

## ASSESSING CORRESPONDENCE BETWEEN RESPONDING IN A DEMAND TASK AND CONJUGATE PREPARATION FOR ROMANTIC PARTNERS

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Transmission of sexually transmitted infections may be attributed to risky health behaviors such as sex without a condom. Behavior-analytic and economic paradigms have been used to assay sexual demand and sexual health decision-making. 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 translational study was to evaluate demand for hypothetical romantic partners. Participants completed a rank order preference assessment using images of potential romantic partners and then completed purchasing tasks for their high, moderate, and low preferred partner. Then, participants completed a conjugate assessment in which images on screen increased in clarity only when increasing forces were applied to a hand dynamometer. Researchers evaluated correspondence between responding in (a) the purchasing task and (b) the conjugate assessment. Findings indicated significant differences in responding based on preference and strong correspondence between the two assessments.

**Keywords:** conjugate preparation, purchasing task, translational science

Each year in the United States (US), 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 and these pathogens are passed between individuals who have made sexual contact (WHO, 2023a). 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, causing stillbirth, neonatal conjunctivitis, and congenital deformities (WHO, 2023a).

Broadly, transmission of STIs may be attributed to risky sexual health behaviors such as sex without a condom and engagement in multiple transient sexual relationships, among others (WHO, 2023a). These risky behaviors warrant further investigation to better understand underlying mechanisms and to develop evidence-based interventions. One useful framework for studying sexual health behaviors is behavioral economics.

To evaluate behavioral demand, behavioral scientists often use commodity purchase tasks (CPTs), first developed by Jacobs and Bickel (1999). Based on participant responding, CPTs allow researchers to model demand and evaluate several important

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features of behavioral demand, including: intensity, breakpoint, and derived  $\alpha$ . These demand metrics are described in Table 1 of Edgemon et al. (2025, p. 60). CPTs have been used to evaluate a variety of commodities across a variety of clinical populations, including sexual health behaviors, because they are effective when logistical or ethical limits preclude traditional methods and are conceptually systematic.

For example, Jarmolowicz et al. (2016) evaluated correspondence between a multiple stimulus without replacement (MSWO; DeLeon & Iwata, 1996) preference assessment and CPTs among undergraduates at a large university. First, they completed an MSWO with 16 images (head and face only) of individuals with whom they would like to have sex. Then, they were presented with three CPTs, one each for their high, moderate, 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 with greatest demand displayed in the condition with the highly preferred partner. Importantly, Jarmolowicz et al. noted the accuracy of responding may have been influenced by implying hypothetical engagement in sex work, a behavior that is illegal throughout the US. Since then, other researchers have developed and evaluated sexual health behaviors using CPTs which avoid implied hypothetical illegal behavior.

Dolan and colleagues (2020) evaluated a CPT for a hotel room among adults. In their study, participants were first presented with an array of 60 color photographs of diverse, clothed people 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. 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. Dolan et al. 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. Similar to Jarmolowicz et al. (2016), Dolan et al. found significant differences in demand metrics based on preference, among other findings.

Importantly, the authors noted this hotel purchase task was unique in that it allowed for evaluation of sexual health behavior without implying hypothetical engagement in sex work.

Jarmolowicz et al. (2016) noted that behavioral paradigms of risky sexual health behavior 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). In addition, Jarmolowicz et al. noted excessive demand of a commodity of interest, such as sexual encounters, may be indicative of maladaptive behavior. Thus, individuals who display excessive demand in CPTs evaluating sexual behavior may be at risk of developing other risky sexual health behaviors. This extreme valuation of sex as a reinforcer may be similar to preference for extreme forms of stimulation.

### Schedules of Covariation

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 (1992) described three types of schedules of covariation: (a) correlated, (b) synchronous, and (c) conjugate (see Edgemon et al. [in press] for a review). 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).

Some studies have conceptualized conjugate preparations as a form of reinforcer assessment (Cook et al., 2024; Davis et al., 2021; Sheridan et al., 2024) based on significant correspondence between responding on preference assessments and responding on conjugate preparations. Said differently, as response requirement increases, participants engage in increasing levels of force exertion to maintain access to preferred stimuli. Moreover, these results have been replicated across visual and auditory stimuli.

