preference assessment tool and its predictive validity. *Journal of Applied Behavior Analysis*. Advance online publication. https://doi.org/10.1002/jaba.1037

Darke, Shane, Hall, Wayne, Heather, Nick, Ward, Jeff & Wodak, Alex. (1991). The reliability and validity of a scale to measure HIV risk-taking behaviour among intravenous drug users. AIDS, 5(2), 181-186. Retrieved from

http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=ovfta&NEWS=N&AN=00002030-199102000-00008.

Davis, W. T., Rapp, J. T., Brogan, K. M., Pinkston, J. W., & Chinnappan, B. (2021). Comparing stimulus preference and response force in a conjugate preparation. *Journal of the Experimental Analysis of Behavior*, *116*(1), 96–113. https://doi.org/10.1002/jeab.705

DeLeon, I. G., & Iwata, B. A. (1996). Evaluation of a multiple-stimulus presentation format for assessing reinforcer preferences. *Journal of Applied Behavior Analysis*, *29*(4), 519-533. https://doi.org/10.1901/jaba.1996.29-519

Deochand, N., Costello, M. S., & Fuqua, R. W. (2020). Real-time contingent feedback to enhance punching performance. *The Psychological Record*, *70*, 33-45. https://doi.org/10.1007/s40732-019-00357-2

Diaz de Villegas, S. C., Dozier, C. L., Jess, R. L., & Foley, E. A. (2020). An evaluation of synchronous reinforcement for increasing on-task behavior in preschool children. *Journal of Applied Behavior Analysis*, *53*(3), 1660-1673. https://doi.org/10.1002/jaba.696

Dolan, S. B., Johnson, P. S., & Johnson, M. W. (2020). The hotel room purchase task: Effects of gender and partner desirability on demand for hypothetical sex in individuals with disordered cocaine use and controls. *Archives of sexual behavior*, *49*, 1251-1262. https://doi.org/10.1007/s10508-020-01634-w

Epstein, L. H., Stein, J. S., Paluch, R. A., MacKillop, J., & Bickel, W. K. (2018). Binary components of food reinforcement: Amplitude and persistence. *Appetite*, *120*, 67-74. https://doi.org/10.1016/j.appet.2017.08.023

Falligant, J. M., Rapp, J. T., Brogan, K. M., & Pinkston, J. W. (2018). Response force in conjugate schedules of reinforcement. *The Psychological Record*, *68*, 525-536. https://doi.org/10.1007/s40732-018-0298-8

Falligant, J. M., Rapp, J. T., Brogan, K. M., & Pinkston, J. W. (2020). Extinction and response force in conjugate schedules. *The Psychological Record*, *70*, 109-121. https://doi.org/10.1007/s40732-020-00374-6

Harsin, J. D., Gelino, B. W., Strickland, J. C., Johnson, M. W., Berry, M. S., & Reed, D. D. (2021). Behavioral economics and safe sex: Examining condom use decisions from a reinforcer pathology framework. *Journal of the experimental analysis of behavior*, *116*(2), 149-165. https://doi.org/10.1002/jeab.706

Hansen, P. G., & Jespersen, A. M. (2013). Nudge and the manipulation of choice: A framework for the responsible use of the nudge approach to behaviour change in public policy. *European Journal of Risk Regulation*, *4*(1), 3-28. https://doi.org/10.1017/S1867299X00002762

Hayaki, J., Anderson, B., & Stein, M. (2006). Sexual risk behaviors among substance users: relationship to impulsivity. *Psychology of addictive behaviors*, *20*(3), 328. https://doi.org/10.1037/0893-164X.20.3.328

Herrmann, E. S., Hand, D. J., Johnson, M. W., Badger, G. J., & Heil, S. H. (2014). Examining delay discounting of condom-protected sex among opioid-dependent women and non-drug-using control women. *Drug and Alcohol Dependence*, *144*, 53-60. https://doi.org/10.1016/j.drugalcdep.2014.07.026

Hursh, S. R., Raslear, T. G., Shurtleff, D., Bauman, R., & Simmons, L. (1988). A cost-benefit analysis of demand for food. *Journal of the Experimental Analysis of Behavior, 50*, 419–440.

Hursh, S. R. & Silberberg, A. (2008). Economic demand and essential value. *Psychological Review*, *115*(1), 186. https://doi.org/10.1037/0033-295X.115.1.186

Jacobs, E. A., & Bickel, W. K. (1999). Modeling drug consumption in the clinic using simulation procedures: Demand for heroin and cigarettes in opioid-dependent outpatients. *Experimental and Clinical Psychopharmacology, 7,* 412–426. doi: 10.1037/1064-1297.7.4.412

Jarmolowicz, D. P., Bickel, W. K., & Gatchalian, K. M. (2013). Alcohol-dependent individuals discount sex at higher rates than controls. Drug and alcohol dependence, 131(3), 320-323. https://doi.org/10.1016/j.drugalcdep.2012.12.014

Jarmolowicz, D. P., Lemley, S. M., Asmussen, L., & Reed, D. D. (2015). Mr. right versus Mr. right now: A discounting-based approach to promiscuity. *Behavioural processes*, *115*, 117-122. https://doi.org/10.1016/j.beproc.2015.03.005

Jarmolowicz, D. P., Lemley, S. M., Mateos, A., & Sofis, M. J. (2016). A multiple-stimulus-without-replacement assessment for sexual partners: Purchase task validation. *Journal of Applied Behavior Analysis*, *49*(3), 723–729. https://doi.org/10.1002/jaba.313

Jarmolowicz, D. P., Landes, R. D., Christensen, D. R., Jones, B. A., Jackson, L., Yi, R., & Bickel, W. K. (2014). Discounting of money and sex: Effects of commodity and temporal position in stimulant-dependent men and women. *Addictive Behaviors*, *39*(11), 1652-1657. https://doi.org/10.1016/j.addbeh.2014.04.026

Johnson, M. W., & Bruner, N. R. (2012). The Sexual Discounting Task: HIV risk behavior and the discounting of delayed sexual rewards in cocaine dependence. *Drug and alcohol dependence*, *123*(1-3), 15-21. https://doi.org/10.1016/j.drugalcdep.2011.09.032

Jones, L., Ghezzi, P. M., & Rapp, J. T. (2024). *Distinguishing between positive conjugate reinforcement and negative reinforcement in a conjugate preparation: A replication and extension*. Manuscript under review.

Kapel, J. H., & Winkler, R. C. (1972). Behavioral economics: Areas of cooperative research between economics and applied behavioral analysis 1. *Journal of Applied Behavior Analysis*, *5*(3), 335-342.

