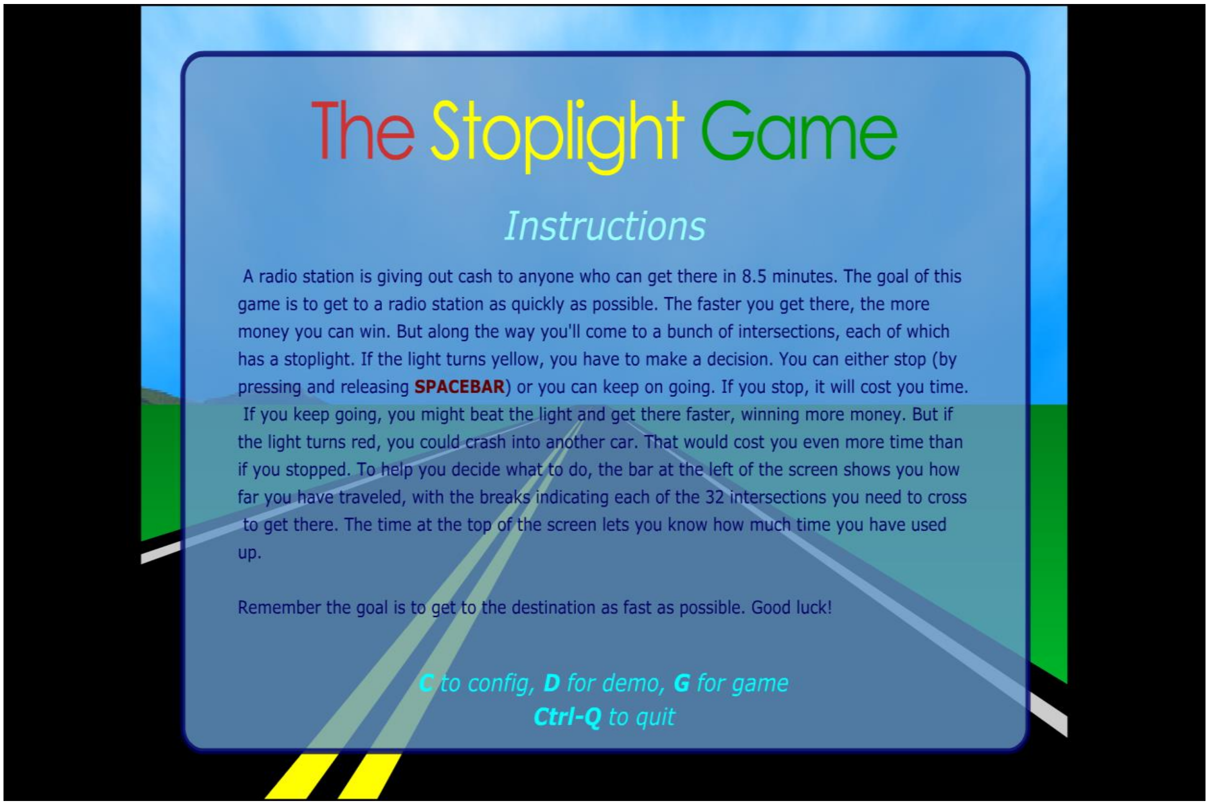
Behavioral Measures

Figure S1. Screenshot of instructions for the Stoplight Task.



Excerpt from the experimenter script: "Your goal in this task is to get to a radio station as fast as you can. The faster you get there, the more money you can win. You have 8.5 minutes to cross 32 intersections and get to your destination. But here's the catch: you have no control over the speed of the car. You only have control over of the brakes of the car. Your task is to decide whether or not you want to stop at each intersection by pressing the SPACE bar. There will be times when there is no other car coming and you can cross it safely. And there will be times when there may be a car coming and you could possibly crash. If you stop, it will cost you time. If you keep going, you might beat the light and get there faster. But if the light turns red and you crash into another car, it will cost you even more time than if you had stopped."

