Supplemental Methods:

The Factorial Reward Anticipation (FRA) task and its variants:

Original FRA task (FRA-standard): This task was administered to 17 subjects (nine males). The FRA task was administered across three 8-minute scanning runs. Task stimuli were white on a black background, and were projected on a screen and viewed with a head coil mirror. Six trial types (18 instances of each of the six trial types across all three scanning runs) were pseudo-randomly presented, and were separated by a jittered inter-trial interval (2-8 s) with fixation crosshair. Each trial lasted 6 s, and featured an anticipatory cue (500 ms), a target (500 ms), and trial feedback (2000 ms)(Figure 1, top). Response trials (square cues) required the subject to respond on a button box while the subsequent target, a white square, was presented. A square enclosing a "$" (square-$ trials), a "?" (square-? trials), or a "0" (square-0 trials) signaled 1.0, 0.5, and 0 probabilities, respectively, of winning $1 for hitting the target. Non-response trials (circle cue series) instructed the subject to withhold a response while the forthcoming target was presented. A circle enclosing a "$" (circle-$ trials), a "?" (circle-? trials), or a "0"(circle-0 trials) indicated 1.0, 0.5, and 0 probabilities, respectively, of passive receipt of $1 after the target was presented. Reward presentation occurred per the programmed outcome regardless of whether the subject withheld a response to the target. The uniform 500 ms target presentation was roughly twice the mean reaction time (RT) of the slowest subjects in MID task variant in order to ensure a successful response if subjects were attending to the task. Indeed, hit rates in response trials) were 96.7% in p = 1.0 and p = 0.5 trials, and 94.2 % in p = 0 trials (Bjork & Hommer, 2007). During feedback, current trial and cumulative winnings were presented.

FRA with uninstructed probabilities (FRA-UP): This variant was administered to nine subjects (six males) in a pilot experiment intended to elicit brain activation related to reward

probability computation (ostensibly in parietal lobe (Dehaene, Molko, Cohen, & Wilson, 2004)), in addition to assessing VS recruitment as a function of certain vs uncertain probability of payoff. The FRA-UP was identical to the FRA-standard in all respects, except that subjects were not instructed about the exact probability of payoff signaled by the square-? and circle-? anticipatory cues. Subjects were simply told that "...if you see a question mark, there is a chance you will win a dollar if you hit the target. You might win a dollar, or you might win nothing."

FRA with skewed distribution of trial payoffs (FRA-lotto): This version was administered to five subjects (three males) in pilot experiment intended to obtain preliminary evidence of whether mesolimbic anticipatory activation to a *mean* $1 reward with a chance for a very large reward would differ from that elicited by a uniform, explicit $1 reward (in the FRA-standard task variant). In the FRA-lotto, the stimulus timing was identical to FRA-standard, but the uniform $1 reward of FRA-standard trials was replaced with a "draw," (Figure 1, bottom) which signified the eligibility to draw a colored marble out of a cloth bag for winnings after the scan, where different colored marbles signified a different payoff amount for that draw. For example, successfully hitting the target in a square-? trial would result in feedback of "+1 draw", along with the cumulative number of marble draws won. A perfect performance would yield 54 marble-draws after the scan.

The draw bag contained 200 marbles. Black marbles (n = 174) each resulted in a 25¢ payoff, yellow marbles (n = 16) each resulted in a $1 payoff, pink marbles (n = 6) each resulted in a $5 payoff, blue marbles (n = 3) each resulted in a $20 payoff, and a single white marble in the bag resulted in a $50 payoff. This distribution was programmed such that the mean payoff for a trial (a marble draw) was approximately $1, except that this skewed distribution of payoffs featured a handful of exceptionally high-magnitude potential payoffs. Prior to scanning, the 200 marbles were displayed on two trays, and subjects were told: "As you can see from these trays,

there are 200 marbles of different colors. The color of the marble determines how much money it is worth, ranging from 25 cents to 50 dollars. The average value of a marble is one dollar." After scanning, the subject drew his or her marbles from the bag as was paid based on the marbles actually drawn.