Kaplan, B. A., Gilroy, S. P., Reed, D. D., Koffarnus, M. N., & Hursh, S. R. (2019). The R package beezdemand: behavioral economic easy demand. *Perspectives on Behavior Science*, *42*(1), 163-180. https://doi.org/10.1007/s40614-018-00187-7

Koffarnus, M. N., Franck, C. T., Stein, J. S., & Bickel, W. K. (2015). A modified exponential behavioral economic demand model to better describe consumption data. *Experimental and clinical psychopharmacology*, *23*(6), 504. https://doi.org/10.1037/pha0000045

Lawyer, S. R., Williams, S. A., Prihodova, T., Rollins, J. D., & Lester, A. C. (2010). Probability and delay discounting of hypothetical sexual outcomes. *Behavioural Processes*, *84*(3), 687-692. https://doi.org/10.1016/j.beproc.2010.04.002

Leslie, S. C., Dozier, C. L., Kamlowsky, M. E., McHugh, C. L., Diaz de Villegas, S. C., & Kanaman, K. C. (2023). Using synchronous reinforcement to increase mask wearing in young children: A replication and extension. *Behavioral Interventions*. Advance online publication. https://doi.org/10.1002/bin.1985

Litman, L., Robinson, J., & Abberbock, T. (2017). TurkPrime.com: A versatile crowdsourcing data acquisition platform for the behavioral sciences. *Behavior Research Methods, 49*(2), 433-442. https://doi.org/10.3758/s13428-016-0727-z

MacAleese, K. R., Ghezzi, P. M., & Rapp, J. T. (2015). Revisiting conjugate schedules. *Journal of the Experimental Analysis of Behavior*, *104*(1), 63-73. https://doi.org/10.1002/jeab.160

Mace, F. C., & Critchfield, T. S. (2010). Translational research in behavior analysis: Historical traditions and imperative for the future. *Journal of the Experimental Analysis of Behavior, 93,* 293–312. doi: 10.1901/jeab.2010.93-293

McHugh, C. L., Dozier, C. L., Diaz de Villegas, S. C., & Kanaman, N. A. (2022). Using synchronous reinforcement to increase mask wearing in adults with intellectual and developmental disabilities. *Journal of Applied Behavior Analysis*, *55*(4), 1157-1171. https://doi.org/10.1002/jaba.950

Rapp, J. T. (2008). Conjugate reinforcement: A brief review and suggestions for applications to the assessment of automatically reinforced behavior. *Behavioral Interventions, 23,* 113–136. https://doi.org/10.1002/bin.259

Reed, D. D., Gelino, B. W., & Strickland, J. C. (2022). Behavioral economic demand: How simulated behavioral tasks can inform health policy. *Policy Insights from the Behavioral and Brain Sciences*, *9*(2), 171-178. https://doi.org/10.1177/23727322221118668

Reed, D. D., Kaplan, B. A., Becirevic, A., Roma, P. G., & Hursh, S. R. (2016). Toward quantifying the abuse liability of ultraviolet tanning: A behavioral economic approach to tanning addiction. *Journal of the Experimental Analysis of Behavior*, *106*(1), 93-106. https://doi.org/10.1002/jeab.216

Reed, D. D., Niileksela, C. R., & Kaplan, B. A. (2013). Behavioral economics: A tutorial for behavior analysts in practice. *Behavior Analysis in Practice, 6(1),* 34-54. https://doi.org/10.1007/BF03391790

Samuelson, P. A., & Nordhaus, W. D. (1985). Economics. New York, NY: McGraw-Hill.

Satterwhite, C. L., Torrone, E., Meites, E., Dunne, E. F., Mahajan, R., Ocfemia, M. C., Su, J., Xu, F., & Weinstock, H. (2013). Sexually transmitted infections among US women and men: prevalence and incidence estimates, 2008. *Sexually Transmitted Diseases*, *40*(3), 187–193. https://doi.org/10.1097/OLQ.0b013e318286bb53

Saunders, S., Ghezzi, P M., & Rapp, J. T. (2024). *A Within-Subjects Analysis of Positive and Negative Conjugate Reinforcement: A Translational Replication and Extension.* Manuscript in preparation.

Serdar, C. C., Cihan, M., Yücel, D., & Serdar, M. A. (2021). Sample size, power and effect size revisited: simplified and practical approaches in pre-clinical, clinical and laboratory studies. *Biochemia Medica*, *31*(1), 27-53. https://doi.org/10.11613/BM.2021.010502

Sheridan, D. J. (2023). *Identifying preferences using a conjugate preparation.* [Master's thesis, Auburn Unversity].

Skidmore, J. R., Murphy, J. G., & Martens, M. P. (2014). Behavioral economic measures of alcohol reward value as problem severity indicators in college students. *Experimental and clinical psychopharmacology*, *22*(3), 198. https://doi.org/10.1037/a0036490

Song R., Hall H. I., Green T. A., Szwarcwald C. L., Pantazis N. (2017). Using CD4 data to estimate HIV incidence, prevalence, and percent of undiagnosed infections in the United States. *Journal of Acquired Immune Deficiency Syndromes, 74,* 3-9. https://doi.org/10.1097/QAI.0000000000001151

Spector, I. P., Carey, M. P., & Steinberg, L. (1996). The Sexual Desire Inventory: Development, factor structure, and evidence of reliability. *Journal of sex & marital therapy*, *22*(3), 175-190. https://doi.org/10.1080/00926239608414655

Strickland, J. C., Bolin, B. L., Romanelli, M. R., Rush, C. R., & Stoops, W. W. (2017). Effects of acute buspirone administration on inhibitory control and sexual discounting in cocaine users. *Human Psychopharmacology: Clinical and Experimental*, *32*(1), e2567. https://doi.org/10.1002/hup.2567

Strickland, J. C., Marks, K. R., & Bolin, B. L. (2020). The condom purchase task: A hypothetical demand method for evaluating sexual health decision-making. *Journal of the Experimental Analysis of Behavior*, *113*(2), 435-448. https://doi.org/10.1002/jeab.585

Thaler, R. H., & Sunstein, C. R. (2008). Nudge: Improving decisions about health, wealth, and happiness. New Haven, CT: Yale University Press.

Tottenham, N., Tanaka, J. W., Leon, A. C., McCarry, T., Nurse, M., Hare, T. A., ... & Nelson, C. (2009). The NimStim set of facial expressions: Judgments from untrained research participants. *Psychiatry Research, 168(3),* 242-249. https://doi.org/10.1016/j.psychres.2008.05.006

Vollmer, T. R. (2011). Three variations of translational research: Comments on Critchfield (2011). *The Behavior Analyst, 34*(1)*,* 31–35. doi: 10.1007/BF03392231

Ward, J., Darke, S., & Hall, W. (1990). *The HIV risk-taking behaviour scale (HRBS) manual*. National Drug and Alcohol Research Centre, University of New South Wales.