Although different in topography, preparations using conjugate schedules 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 because the study was conducted in a geographic location in which purchasing sexual acts was illegal. By contrast, conjugate preparations neither require previous experience nor 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 histories.

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 behaviors. This is an important consideration because risky sexual health behavior 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 non-discrete, continuous events.

### **Purpose and Hypotheses**

The present study sought to replicate and extend previous research evaluating demand for hypothetical romantic partners. 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 dates they would purchase at ascending prices. Then, participant responding was evaluated using a conjugate assessment. The purpose was to determine if demand, as measured by the CPT, corresponded to the rank order of force participants exerted in the conjugate assessment.

Consistent with findings from Davis et al. (2021), Jarmolowicz et al. (2016), and Sheridan et al. (2024), we hypothesized:

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

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

(c) Hypothesis 3: Demand metrics would correspond to rank order of force exerted in the conjugate assessment such that participants demonstrate greatest demand and highest rank order of force for the high preferred partner.

## **METHOD**

### **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 assessment 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, we 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, and physical appearance. Specifically, these images vary in the positions, backgrounds, and clothing of individuals.

### **Data Collection and Response Measurement**

#### ***Rank Order Preference Assessment***

First, using Qualtrics, participants were instructed to complete a demographics questionnaire and a modified rank order preference assessment. 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 click to select images. Following image selection, participants were presented with selected images and asked to indicate who they: (a) most wanted to have sex with, (b) might have sex with, and (c) least wanted to have sex with. Participants could sort the same image into (a), (b), and (c) if they so chose, but this did not occur.

### **Date Purchasing Task**

Next, participants completed a date purchasing task (DPT) on Qualtrics. This modified purchasing task was adapted from the hotel purchase task described by Dolan et al. (2020). This task first presented the following vignette on-screen:

*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 date purchasing task for the following conditions: (a) high preferred (i.e., the person they most wanted to have sex with), (b) moderate 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. Participants completed three date purchasing tasks in total and the order of tasks was randomized. The prices for date purchasing tasks used were \$0, \$1, \$3, \$5, \$10, \$30, \$50, \$100, \$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 \_\_\_?"

### **Conjugate Assessment**

Finally, participants completed the conjugate assessment (Davis et al., 2021; Sheridan et al., 2024). 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. 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., 2024; Davis et al., 2021; Sheridan et al., 2024).

At the start of the session, 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?*

Sheridan et al. (2024) indicated a vague verbal S<sup>D</sup> may have contributed to a large number of undifferentiated responding. Thus, we used a more specific verbal S<sup>D</sup> as described above. During three trials of the experimental task, participants were presented with images on a computer screen of their high, moderate, and low preferred partners based on their responding in the rank order assessment. The order of pictures (i.e., trials) was randomized across participants.

Each second of the experimental task, the software used force recordings to determine the percentage of clarity of the image. If the

**Table 1**

*Graph Categorization via Visual Inspection*

Correspondence Category	Definition	Percentage
HP and LP	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.	26.67% (4)
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.	26.67% (4)
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	13.3% (2)
Decreasing Trend	Responding in which mean force decreased across at least two of three stimuli in order of stimulus presentation.	13.3% (2)
Nonresponse	Responding in which peak force does not exceed 0.5 kg for any stimulus	0% (0)
Undifferentiated	Responding in which there were no discernible relations between responding on the RO assessment and responding in the conjugate preparation.	20% (3)

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

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 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<sup>1</sup>. Participants repeated this process across three trials in random order: (a) high preferred (i.e., the person they most wanted to have sex with), (b) moderate 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.

## Analytical Plan

### *Date Purchasing Task*

Data were processed and screened for nonsystematic responding using beezdemand (v0.1.0; Kaplan et al., 2019) in RStudio (Version 1.4.1717). The first author (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. The researcher evaluated demand using (a) observed intensity, (b) derived  $\alpha$ , and (c) observed breakpoint. To correct for skew in distribution, demand values were log-transformed prior to analyses. To allow for consistent interpretation of  $\alpha$ , the default method for calculating  $k$  was used wherein  $k$  is calculated as the difference in logarithmic units between the maximum and minimum values of consumption (see Kaplan et al., 2019). The first author conducted repeated measures ANOVAs to compare the effect of date purchasing task condition on demand indices (i.e., intensity, breakpoint, and  $\alpha$ ). This is considered a two-stage approach (Kaplan et al., 2021).