Delay Discounting Task.

The Delay Discounting task assesses subjective preference for smaller, immediate rewards relative to larger, delayed rewards. We used the same version of the measure on which prior studies have reliably found effects of the presence of same-sex peers (O'Brien, Albert, Chein, & Steinberg, 2011; Silva, Chein, & Steinberg, 2016; Weigard et al., 2014). In the task, participants are presented with a series of choices between a relatively small reward received immediately and a larger reward received later (e.g., "Would you rather have $200 today or $1000 in 1 year?"). Participants are informed that there is no right or wrong answer, and to simply choose which of the two (hypothetical) options they prefer. In contrast to the Stoplight game, the delay-discounting task was introduced as a measure of preference, not performance. The experimenter explicitly told participants that their choices on this task had no impact on their final compensation. By removing this contingency, we maintained the delay-discounting task as a measure of reward processing outside the context of risk, where the main consideration is simply a choice between a smaller reward sooner versus a larger reward later.

The outcome of interest in delay discounting is the extent to which participants prefer the immediate but less valuable reward over the delayed but more valuable one. In our adaptation of the task, the amount of the delayed reward was held constant at $1,000. The delay interval is varied across six blocks (1 week, 1 month, 6 months, 1 year, 5 years, and 15 years), which are presented in a random order. For each block, the starting value of the immediate reward is $200, $500, or $800, randomly determined for each participant. The participant is then asked to choose between the immediate reward and a delayed reward of $1,000. If the immediate reward is preferred, the subsequent question presents an immediate reward midway between the prior one and zero (i.e., a lower figure). If the delayed reward is preferred, the subsequent question presents an immediate reward midway between the prior one and $1,000 (i.e., a higher figure). Participants work their way through a total of nine ascending or descending choices until their responses converge, and their preference for the immediate and delayed rewards is equal, at a value reflecting the "discounted" value of the delayed reward (i.e., the subjective value of the delayed reward if it were offered immediately; Green, Myerson, & Macaux, 2005), which is referred to as the *indifference point* (Ohmura, Takahashi, Kitamura, & Wehr, 2006). For each individual, the task generated six indifference points (one for each delay interval). Using these indifference points, we then computed a *discount rate* (k) for each individual. The *discount rate* (k) is an index of the degree to which an individual devalues a reward as a function of the length of delay to receipt, which we computed using the standard equation, $V=A/(1+kD)$, where V is the subjective value of the delayed reward (i.e., the indifference point), A is the actual amount of the delayed reward, D is the delay interval, and k is the discount rate. Because, as is usually the case (O'Brien, Albert, Chein, & Steinberg, 2011; Silva, Chein, & Steinberg, 2016), the distribution of k is highly positive skewed (4.64), we employed a natural log transformation to reduce skew to an acceptable level (0.06). Higher log-transformed discount rates indicate greater orientation toward immediate relative to future rewards.

Modified Iowa Gambling Task.

The Iowa Gambling Task (IGT; Bechara, Damasio, Damasio, & Anderson, 1994) is a neurocognitive measure that has been extensively used in studies of individuals who persistently engage in risky behavior despite experiencing negative consequences, such as compulsive gamblers or substance abusers (e.g., Verdejo-Garcia et al., 2007). In the original version of the task, participants are presented with four decks of cards, turned face down, and told that two of the decks are advantageous (i.e., choosing from them ultimately leads to wins) and two are disadvantageous (i.e., choosing from them ultimately leads to losses). They are then asked to draw cards from the decks so as to maximize their winnings.