Weinstock, J., Mulhauser, K., Oremus, E. G., & D'Agostino, A. R. (2016). Demand for gambling: Development and assessment of a gambling purchase task. *International Gambling Studies*, *16*(2), 316-327. https://doi.org/10.1080/14459795.2016.1182570

Williams, D. C., & Johnston, J. M. (1992). Continuous versus discrete dimensions of reinforcement schedules: an integrative analysis. *Journal of the Experimental Analysis of Behavior, 58(1)*, 205–228. https://doi.org/ 10.1901/jeab.1992.58-205

World Health Organization. (2023a, July 10). *Sexually transmitted infections (STIs)*. World Health Organization. https://www.who.int/news-room/fact-sheets/detail/sexually-transmitted-infections-(stis)

World Health Organization. (2023b). *New Good Practice Statement on Counselling Behavioural Interventions For Key Populations to Prevent HIV, Viral Hepatitis and STIs* [Policy brief]. World Health Organization. https://iris.who.int/bitstream/handle/10665/369625/9789240072275-eng.pdf?sequence=1

Wu, M., & Zuo, Y. (2009). Trimmed and winsorized means based on a scaled deviation. *Journal of Statistical Planning and Inference, 139(2)*, 350-365. https://doi.org/10.1016/j.jspi.2008.03.039

Table 1

Description of Demand Metrics

Demand Metric	Description	Observed or Derived
Intensity	Responding at price of $0.00	Derived
Alpha	Rate of change in slope (i.e., elasticity) across demand curve	Derived
Breakpoint 0	First price at which responding is zero	Derived

Table 2

Participant Demographics from Experiment I

Demographic Variable	Percentage
Sex	
Male	23.3% (7)
Female	76.6% (23)
Gender	
Female	66.67% (20)
Male	23.33% (7)
Cisgender female	3.33% (1)
Genderfluid	3.33% (1)
Woman	3.33% (1)
Age (Years)	
Mean	18.83
SD	1.05
Range	18, 22
Grade Point Average	
Mean	3.44
SD	0.61
Range	1.9, 4.5
Racial identity	
White	90% (27)
Black or African American	3.33% (1)
Asian	3.33% (1)
Multiracial	3.33% (1)
Native Hawaiian or Pacific Islander	0% (0)
First Nations or Indigenous Peoples	0% (0)
Prefer not to answer	0% (0)
Ethnicity	
Non-Hispanic	96.67% (29)

Demographic Variable	Percentage
Hispanic	3.33% (1)
Relationship Status	
Not dating, but looking	50% (15)
Dating one person for *more* than 6 months	33.33% (10)
I do not date	6.67% (2)
Dating one person for *less* than 6 months	3.33% (1)
Dating a few people	3.33% (1)
Prefer not to answer	3.33% (1)
Divorced	0% (0)
Married	0% (0)
Sexual Orientation	
Heterosexual	73.33% (22)
Bisexual	10% (3)
Homosexual	10% (3)
Asexual	3.33% (1)
Prefer not to answer	3.33% (1)
Demisexual	0% (0)
Pansexual	0% (0)
Queer	0% (0)

Note. Participants self-reported grade point average and gender. All other demographics were presented as multiple-choice questions.

Table 3

Results of χ2 Tests of Independence in Experiment I

Comparison	χ^2	df	*p*	*Cramér's V*
RO Assessment by Mean Force Rank	5.45	4	.244	.29
RO Assessment by Peak Force Rank	6.21	6	.399	.31
RO Assessment by Stimulus Order	3.82	4	.431	.24
Stimulus Order by Mean Force Rank	8.73	4	.068	.36
Stimulus Order by Peak Force Rank	4.64	6	.591	.26

Note. $n = 9$, RO = Rank Order.

Table 4

Graph Categorization via Visual Inspection

Category	Definition
HP and LP Correspondence	Responding in which the high HP stimulus identified by the RO assessment produces the greatest mean force *and* the LP stimulus produces the least mean force.
HP Only	Responding in which the HP stimulus identified by the RO assessment produces the greatest mean force; the LP stimulus does *not* produce the least mean force.
LP Only	Responding in which the LP stimulus identified by the RO assessment produces the least mean force; the HP stimulus does *not* produce the greatest mean force
Decreasing Trend	Responding in which mean force decreased across at least two of three stimuli in order of stimulus presentation.
Nonresponse	Responding in which peak force does not exceed 0.5 kg for any stimulus
Undifferentiated	Responding in which there were no discernible relations between responding on the RO assessment and responding in the conjugate preparation.

Note. HP = high preferred, LP = low preferred.

Table 5

Results of χ2 Tests of Independence for CPT Ranks in Experiment I

Comparison	χ^2	df	*p*	*Cramér's V*
RO Assessment by CPT Intensity Ranks	2.49	2	.288	.30
RO Assessment by CPT Breakpoint Ranks	2.49	2	.288	.30
RO Assessment by CPT Elasticity Ranks	7.33	4	.119	.37
CPT Intensity Ranks by Mean Force Ranks	1.42	2	.491	.23
CPT Breakpoint Ranks by Mean Force Ranks	1.42	2	.491	.23
CPT Elasticity Ranks by Mean Force Ranks	7.33	4	.119	.37
CPT Intensity Ranks by Peak Force Ranks	5.84	3	.119	.46
CPT Breakpoint Ranks by Peak Force Ranks	5.84	3	.119	.46
CPT Elasticity Ranks by Peak Force Ranks	10.05	6	.122	.43

Note. $n = 9$, RO = Rank Order, CPT = Commodity Purchase Task.

Table 6

Participant Demographics from Experiment II

Demographic Variable	Percentage
Sex	
Male	32.1% (9)
Female	67.8% (19)
Gender	
Female	50% (14)
Male	25% (7)
Cisgender female	7.14% (2)
Woman	7.14% (2)
Non-binary	7.14% (2)
Genderqueer	3.57%(1)
Age (Years)	
Mean	20.03
SD	1.97
Range	18, 27
Grade Point Average	
Mean	3.50
SD	0.47
Range	2.28, 4.0
Racial identity	
White	78.6% (22)
Black or African American	10.7% (3)
Asian	7.14% (2)
Multiracial	3.57% (1)
Native Hawaiian or Pacific Islander	0% (0)
First Nations or Indigenous Peoples	0% (0)
Prefer not to answer	0% (0)
Ethnicity	

Demographic Variable	Percentage
Non-Hispanic	96.43% (27)
Hispanic	3.57% (1)
Relationship Status	
Not dating, but looking	57.14% (16)
Dating one person for *more* than 6 months	28.57% (8)
Dating one person for *less* than 6 months	14.26% (4)
I do not date	0% (0)
Dating a few people	0% (0)
Prefer not to answer	0% (0)
Divorced	0% (0)
Married	0% (0)
Sexual Orientation	
Heterosexual	64.3% (18)
Bisexual	25% (7)
Pansexual	3.57% (1)
Prefer not to answer	3.57% (1)
Queer	3.57% (1)
Asexual	0% (0)
Demisexual	0% (0)
Homosexual	0% (0)

Note. Participants self-reported grade point average and gender. All other demographics were presented as multiple-choice questions.

