Cross-Price Elasticity and Demand of Social and Drug Reinforcement

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BACKGROUND AND AIMS

- Drug addiction is characterized, in part, by the pathological choice of drugs over other reinforcers
- Recent technical advances in operant conditioning chambers permit behavior to be reinforced by both intravenous drug administration and social contact in either discrete-trial or free-operant procedures
- Behavioral economic approaches to behavior may be used to examine demand and cross-price elasticity of concurrently available reinforcers to identify the behavioral mechanisms contributing to pathological choice
- The primary aim of this study was to examine demand and cross-price elasticity of cocaine and social contact using independently operating concurrent (FR, FR) schedules of reinforcement
- A secondary aim of this study was to determine whether demand and elasticity measures differed depending on whether the social partner was intoxicated (i.e., cocaine-treated vs. cocaine-free)

GENERAL METHODS

- Male, Long-Evans rats were trained to respond in modified operant conditioning chambers in which lever pressing was reinforced with either intravenous cocaine (0.5 mg/kg/infusion) or 30-s access to a social partner
- Social contact was provided via opening a guillotine door to a side compartment housing a sex- and age-matched social partner

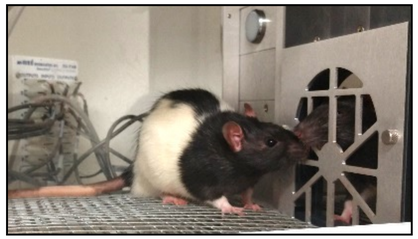
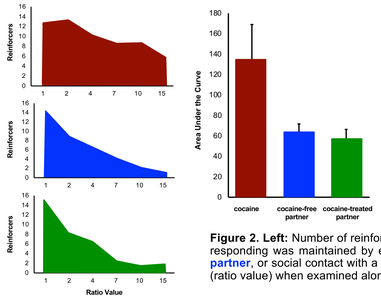


Figure 1. Operant conditioning chamber permitting concurrent access to intravenous cocaine and social contact. Lever presses can be programmed to activate a syringe pump via an infusion line protected by a stainless-steel spring (not shown) or raise a guillotine door leading to a side compartment housing an age- and sex-matched partner. The two rats are separated by a steel gate that permits tactile, visual, auditory, and olfactory contact, but prevents the social partner from accessing the subject's tethering system and active response lever.

- Responding was maintained by cocaine and social contact under independently operating concurrent (FR FR) schedules of reinforcement; thus, rats could respond for cocaine during periods of social contact and vice versa
- Unit price was manipulated across sessions by altering the ratio requirement of the fixed ratio schedule (FR1, 2 4, 7, 10, 15)
- Data were collected under conditions in which only a single reinforcer was available (I.e., cocaine, cocaine-treated partner, cocaine-free partner) and under conditions in which both cocaine and social contact were available
- Concurrent access sessions were conducted by varying the unit price for one reinforcer while holding the unit price for the other reinforcer constant at FR1
- Reinforcing value for each stimulus alone and under concurrent access conditions was initially defined by an Area Under the Curve (AUC) analysis
- Behavioral economic demand measures of intensity and elasticity were determined using the group data

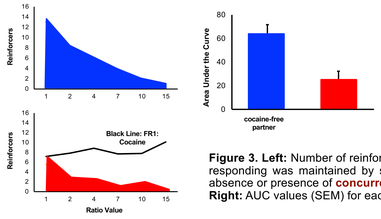
Financial support for this study was provided by US Public Service Grants DA045364, DA031725, and DA045714

REINFORCING VALUE OF COCAINE AND SOCIAL CONTACT (AREA UNDER THE CURVE ANALYSIS)



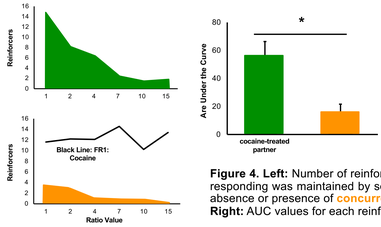
- The number of reinforcers obtained decreased as a function of unit price (i.e., ratio value) for cocaine and social contact
- The reinforcing value of **cocaine** was nonsignificantly greater than social contact with either a **cocaine-free** or a **cocaine-treated** partner

Figure 2. Left: Number of reinforcers obtained during 30-min test sessions in which responding was maintained by either **cocaine**, social contact with a **cocaine-free partner**, or social contact with a **cocaine-treated partner** as a function of unit price (ratio value) when examined alone. **Right:** AUC values (SEM) for each reinforcer.