In the present study, we used a modified version of the task (Cauffman et al., 2010), in which participants made a play/pass decision on one of 4 decks that is pre-selected by the computer on each trial, rather than deciding to choose to draw from any of 4 decks on any trial, as in the original task. Each subject started the task with $2,000 (of pretend money) and was instructed that his goal was to win as much money as possible. Participants were told that there were good decks and bad decks in the task and that they would earn the most money by learning to play more from the good decks while avoiding the bad ones. The computer selected a card from one of the four decks and participants were given 4 seconds to decide whether to play the card (which subsequently revealed the monetary win or loss) or pass (in which case no feedback was provided). Subjects played a total of 120 trials, which were divided and analyzed into six blocks of 20 trials each. This modification has been used successfully in a prior study of peer effects on IGT performance (Silva, Shulman, Chein, & Steinberg, 2015), and reliably allowed us to determine the independent effects of negative (loss) and positive (reward) outcomes, because the percentage of advantageous decks chosen on a given trial is *not* contingent upon the percentage of disadvantageous decks avoided.

In the present study, we operationalized IGT performance in two ways: (1) the percentage of plays from advantageous decks over the course of the task (reward learning), and (2) the percentage of plays on disadvantageous decks over the course of the task (cost avoidance learning). For reward learning, the expected pattern of behavior is an increase in the percentage of plays on good decks, while for cost avoidance learning, the expected pattern of behavior is a decline in the percentage of plays on bad decks over the course of the task. The rates at which this incline and decline of "good" and "bad" plays, respectively, occur are the main outcomes of interest. As in prior studies (e.g., Cauffman et al., 2010; Silva et al., 2015), the rate of change across the task (i.e., slope) in percentage of good plays served as a measure of reward sensitivity or reward learning (i.e., approach behavior), with more steeply positive slopes indicating increasing attraction to rewarding decks and quicker detection of which decks result in monetary gains over repeated play. The rate of change in percentage of bad plays across the task served as a measure of cost sensitivity or cost-avoidance learning, with more steeply negative slopes indicating greater sensitivity to losses produced by the disadvantageous decks.

Inhibitory Control.

We measured inhibitory control using two variants of the classic Stroop Task: a cognitive version and an emotional version. Both versions of the Stroop are designed to measure individuals' ability to inhibit attention to salient but irrelevant stimuli in favor of more deliberate and controlled actions (Huizinga et al., 2006; McKenna & Sharma, 1995; Nee et al., 2007; Veroude, Jolles, Croiset, & Krabbendamn, 2013). The cognitive version requires control over interfering stimuli that are affectively neutral, whereas the emotional variant of the task requires control over emotionally charged stimuli. The data analysis for both tasks excluded incorrect trials, as well as trials with extreme dispersion (i.e., trials in which the response time (RT) was 4 standard deviations above the participant's own mean RT, as advised by Hoeflich & Preston, 2011). For both tasks, the variable of interest is the difference in response time and accuracy between incongruent and congruent trials (i.e., *Incongruent – Congruent*). Incongruent trials contain salient, but irrelevant information, and, as such, require participants to inhibit attention to interfering stimuli. There is no interfering information on congruent trials. Because incongruent trials are harder than congruent trials, lower accuracy scores and longer response times are expected on incongruent trials relative to congruent trials. This change in accuracy and response time between congruent and incongruent trials is referred to as the *Stroop Effect* (Andrews-Hanna et al., 2011; Long & Prat, 2002; Morey et al., 2012), which is thought to result from cognitive conflict induced by incongruent trails (where subjects have to resist attention to interfering stimuli). A larger Stroop effect for response time is typically characterized by longer response times on incongruent relative to congruent trials, and a larger Stroop effect for accuracy is characterized by lower accuracy on incongruent relative to congruent trials. A larger Stroop effect for both accuracy and response time indicates lower inhibitory control over interfering information. High inhibitory control is characterized by a smaller Stroop effect for both response time (less slowing down) and accuracy (lower drop in accuracy) (e.g., Kane & Engle, 2003; Long & Prat, 2002). The Cognitive and Emotional Stroop Tasks are described in detail below.