### *Rank Order Assessment and Conjugate Assessment*

<sup>1</sup> Please see Figure 1 in Sheridan et al. (2024) for an illustration of changing forcing requirements

**Table 2**

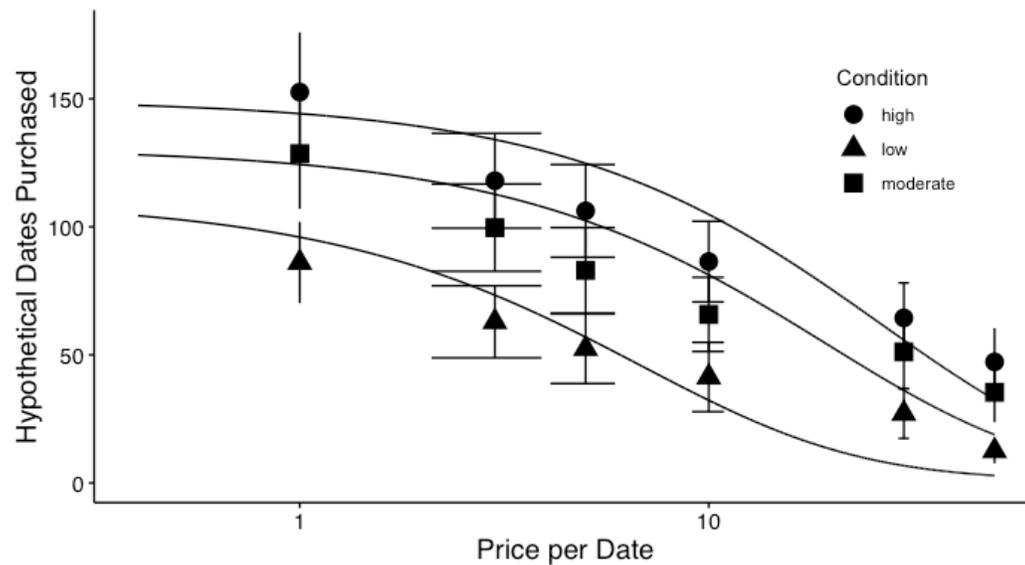
### *Participant Demographics*

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	
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

To evaluate correspondence between responding on the rank order assessment and responding in the conjugate assessment, the first author conducted statistical analysis. In addition, we provide visual analysis to

in a given trial with active and passive responding.

**Figure 1***Demand Across Date Purchase Task Conditions*

*Note.* Comparison of demand across Date Purchase Task conditions. Bars represent standard error of the mean.

High = High preferred, Moderate = Moderately preferred, Low = Low preferred.  $n = 25$ .

supplement statistical analysis. First, the first author conducted  $\chi^2$  Tests of Independence to evaluate the correspondence between participants' responding on the rank order assessment and the conjugate assessment. Then, to ensure this finding was not due to stimulus presentation order, the researcher conducted  $\chi^2$  Tests of Independence to evaluate the association between stimulus presentation order and mean and peak force rank order.

Finally, the researcher created graphs for each participant displaying (a) rank order assessment data, (b) mean force ranks from the conjugate assessment, and (c) stimulus presentation order in the conjugate assessment. Based on visual inspection, the researcher categorized participants' responding based on response categories developed by Davis et al. (2021) and repeated

by Cook et al. (2024) and Sheridan et al. (2024). See Table 1 for descriptions of each category.