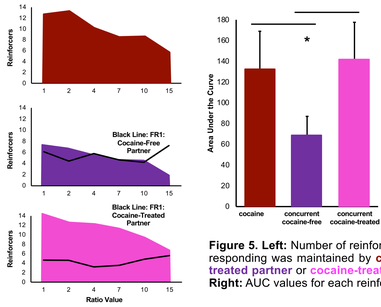
- **Concurrent access to cocaine** nonsignificantly decreased the reinforcing value of social contact with **cocaine-free partner**

Figure 3. Left: Number of reinforcers obtained during 30-min test sessions in which responding was maintained by social contact with a **cocaine-free partner** in the absence or presence of **concurrent cocaine** as a function of unit price (ratio value). **Right:** AUC values (SEM) for each reinforcer.



- **Concurrent access to cocaine** significantly decreased the reinforcing value of social contact with a **cocaine-treated partner**

Figure 4. Left: Number of reinforcers obtained during 30-min test sessions in which responding was maintained by social contact with a **cocaine-treated partner** in the absence or presence of **concurrent cocaine** as a function of unit price (ratio value). **Right:** AUC values for each reinforcer. Asterisk indicates significant difference.



- Concurrent access to a **cocaine-free partner** markedly decreased the reinforcing value of **cocaine**
- Concurrent access to a **cocaine-treated partner** did **NOT** decrease the reinforcing value of **cocaine**

Figure 5. Left: Number of reinforcers obtained during 30-min test sessions in which responding was maintained by **cocaine** in the absence or presence of a **cocaine-treated partner** or **cocaine-treated partner** as a function of unit price (ratio value). **Right:** AUC values for each reinforcer. Asterisk indicates significant differences.

ECONOMIC DEMAND AND CROSS-PRICE ELASTICITY FOR COCAINE AND SOCIAL CONTACT UNDER CONCURRENT ACCESS CONDITIONS

- Concurrent access to a **cocaine-free** partner significantly decreased the **Intensity of Demand** for **cocaine**
- Concurrent access to a **cocaine-free** partner significantly increased the **Elasticity of Demand** for **cocaine**
- Concurrent access to a **cocaine-treated** partner significantly decreased the **Intensity of Demand** for **cocaine,** but this effect was less than that produced by a **cocaine-free** partner

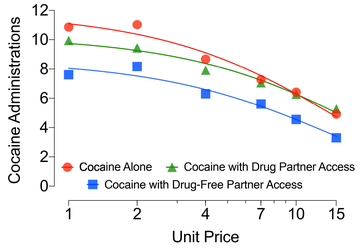


Figure 6. Demand curves for **cocaine** in the absence and in the presence of either a **cocaine-free** or **cocaine-treated** partner. Extra sums-of-squares F-tests indicated that concurrent access to a **cocaine-free** partner reduced the **intensity of demand** and increased the **elasticity of demand** for **cocaine**; however, concurrent access to a **cocaine-treated** partner only modestly decreased the **intensity of demand** for **cocaine**.

- **Elasticity of Demand** was greater for social contact for both a **cocaine-free** and a **cocaine-treated** partner than for **cocaine** (compare **red circles/lines** across Figures 6 and 7)
- Concurrent access to **cocaine** significantly decreased the **Intensity of Demand** for a **cocaine-free** partner (left panel)
- Concurrent access to **cocaine** significantly increased the **Elasticity of Demand** for a **cocaine-free** partner (left panel)
- Concurrent access to **cocaine** significantly decreased the **Intensity of Demand** for a **cocaine-treated** partner (right panel)

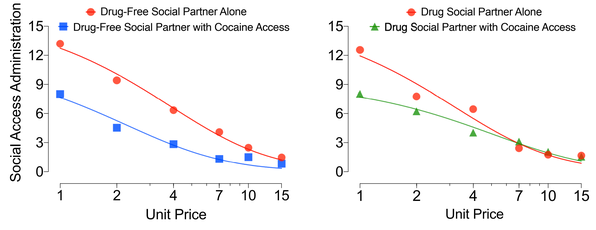


Figure 7. Left. Demand curves for a **cocaine-free** partner in the absence or presence of **cocaine**. Concurrent access to **cocaine** reduced the **intensity of demand** and increased the **elasticity of demand** for **a cocaine-free** partner. **Right:** Demand curves for a **cocaine-treated** partner in the absence of presence of **cocaine**. Concurrent access to **cocaine** reduced the **intensity of demand** but NOT the **elasticity of demand** for **a cocaine-treated** partner.

CONCLUSIONS

Cocaine decreases demand for a social partner under concurrent access conditions

A social partner decreases demand for cocaine, but this effect diminishes if the partner is intoxicated with cocaine