Cognitive Stroop Task. Participants completed a practice block consisting of 36 trials, followed by three continuous rounds of 36 trials each (for a total of 108 trials). On each trial, participants were presented with the name of a color word (RED, YELLOW, GREEN, or BLUE) shown in a colored font (red, yellow, green, or blue). Participants were instructed to respond by pressing a colored key (on a specialized keypad) corresponding to the font color of the word, while ignoring the written word name. Thus, participants must inhibit the impulse to read the word and instead identify the color in which the word appears. Trials are either congruent, where the written word and font color are the same (e.g., the word "RED" displayed in red font), or incongruent, where the written word and the font color are mismatched (e.g. "RED" displayed in blue font). Half the trials were congruent and half were incongruent. On all trials, the stimulus was presented for 4000 ms or until a key was pressed. Performance was calculated in terms of overall accuracy and response time on incongruent relative to congruent trials. In this task, slow performance and a high error rate indicate greater difficulty in inhibiting attention to interfering stimuli.

Emotional Stroop Task. In this variation of the task, participants were presented with a series of pictures of individual faces displaying different emotional expressions, which vary among happy, sad, and angry. A word corresponding to one of these three emotion categories was overlaid on the picture. Participants were given a special keypad with three keys, marked "A" for angry, "H" for happy, and "S" for sad. They were instructed to press the key on the keypad that corresponds to the emotion of the facial expression, while ignoring the word overlaid. Similar to the cognitive Stroop, participants must suppress the impulse to read the word and instead identify the facial expression.

Congruent trials contained a face and word of the same emotional valence (e.g., angry face with the word “angry” overlaid), whereas incongruent trials presented a face in one emotion category and a word in another category (e.g., an angry face with the word “happy” overlaid). As with the Cognitive Stroop Task implementation, half of the trials on the Emotional Stroop Task were congruent and half were incongruent.

In order to accommodate the lengthier period of time it takes to process emotional stimuli (relative to colored fonts and words), each stimulus in the series was presented until a response is made, with no time limit. Trial-based feedback was provided immediately following the response—when subjects responded correctly, a screen flash appeared in green; when subjects responded incorrectly, a red screen flash appeared. Subjects completed a practice round consisting of 16 trials, followed by three continuous rounds of 48 trials each (for a total of 144 experimental trials). Similar to the Cognitive Stroop, performance on the Emotional Stroop was operationalized in terms of overall accuracy and response time on incongruent relative to congruent trials. Slow performance and a high error rate are indicative of greater difficulty inhibiting attention to interfering emotional stimuli.

Table S1: Summary of Behavioral Findings.

	Alone M (SD)	Confederate M (SD)	Together M (SD)	Group Differences
Stoplight (RI)[1]	0.35 (0.16)	0.33 (0.16)	0.27 (0.12)	F(2, 129)=5.62, p=0.01, η^2=0.08
Stoplight (CT)[2]	7.50 (0.13)	7.55 (0.16)	7.57 (0.13)	F(2, 129)=2.53, p=0.08, η^2=0.04
Delay Discounting	-6.22 (1.9)	-5.73 (1.3)	-6.49 (1.7)	F(2, 130)=3.14, p=0.05, η^2=0.05
Cognitive Stroop	74.4 (54.4)	67.87 (51.6)	61.4 (50.1)	F(2, 130)=0.67, p=0.51, η^2=0.01
Emotional Stroop	76.0 (69.6)	55.1 (106.5)	92.9 (63.6)	F(2, 130)=2.03, p=0.14, η^2=0.03
Iowa Gambling Task (IGT)[3]	***Estimated slope***	***SE***	***p-value*** [4]	
Approach Behavior				
Alone (reference)	2.86	0.79		
Confederate	1.43	0.92	0.12	
Romantic Partner	2.76	0.93	0.91	
Avoidance Behavior				
Alone (reference)	-5.98	1.03		
Confederate	-8.39	1.21	0.05	
Romantic Partner	-5.13	1.23	0.49	

Note: The *confederate* condition refers to participants completing the tasks in the presence of an attractive female stranger. The *together* condition refers to participants completing the tasks in the presence of their romantic partners. All tests adjust for age.