Table 7

Results of χ2 Tests of Independence in Experiment II

Comparison	χ^2	df	*p*	*Cramér's V*
Modified RO by Mean Force Rank	13.2**	4	.010	.38
Modified RO by Peak Force Rank	13.2**	4	.010	.38
Modified RO by Stimulus Order	3.2	4	.525	.18
Stimulus Order by Mean Force Rank	5.6	4	.231	.24
Stimulus Order by Peak Force Rank	5.6	4	.231	.24

Note. RO = Rank Order Assessment, $n = 15$. * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Table 8

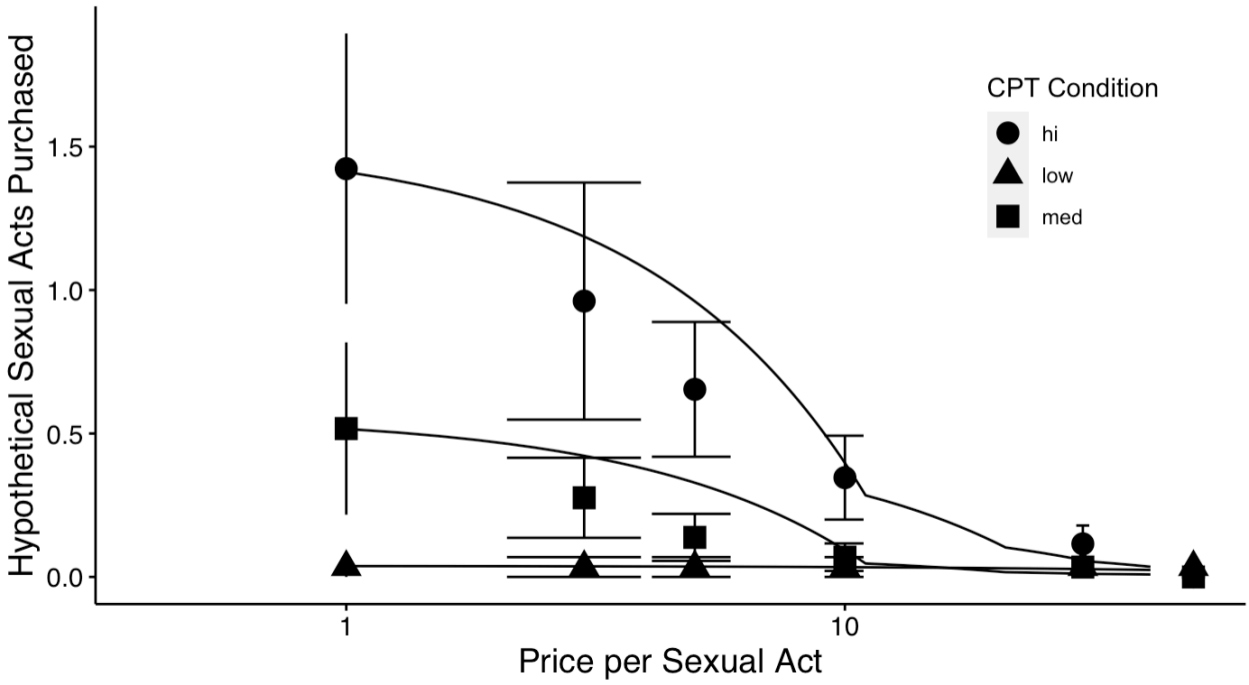
Results of χ2 Tests of Independence for CPT Ranks in Experiment II

Comparison	χ^2	df	*p*	*Cramér's V*
Modified RO by DPT Intensity Ranks	27.33**	8	.0006	.62
Modified RO by DPT Breakpoint Ranks	10.85*	4	.03	.39
Modified RO by DPT Elasticity Ranks	17.45**	4	.001	.51
Mean Force Ranks by DPT Intensity Ranks	25.74**	8	.001	.60
Mean Force Ranks by DPT Breakpoint Ranks	8.25	4	.08	.34
Mean Force Ranks DPT Elasticity Ranks	8.73	4	.068	.36
Peak Force Ranks by DPT Intensity Ranks	25.74**	8	.001	.60
Peak Force Ranks by DPT Breakpoint Ranks	8.25	4	.08	.34
Peak Force Ranks by DPT Elasticity Ranks	8.73	4	.068	.36
Stimulus Order by DPT Intensity Ranks	10.05	8	.261	.37
Stimulus Order by DPT Breakpoint Ranks	6.75	4	.15	.30
Stimulus Order by DPT Elasticity Ranks	6	4	.20	.30

Note. DPT= Date Purchasing Task, $n = 12$. * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Figure 1

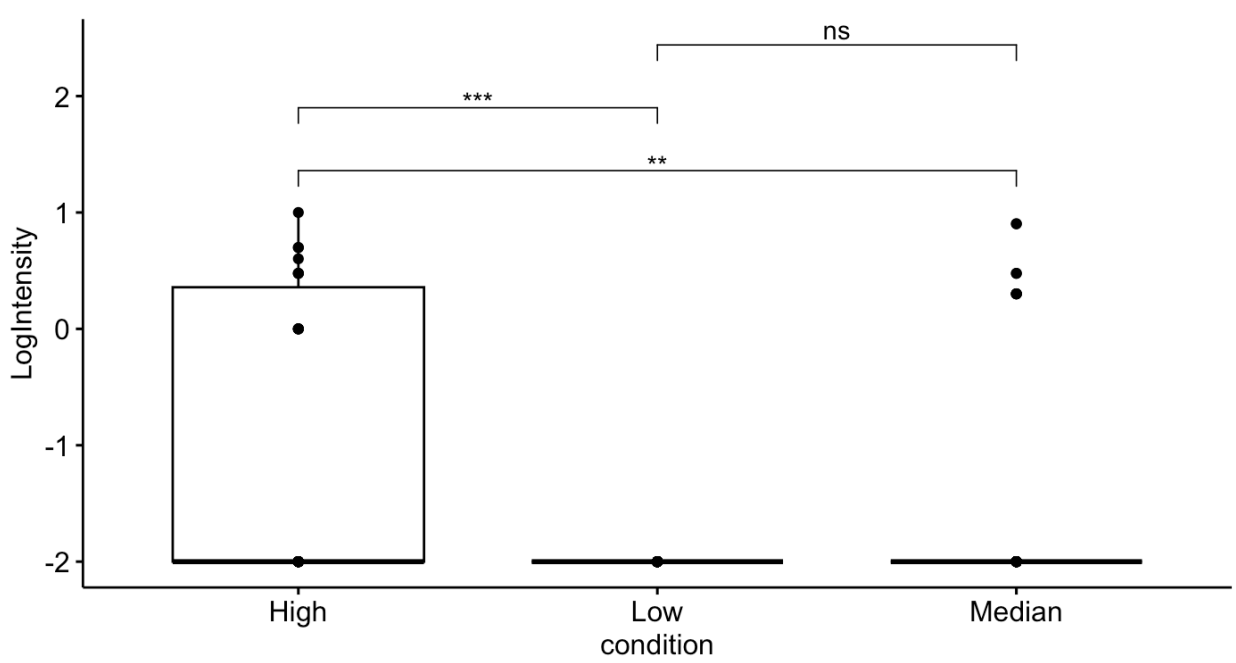
Demand Across Commodity Purchase Task Conditions in Experiment I



Note. CPT = Commodity Purchase Task, Hi = High preferred, Med = Median preferred, Low = Low preferred. n = 26.