### **Purchasing Task and Conjugate Assessment**

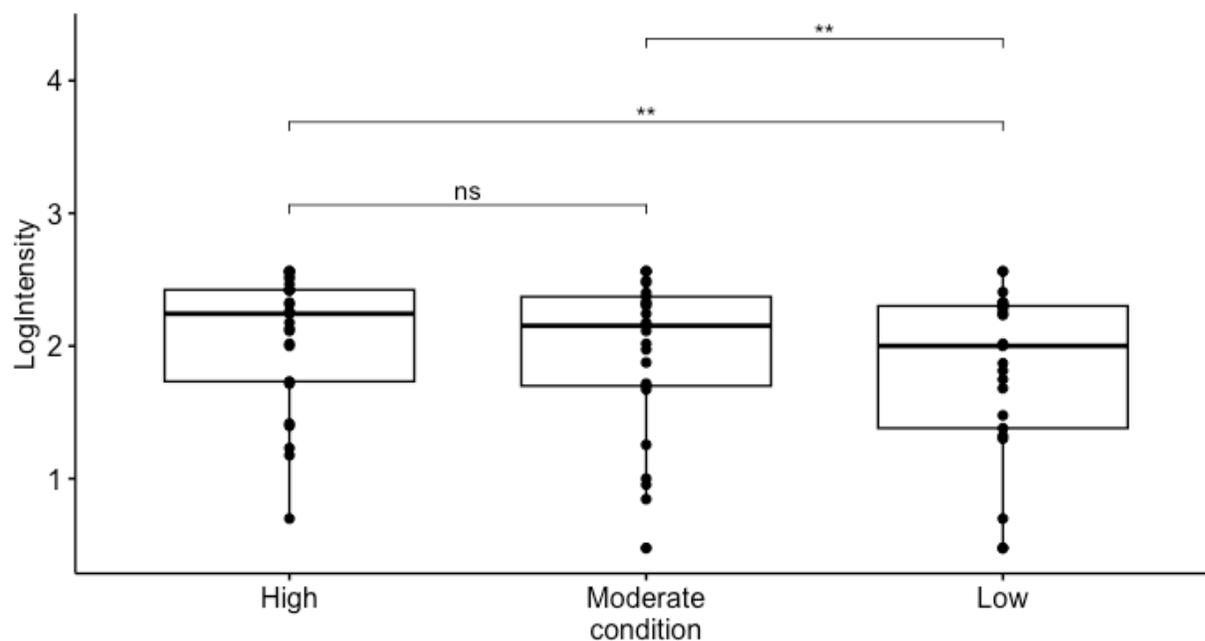
To evaluate the third hypothesis (i.e., demand metrics would correlate with force exerted in the conjugate assessment), the first author conducted  $\chi^2$  Tests of Independence with participant responding in the date purchasing tasks and conjugate assessment.

## **RESULTS**

We recruited 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 rank order assessment. That is, when instructed to select pictures of

**Figure 2**

*Box Plot of Intensity Values Across Commodity Purchase Task Conditions*



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

individuals with whom the participant would have sex, these participants selected fewer than three images. Thus, their responding on the subsequent date purchasing tasks and conjugate assessment was not compatible with the analyses. All subsequent analyses are based on data for the remaining 28 participants. Table 2 displays demographic data for these participants. The majority of participants identified as female, heterosexual, White, and non-Hispanic.

### **Correspondence Between Preference Assessment and Purchasing Task**

From the 28 participants, we included 25 winsorized datasets in the analysis for the high, moderate, and low preferred date purchasing task conditions. Data for two participants were excluded due to bounce (i.e., excessive price-to-price increases in consumption despite an overall decreasing trend in consumption) and data for one participant was excluded due to reversal from zero (i.e., the participant discontinued consumption at one price and resumed consumption at a higher price). These demand

curves are depicted graphically in Figure 1. The exponentiated equation provided good fit for data in the high preferred condition ( $M = 0.92$ ,  $m = .94$ , range: 0.41 – 0.99), moderate preferred condition ( $M = 0.79$ ,  $m = .96$ , range: 0.76 – 0.99), and low preferred condition ( $M = 0.92$ ,  $m = .97$ , range: 0.62 – 0.99).