Psychopathic Personality Inventory (PPI):

The PPI (Lilienfeld & Andrews, 1996) is a 187-item questionnaire on which subjects rate on 4-point Likert scales their endorsements of personality traits and behaviors across eight subscales. As part of participation in another investigation, the PPI was administered to 17 subjects who completed the FRA-standard task, nine subjects who completed the FRA-UP task, and five subjects who completed the FRA-lotto task. The PPI subscales have been factor analyzed into two principal components when administered to a community sample (Benning, et al., 2003). The first is Impulsive Antisociality (PPI-IA), which is derived from the Impulsive Nonconformity, Blame Externalization, Machiavellian Egocentricity, and Carefree Nonplanfulness. The second is Fearless Dominance (PPI-FD), which is derived from Social Potency, Stress Immunity, and Fearlessness. The eighth subscale, Coldheartedness, did not load into either factor. We calculated PPI-IA and PPI-FD scores and entered these values into MEMA as a continuous covariate (explained below).

fMRI data collection and analysis

fMRI acquisition: We used a 3 T scanner (General Electric, Milwaukee, WI) and a quadrature head coil. The same scanner was used for all task variants. We collected 24 3.8-mm-thick axial slices with a 1 mm interslice gap. In-plane resolution was 3.75 X 3.75 mm. Functional scans were acquired using a T2*-sensitive echoplanar sequence with a repetition time

(TR) = 2000 msec, echo time (TE) =40 msec, flip = 90°. Structural scans were acquired using a T1-weighted MP-RAGE sequence (TR, 100 msec; TE, 7 msec; flip, 90°) for co-registration of functional data. Each subject's head was immobilized by a deflatable head restraint.

FMRI pre-processing: Blood Oxygen-Level Dependent (BOLD) signal was analyzed using Analysis of Functional NeuroImages (AFNI) software (Cox, 1996). Time-series datasets were time-shifted to approximate simultaneous slice acquisition, warped into Talairach space as 3.75mm isotropic voxels, corrected for head motion, and spatially smoothed to a uniform 8mm full-width half maximum in brain voxels. Processed time series were modeled with canonical gammavariate hemodynamic responses time-locked to anticipatory cues. Canonical hemodynamic responses were scaled so that beta weights (partial correlations) would reflect percent-signal-change. The drifting effect in the signal was fitted with extended polynomials for each run.

Additional fMRI statistical analysis:

Our task design enabled a third, higher-order contrast to further isolate *motivation*-related mesolimbic recruitment- that is, activation specific to the joint presence of a potential reward together with the requirement to make an instrumental response for it (Bjork & Hommer, 2007; Elliott, Newman, Longe, & William Deakin, 2004). This was calculated as activation during anticipation of responding for potential reward (square- $ + ?) versus anticipation of responding for no reward (square-0), where this contrast was itself masked by (i.e. subtracted by) the contrast of passive receipt of potential reward (circle- $ + ?) versus passive nonreward (circle-0).

Individual subject maps of linear contrast t-statistics were incorporated to create taskwise group maps, as well as maps of task-wise differences using AFNI with a recently-developed software module, 3dMEMA (http://afni.nimh.nih.gov/sscc/gangc/MEMA.html). 3dMEMA uses a linear mixed-effects multilevel model that incorporates both within-subject and cross-subjects

variability. Voxelwise correlations between PPI and contrast activations, and assessments of direct taskwise differences in contrast are detected and reported here only after survival of family-wise error rate correction to adjusted $p < .05$ using Monte Carlo simulation (AFNI plug-in 3dClustSim).

Volume of interest (VOI) analysis:

We wished to characterize which trial types *specifically* were driving the correlations between PPI scores and mesolimbic activation as detected by event *contrasts*. We therefore extracted signal change in a VOI analysis of the nucleus accumbens (NAcc), which is consistently recruited by the MID task as a marker of motivation (Bjork et al., 2004; Knutson, et al., 2001; Knutson, Taylor, Kaufman, Peterson, & Glover, 2005; Scheres, Milham, Knutson, & Castellanos, 2007). To avoid circularity of statistical inference (Kriegeskorte, Simmons, Bellgowan, & Baker, 2009; Vul, Harris, Winkielman, & Pasher, 2009), the masks were not placed at activation or correlation maxima observed in the statistical maps, but rather were anatomically localized *a priori* in the NAcc (see Figure 2, part C, inset) (Haber & Knutson, 2010) at the intersection of the caudate and the putamen in the coronal plane (Talairach $y = 10$) most consistently activated in previous reports with the mid task. These masks were in fact the identical files invoked in a different dataset and investigation (Bjork, Smith, Chen, & Hommer, 2010), and each mask was comprised of two contiguous 3.75mm cubic voxels. Each subject's hemodynamic responses were: 1) averaged by anticipatory cue (i.e. trial) type, 2) modeled and corrected for low-frequency baseline drifts as per the core regression analysis, and 3) passed through the NAcc masks. These peak modeled signal change values (~6 s lag after cue presentation) were then correlated with PPI scores in bivariate analyses. We also characterized which trial type drove the observed contrast between PPI-total scores and recruitment of mFC

by the contrast between anticipation of passive receipt of potential reward and non-reward in a *post hoc* descriptive VOI analysis. Here, post-cue signal change was averaged (as above) across a five-voxel mask drawn in the saggital plane (x = 6) at the observed correlation maxima.