Figure 2

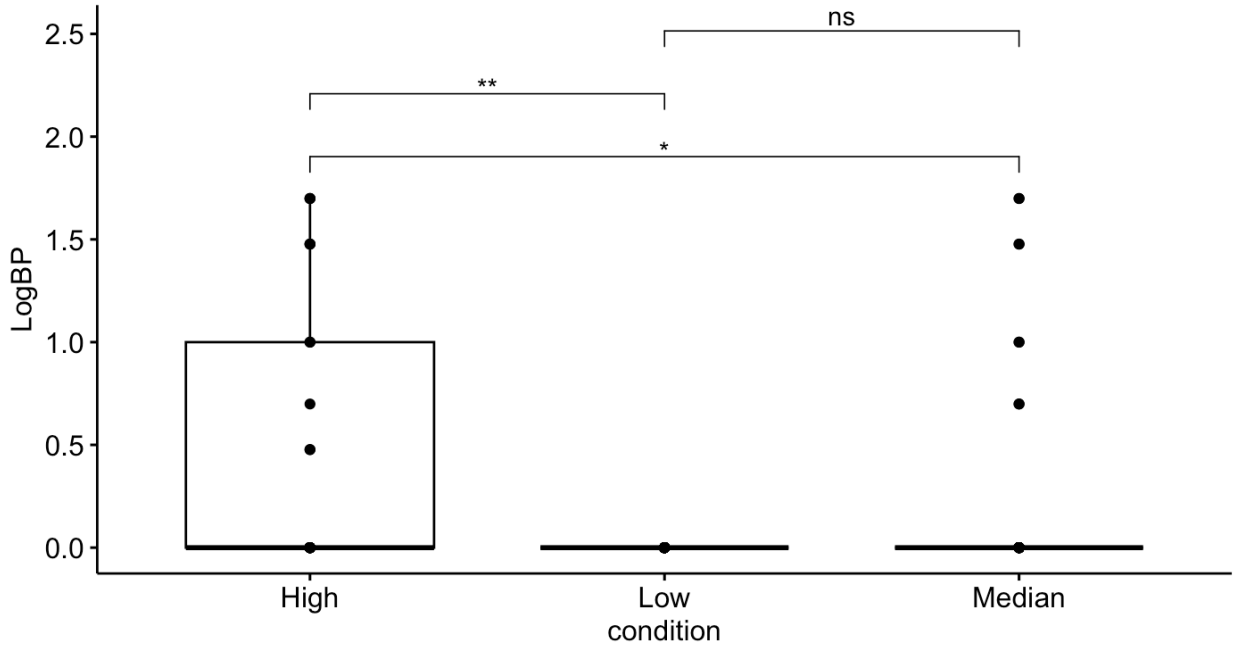
Box Plot of Intensity Values Across Commodity Purchase Task Conditions in Experiment I



Note. n = 26. Error bars indicate standard deviations. CPT = Commodity Purchase Task, * = p<.05, ** = p < .01, *** = p<.001, ns = not significant.

Figure 3

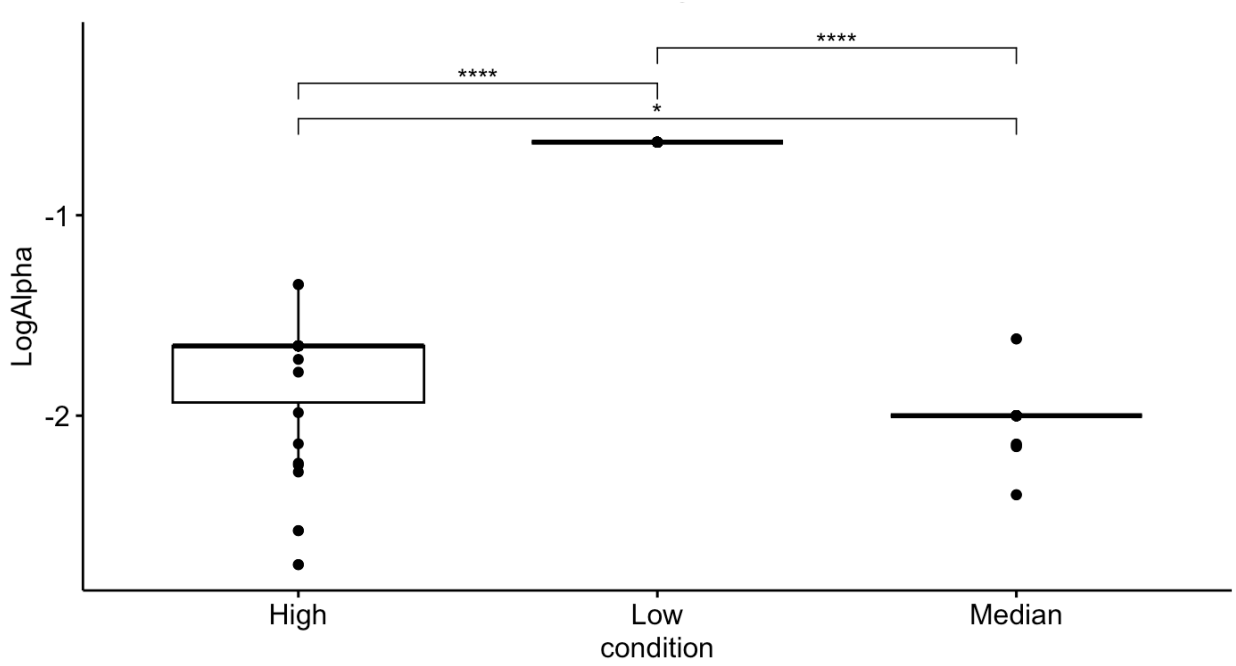
Box Plot of Breakpoint Values Across Commodity Purchase Task Conditions in Experiment I



Note. n = 26. Error bars indicate standard deviations. CPT = Commodity Purchase Task, * = p<.05, ** = p < .01, *** = p<.001, ns = not significant.