[1] RI=Risk Index. [2] CT=completion time (in minutes). [3] IGT behavior was analyzed using growth curve modeling in Mplus. IGT performance is described in terms of the rate of change (i.e., slope) in % of plays on good (approach behavior) and bad (avoidance behavior) decks over time (i.e., across task blocks). Rate of change in approach behavior is expected to be positive, as subjects increase decisions to play on good decks over time. Rate of change in avoidance behavior is expected to be negative, as subjects decrease decisions to play on bad decks over time. Coefficients represent the average slope for subjects in each condition. [4] P-values for the confederate and together conditions indicate whether slopes differed significantly compared to the alone condition.

Additional Supplemental Figures

The *confederate* condition refers to participants completing the tasks in the presence of an attractive female stranger. The *together* condition refers to participants completing the tasks in the presence of their romantic partners.

Figure S2. Discounting behavior varied by condition.
Higher values on the Y-axis indicate greater discounting of future rewards (or greater preference for immediate rewards). Participants in the presence of the partners showed greater preference for future rewards compared to participants in the presence of an attractive confederate.

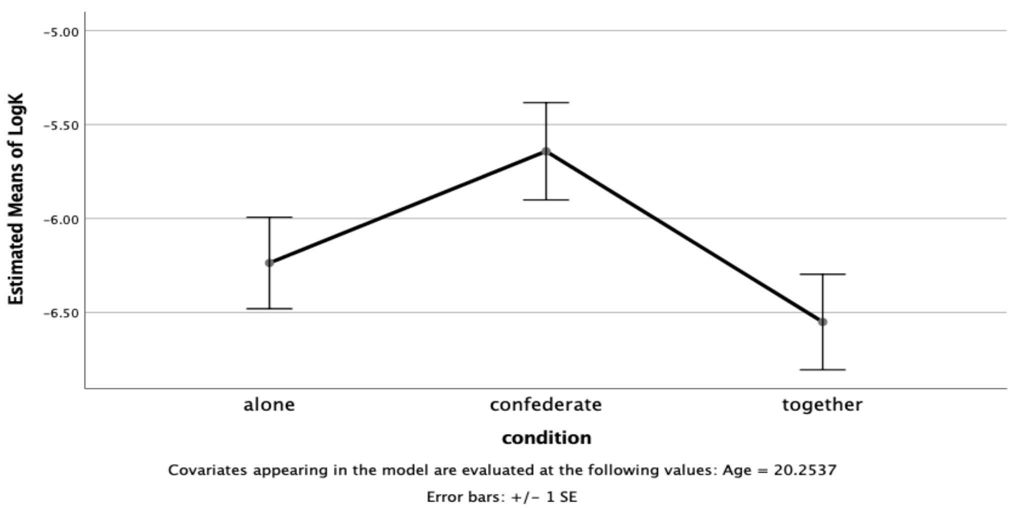


Figure S3. Cognitive interference in the STROOP task did not vary by condition.
Higher values on the Y-axis indicate longer response time on incongruent (relative to incongruent) trials and suggest greater effort to correctly inhibit attention to distracting stimuli (i.e., lower inhibitory control).