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 moderate preferred condition ( $M = 1.94$ ,  $S^D = 0.60$ ) and the high preferred condition ( $M = 2.05$ ,  $S^D = 0.51$ ). The mean value of intensity was significantly different between the low preferred condition ( $M = 1.78$ ,  $S^D = 0.67$ ) and the high preferred condition ( $p < 0.01$ ). There was also a significant difference between the moderate preferred and low preferred conditions ( $p < .01$ ). 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,  $F(2, 48) = 7.827, p < .01, \eta^2 = 0.04$ . A post-hoc Bonferroni Test for pairwise comparisons found that the mean value of breakpoint was not significantly different between the moderate preferred condition ( $M = 2.10, S^D = 0.58$ ) and the high preferred condition ( $M = 2.17, S^D = 0.51$ ). The mean value of breakpoint was significantly different between the low preferred condition ( $M = 1.88, S^D = 0.7$ ) and the high preferred condition ( $p < .05$ ). There was also a significant difference between the mean value of breakpoint between the moderate preferred condition and the low preferred condition ( $p < .05$ ). Results of this analysis are depicted graphically in Figure 3.

The third repeated measures ANOVA indicated there was no significant difference in  $\alpha$  between conditions,  $F(2, 48) = 0.833, p = .39$ . Results of this analysis are depicted graphically in Figure 4. Overall, these findings comport with Jarmolowicz et al. (2016) insofar as participants demonstrated differential responding in purchasing tasks based on preference.

**Correspondence Between Preference Assessment and Purchasing Task**

**Table 3**

*Results of  $\chi^2$  Tests of Independence*

Comparison	$\chi^2$	df	p	Cramér's V
RO by Mean Force Rank	13.2**	4	.010	.38
RO by Peak Force Rank	13.2**	4	.010	.38
RO by Stimulus Order	3.2	4	.525	NA
Stimulus Order by Mean Force Rank	5.6	4	.231	NA
Stimulus Order by Peak Force Rank	5.6	4	.231	NA

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

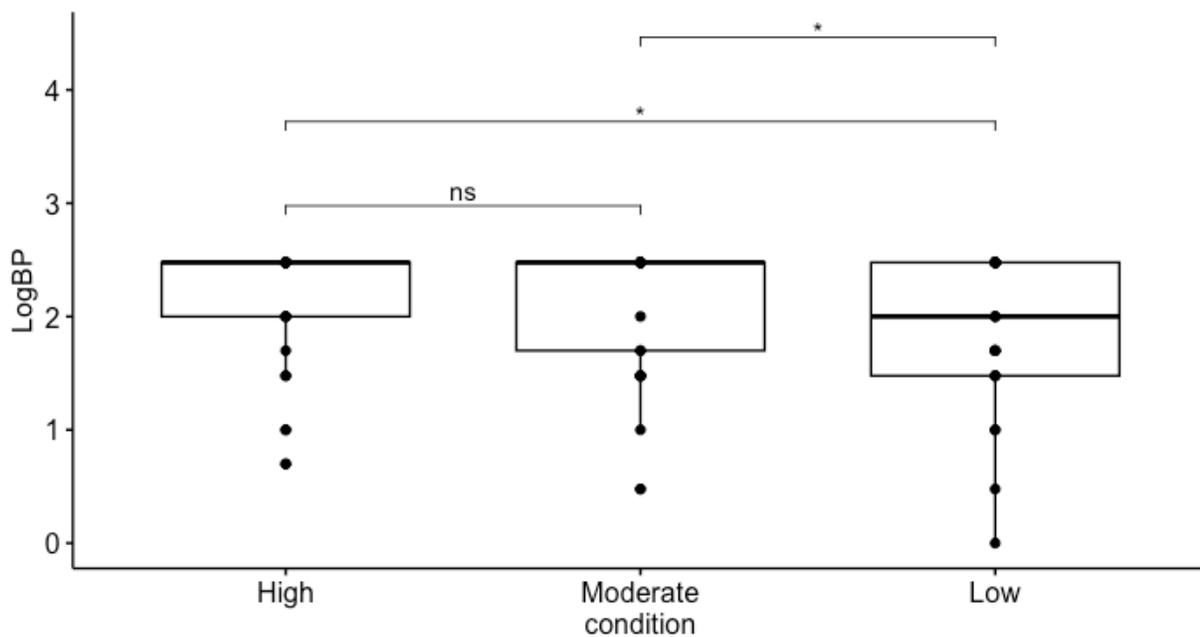
Due to repeated software and hardware malfunctions, only 15 participants completed the conjugate assessment.