Figure 4

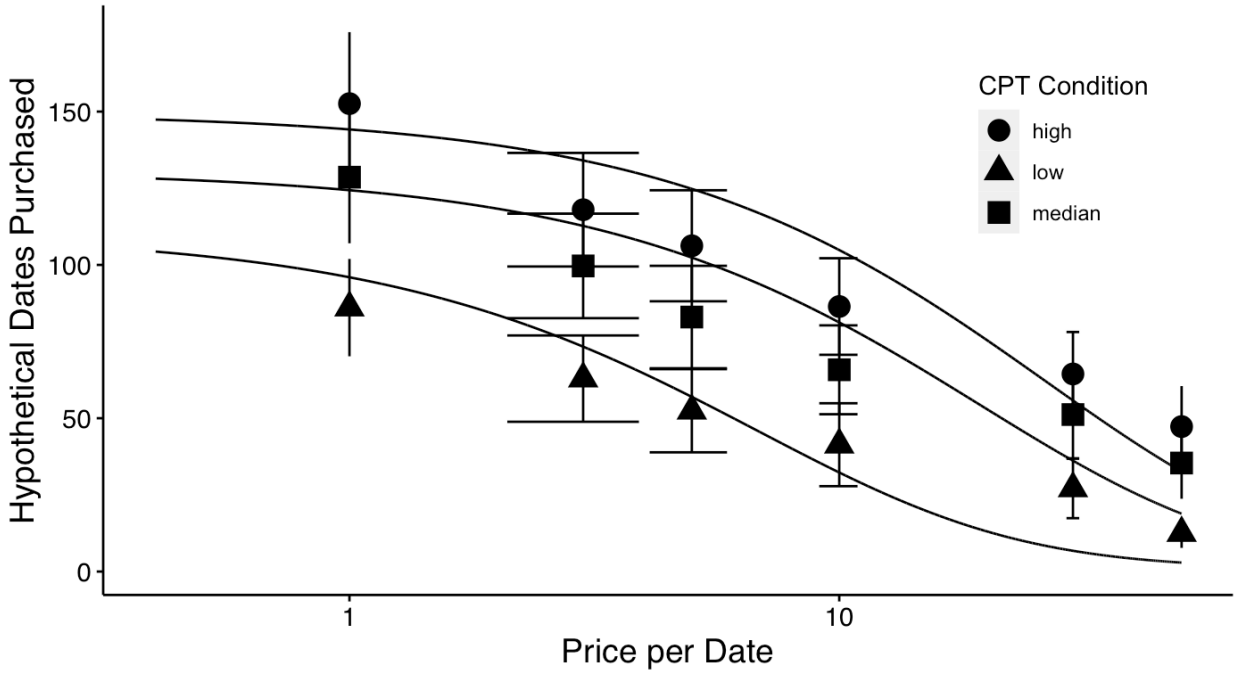
Box Plot of Elasticity Values Across Commodity Purchase Task Conditions in Experiment I



Note. n = 26. Error bars indicate standard deviations. CPT = Commodity Purchase Task, * = p<.05, ** = p < .01, **** = p<.001, ns = not significant.

Figure 5

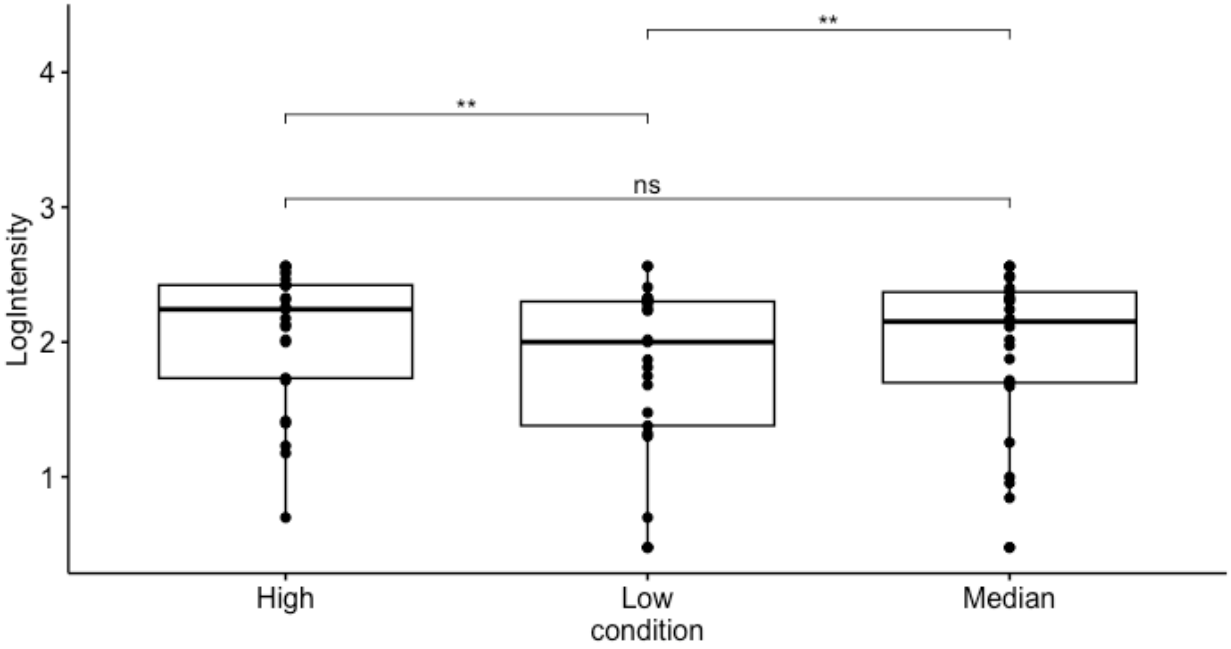
Demand Across Commodity Purchase Task Conditions in Experiment II



Note. n = 25. CPT = Commodity Purchase Task, High = High preferred, Med = Median preferred, Low = Low preferred. n = 25.

Figure 6

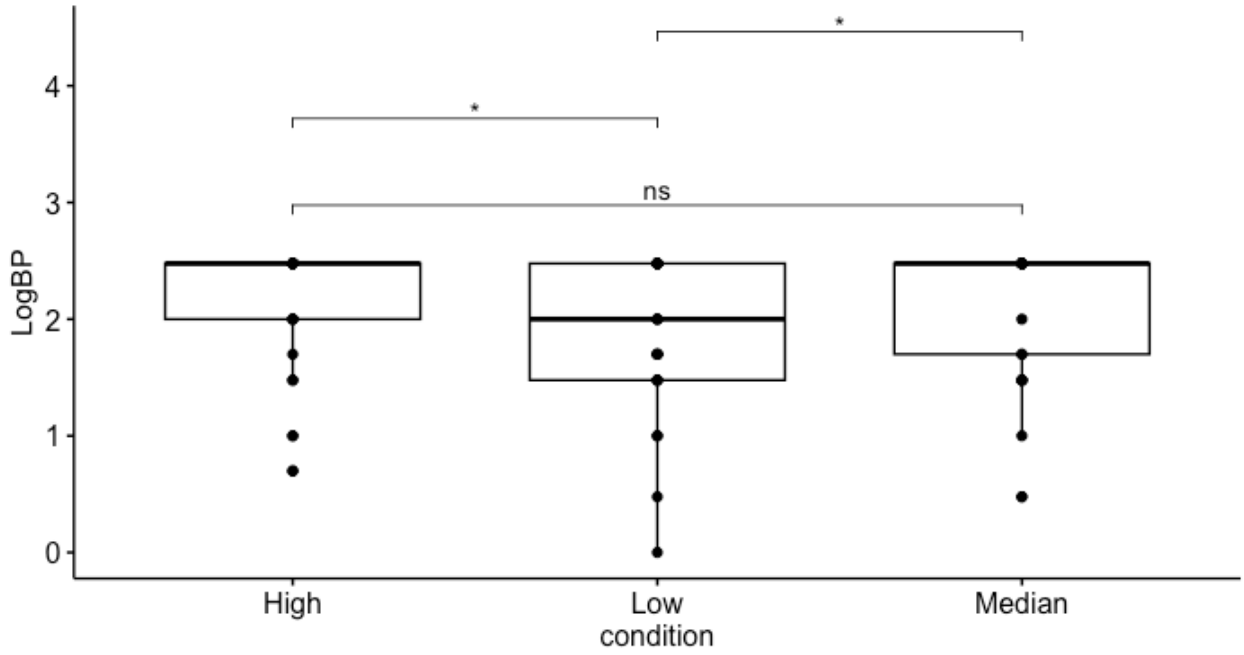
Box Plot of Intensity Values Across Commodity Purchase Task Conditions in Experiment II