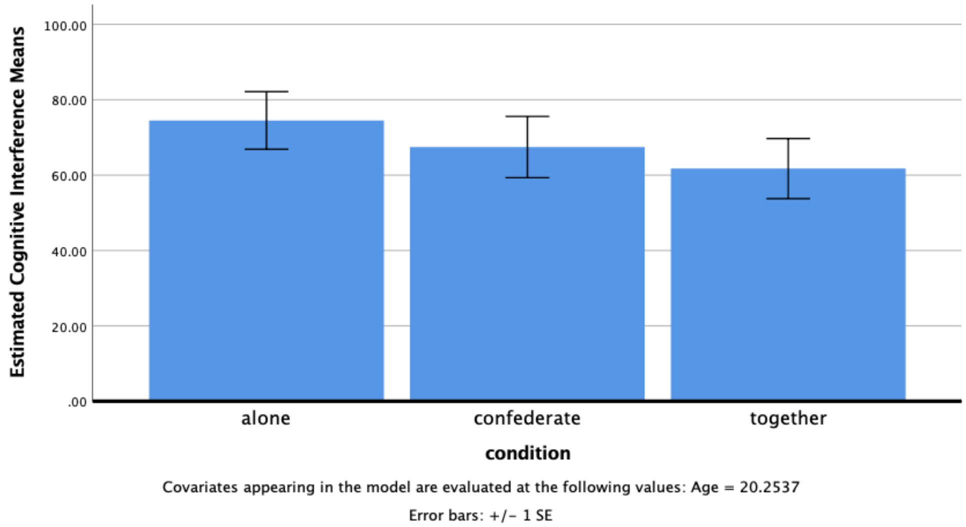


Figure S4. Emotional interference in the Emotional STROOP Task did not vary by condition.
Higher values on the Y-axis indicate longer response time on incongruent (relative to incongruent) trials and suggest greater effort to correctly inhibit attention to emotionally distracting stimuli (i.e., lower inhibitory control of emotionally distracting information). Participants in the confederate condition showed greater inhibitory control over emotional content compared to participants in the presence of their partners (Together condition).

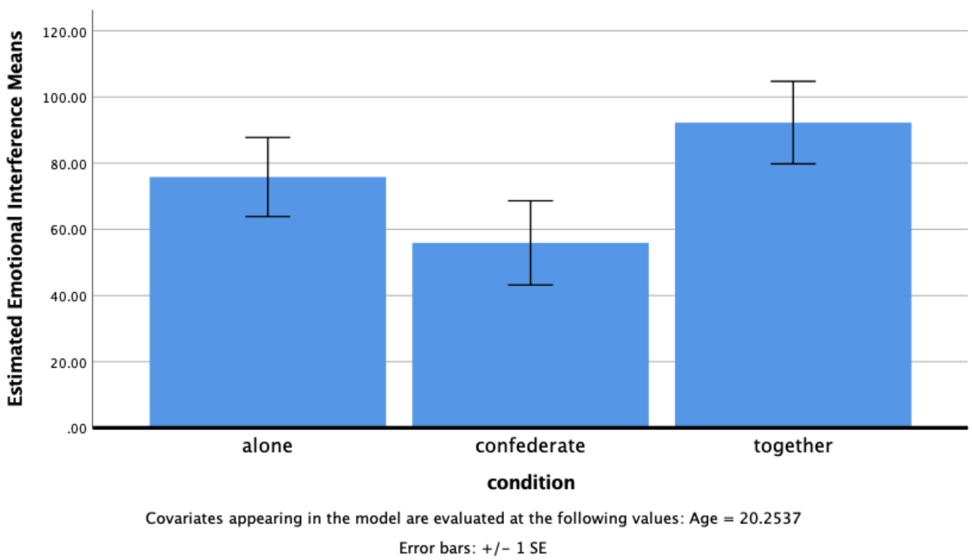


Figure S5a. Approach behavior did not vary by conditions.