**Statistical Analysis**

Results of statistical analyses are depicted in Table 3. In the first omnibus  $\chi^2$  Test of Independence, there was a significant association between responding on the rank order assessment and mean force rank order ( $p = .010$ ). Post hoc analysis revealed a significant

**Figure 3**

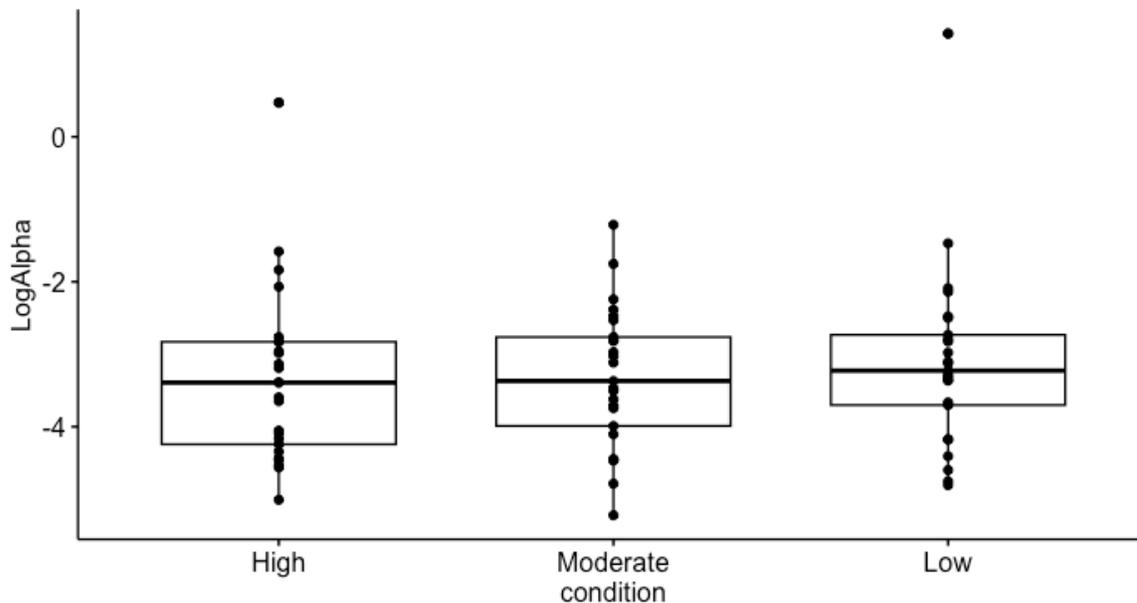
*Box Plot of Breakpoint Values Across Commodity Purchase Task Conditions*



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

**Figure 4**

*Box Plot of  $\alpha$  Values Across Commodity Purchase Task Conditions*



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

correspondence between assessments for stimuli identified as high preferred (i.e., the lowest rank order rank and the lowest mean force). In the second omnibus  $\chi^2$  Test of Independence, there was a significant association between responding on the rank order assessment and peak force rank order ( $p = .010$ ). Similarly, post hoc analysis revealed significant correspondence between assessments for stimuli identified as high preferred. Again, this indicates correspondence between the lowest rank order rank and the lowest peak force rank.

Results indicated there were no significant associations between mean nor peak force ranks and the stimulus presentation order. In addition, there was no association between participant responding on the rank order assessment and stimulus presentation order. These results reproduce findings from Sheridan et al. (2024).

#### *Visual Analysis of Individual Participant Data*

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. Notably, this visual analysis suggests there was high correspondence between responding on the rank order assessment and mean force rank for highly preferred stimuli for 53.34% of participants. This might be considered an HP Inclusive category. Similarly, there was high correspondence between responding in the rank order assessment and mean force rank for low preferred stimuli for 40% of participants. This might be considered an LP Inclusive category. These findings comport with previous studies (Cook et al., 2024; Davis et al., 2021; Sheridan et al., 2024) indicating responding on these two preparations tends to correspond most closely among HP or LP stimuli.