Note. $n = 25$. Error bars indicate standard deviations. ** = $p < .01$, ns = not significant.

Figure 7

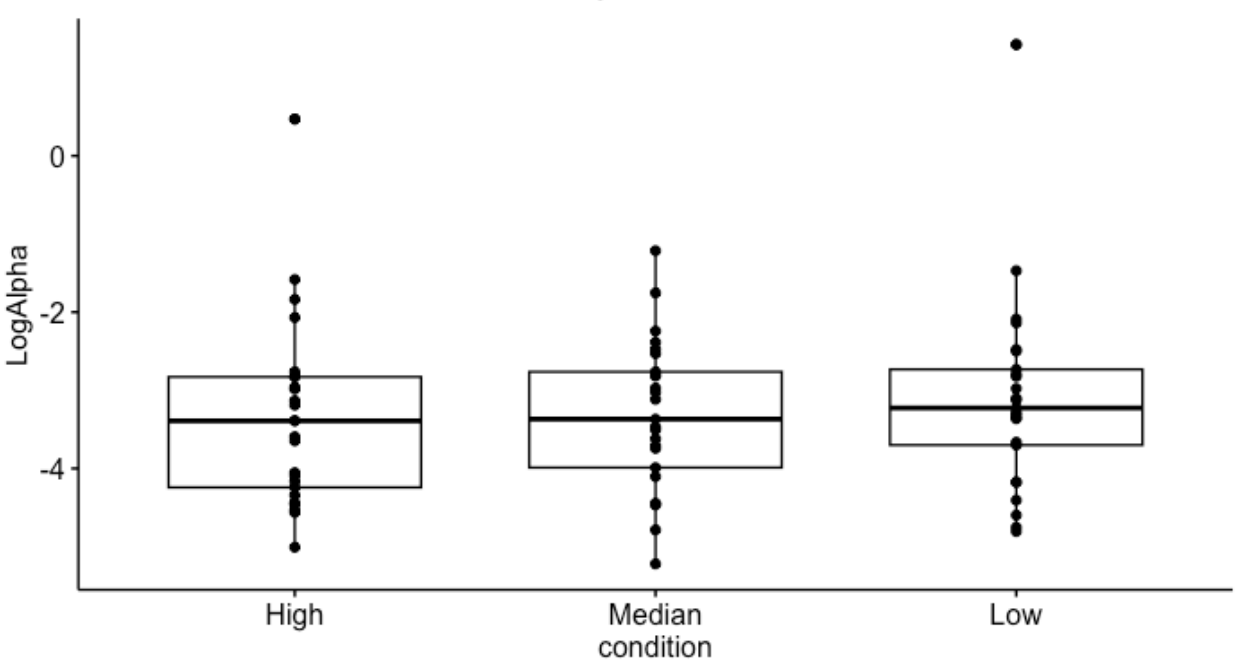
Box Plot of Breakpoint Values Across Commodity Purchase Task Conditions in Experiment II



Note. $n = 25$. Error bars indicate standard deviations. * = $p < .05$, ns = not significant.

Figure 8

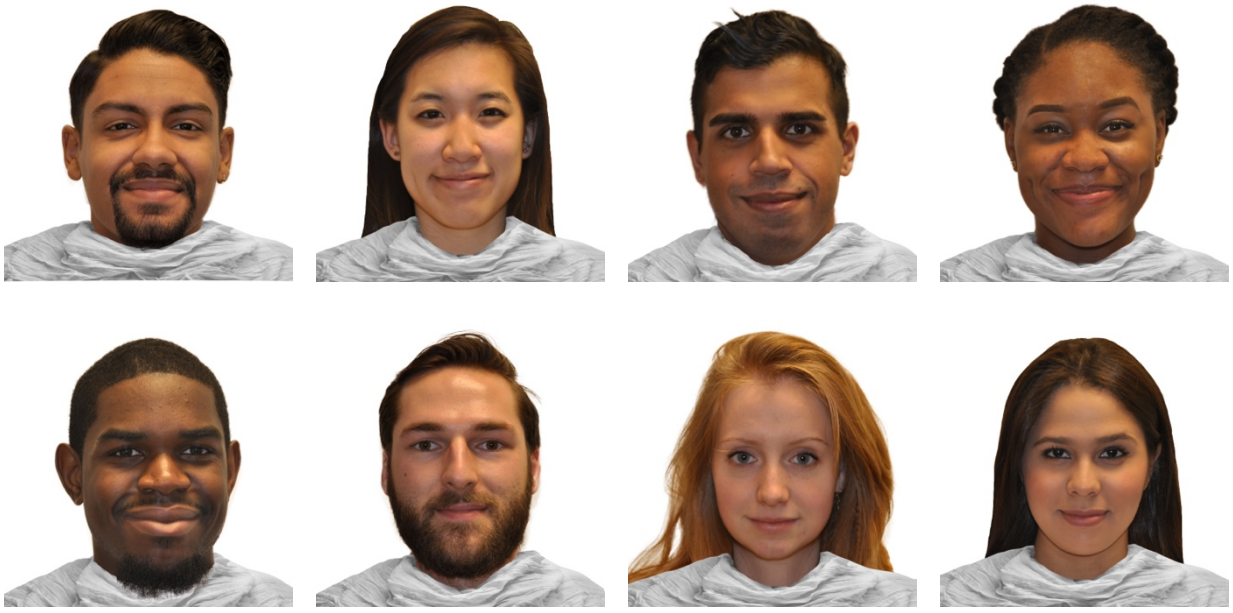
Box Plot of Elasticity Values Across Commodity Purchase Task Conditions in Experiment II



Note. n = 25. Error bars indicate standard deviations.