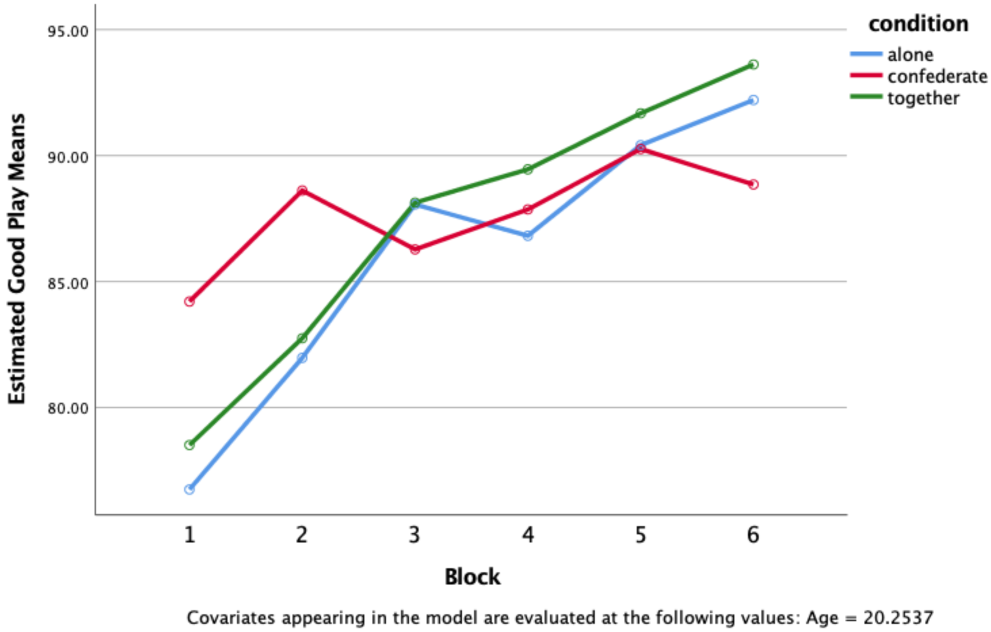
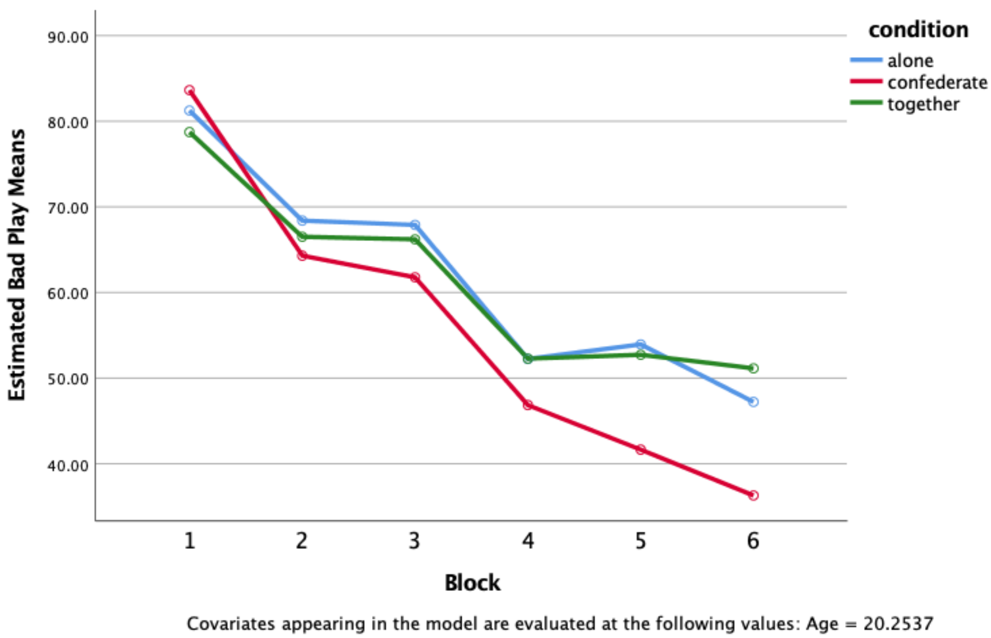


Figure S5b. Avoidance behavior varied by condition.
Participants in the presence of the confederate were significantly quicker than participants in the other two conditions to avoid playing from the bad decks (i.e., they learned faster from negative consequence of risky decisions).



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