### Correspondence Between Purchasing Task and Conjugate Assessment

Of the 15 participants who completed the conjugate assessment, three demonstrated nonsystematic responding in the date purchasing tasks and were thus excluded from analyses involving demand metrics. Thus, these analyses include data for 12 participants who (a) completed the conjugate assessment

**Table 4**

*Results of  $\chi^2$  Tests of Independence for Date Purchasing Task Ranks*

Comparison	$\chi^2$	df	<i>p</i>	Cramér's <i>V</i>
RO by DPT Intensity Ranks	27.33**	8	.0006	.62
RO by DPT Breakpoint Ranks	10.85*	4	.03	.39
RO by DPT $\alpha$ 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	NA
Mean Force Ranks by DPT $\alpha$ Ranks	8.73	4	.068	NA
Peak Force Ranks by DPT Intensity Ranks	25.74**	8	.001	.60
Peak Force Ranks by DPT Breakpoint Ranks	8.25	4	.08	NA
Peak Force Ranks by DPT $\alpha$ Ranks	8.73	4	.068	NA
Stimulus Order by DPT Intensity Ranks	10.05	8	.261	NA
Stimulus Order by DPT Breakpoint Ranks	6.75	4	.15	NA
Stimulus Order by DPT $\alpha$ Ranks	6	4	.20	NA

*Note.* RO = Rank order preference assessment. DPT= Date Purchasing Task. *n* = 12. \* = *p* < .05, \*\* = *p* < .01, \*\*\* = *p* < .001. Tied observations were given the average of the ranks they would have received as if no ranks were tied. This produced differences in the number of comparisons made across each  $\chi^2$  test and, subsequently, differences in degrees of freedom.

and (b) demonstrated systematic responding in the date purchasing tasks.

### Statistical Analysis

Results of statistical analyses are depicted in Table 4. First, the researcher conducted  $\chi^2$  Tests of Independence to evaluate the association between participant responding on the rank order assessment and in the date purchasing task. Results indicate there were significant associations between rank order assessment ranks and date purchasing task (a) intensity ranks, (b) breakpoint ranks, and (c)  $\alpha$  ranks. These findings corroborate the results of the repeated measures ANOVAs used to compare responding on the rank order assessment to responding in the date purchasing tasks.

Second, the researcher conducted  $\chi^2$  Tests of Independence to evaluate associations between participants' responding on the date purchasing task and mean force ranks. There was a significant positive association between mean force ranks and date purchasing task intensity ranks. Third, the researcher conducted a  $\chi^2$  Tests of Independence to evaluate associations between participants' responding on the date purchasing tasks and peak force ranks. Again, there was a significant association between peak force ranks and date purchasing tasks intensity ranks.

Taken together, the positive associations between mean and peak force ranks for DPT intensity and  $\alpha$  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 date purchasing task demand metrics. There were no significant associations.

### DISCUSSION

The purpose of this translational study was to evaluate demand and preference for romantic partners using commodity purchasing tasks by comparing these results with a conjugate assessment. To our knowledge, this is the first study to compare responding on a commodity purchasing task to responding in a conjugate assessment. In addition, our findings replicated and extended previous research. That is, in the date purchasing tasks, participants demonstrated differential

demand based on preference (i.e., replication of Dolan et al., 2020 and Jarmolowicz et al., 2016) and force exerted in the conjugate assessment corresponded with preference (i.e., replication of Cook et al., 2024; Davis et al., 2021; and Sheridan et al. 2024). These findings suggest that for high and medium preferred partners, participant responding indicated high levels of demand for lower price dates. However, there was no difference in price sensitivity across partner preference. In addition, our findings indicated participant responding in the conjugate assessment corresponded with responding on the date purchasing tasks on two demand metrics (i.e., intensity and  $\alpha$ ).