Appendix A

Stimuli Selected from the RADIATE Stimulus Set used in Experiment I



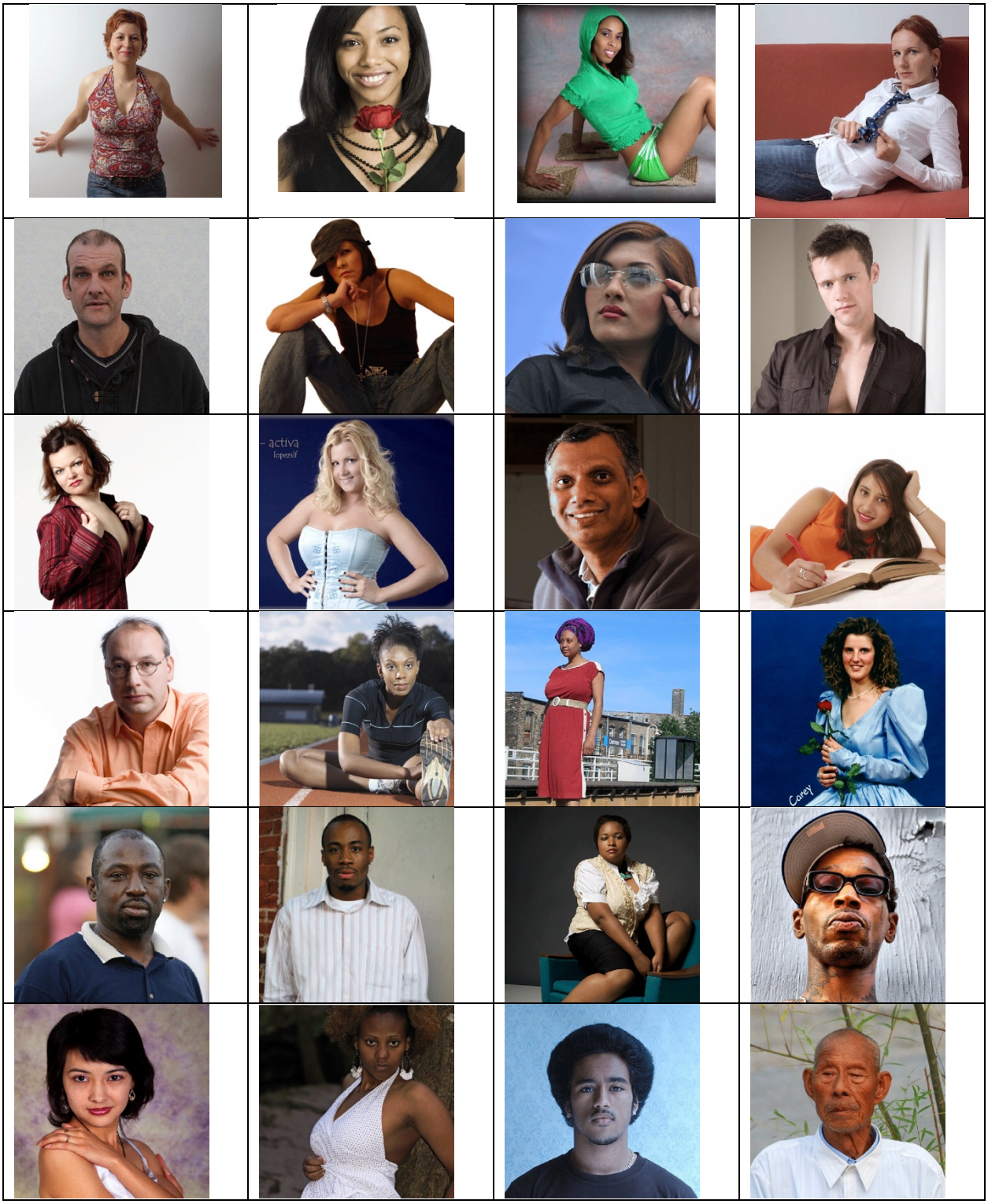
Appendix B

Commodity Purchasing Task

1. How many times would you have sex with this person, beginning today, if each sex act cost $1?
2. How many times would you have sex with this person, beginning today, if each sex act cost $3?
3. How many times would you have sex with this person, beginning today, if each sex act cost $5?
4. How many times would you have sex with this person, beginning today, if each sex act cost $10?
5. How many times would you have sex with this person, beginning today, if each sex act cost $30?
6. How many times would you have sex with this person, beginning today, if each sex act cost $50?
7. How many times would you have sex with this person, beginning today, if each sex act cost $100?
8. How many times would you have sex with this person, beginning today, if each sex act cost $300?
9. How many times would you have sex with this person, beginning today, if each sex act cost $500?
10. How many times would you have sex with this person, beginning today, if each sex act cost $1,000?
11. How many times would you have sex with this person, beginning today, if each sex act cost $3,000?
12. How many times would you have sex with this person, beginning today, if each sex act cost $5,000?
13. How many times would you have sex with this person, beginning today, if each sex act cost $10,000?
14. How many times would you have sex with this person, beginning today, if each sex act cost $30,000?
15. How many times would you have sex with this person, beginning today, if each sex act cost $50,000?
16. How many times would you have sex with this person, beginning today, if each sex act cost $100,000?
17. How many times would you have sex with this person, beginning today, if each sex act cost $300,000?
18. How many times would you have sex with this person, beginning today, if each sex act cost $500,000?
19. How many times would you have sex with this person, beginning today, if each sex act cost $1,000,000?

Appendix C

Stimuli used in Experiment II



Appendix D

Date Purchasing Task

Instructions: In the questions that follow we would like you to pretend that the person in the photograph wants to date you on a regular basis. Neither of you are currently in a relationship. However, even though you can go on dates with this person whenever you want, you must always purchase a date first. In the questions that follow, you will be asked to purchase individual dates (daytime, nighttime, weekdays, weekends) for the upcoming year. Please answer the questions honestly and thoughtfully. Pretend that this is the only opportunity go on dates that is available to you. You cannot date anyone else except for the dates you choose to purchase in the following questions. Also assume you have no other potential dating partners. In other words, if you want to go on a date at any time during the course of the upcoming year, you must do so only on dates that you purchase today. Prices for the dates you may buy are listed below. You may buy as many as 365 dates (1 years' worth) or as few as 0 dates. Also, assume that the dates you are about to purchase are for your personal use only for dating the photographed individual. The dates cannot be used for any other reasons. You can't sell the dates or give them to anyone else to use for any reason. All of the dates you buy are, therefore, for your own personal, dating use with the photographed individual within the year. Below is a list of various prices for the dates. In the space provided please indicate how many of these dates you would purchase at each of the prices listed in the column on the left. Please complete the entire table. If you wouldn't purchase any dates at a particular price, please put "0." Remember, only buy dates you would personally use over the next year. If you have any questions, please ask us for help.

How many times would you date this person, over the course of the next year, if each date cost:

Price	**Number of Dates**
$0	
$1	
$3	
$5	
$10	
$30	
$50	
$100	
$300	