Taken together, findings from this study improve the clinical utility of preparations using conjugate schedules in at least four ways. First, findings from the present study further extend the generality of preference and reinforcer assessment frameworks to romantic partners. Jarmolowicz et al. (2016) used responding on purchasing tasks to validate the use of an MSWO preference assessment for evaluating preferred sexual partners. Rapp (2008) also suggested conjugate schedules may be useful for assessing stimulus preference using active responding as compared to traditional preference assessment methods, which only require a selection response (i.e., passive responding). By contrast, preparations using conjugate schedules require the individual to emit continuous responding, especially when a progressive schedule is added.

Previous studies evaluating correspondence between traditional preference assessment methods and conjugate assessments indicated strong correspondence between the two assessment methods, especially for high preferred stimuli (e.g., Cook et al., 2024; Davis et al., 2021; Falligant et al., 2018, 2020; Sheridan et al., 2024). However, no previous research has demonstrated this correspondence in the explicit context of physical attraction. Findings from this study support (a) the need for explicit instruction to ensure appropriate stimulus control and (b) the use of conjugate assessments 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 schedules, context matters (Sheridan et al., 2025). Future research should continue to

evaluate the clinical utility of preparations using schedules of covariation and the effect of context on participant responding.

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 a commodity may covary with maladaptive behavior, such as risky sexual health behaviors (Jarmolowicz et al., 2015). Jarmolowicz et al. (2016) suggested individuals who demonstrate high demand for moderate preferred sexual partners may be at greater risk of developing risky sexual health behaviors later. Thus, findings from the present study may support the use of conjugate preparations to identify responding consistent with risky sexual health behaviors, such as high force exerted to view the picture of the moderate preferred partner. Indeed, findings from the present study indicated there was no significant difference between participant responding in the high versus moderate preferred partner conditions in the date purchasing task. Future research should evaluate correspondence between responding on preparations using schedules of covariation and responding on validated assessments of sexual health behaviors (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 rate of STIs (as were participants of this study), future research should seek to evaluate demand with clinical populations, such as the key populations the WHO identified as being uniquely affected by STIs (WHO, 2023b).

Finally, conjugate assessments may offer a solution to validation of commodity purchasing tasks for behavior that is not ethical or legal to evoke, even in laboratory settings. Historically, commodity purchasing tasks 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 commodity purchasing tasks and demand for commodities in laboratory environments (e.g., Amlung et al., 2012; Berry et al., 2023). Preparations using schedules of covariation may offer real world behavioral outcome measures with which to

validate responding on hypothetical tasks evaluating physical attraction. This would be an important first step in understanding psychological mechanisms underlying risky sexual health behaviors and thus developing improved interventions.

A few limitations of this study are worth noting. First, findings may lack generality to other populations because we 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 study produced power values ranging from 0.05 – 0.9, based on post hoc analyses. Nonetheless, future studies should seek to replicate these findings with larger sample sizes. This might be achieved by using crowdsourcing data acquisition platforms.

Second, 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 et al. (2024), the researcher did not evaluate within-subject replication of force exerted in the conjugate preparation. However, stimulus presentation order was not significantly correlated with rank order ranks, peak force ranks, nor mean force ranks. In addition, we specifically limited the number of stimuli assessed in the conjugate assessment to three because it has been suggested this preparation may lead to muscle fatigue (Cook et al., 2024; Sheridan et al., 2024). 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 conjugate preparations which utilize force exertion as the dependent variable.

For studies implementing preparations using schedules of covariation, results of the present study suggest context matters. Although the results reproduce findings from Sheridan et al. (2024) in that there was significant association between rank order assessment ranks and mean and peak force ranks from the conjugate assessment, the instructions presented to participants were distinctly different. That is, Sheridan et al. provided limited instruction to participants regarding how the stimuli presented should affect their behavior in the preference assessment and subsequent conjugate assessment. By contrast, in the present study, 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 et al. 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. Future studies should specifically examine the effect of context on behavior in synchronous and 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 preference and demand for romantic partners may improve our understanding of sexual health behaviors. Doing so may lead to evidence-based interventions to decrease risky sexual behavior. Synchronous and conjugate preparations may be important tools in this effort. 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 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 synchronous and conjugate preparations and ease of use, they may be especially relevant for use in this context. By continuing this work, we may improve health and quality of life for vulnerable community members.

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