

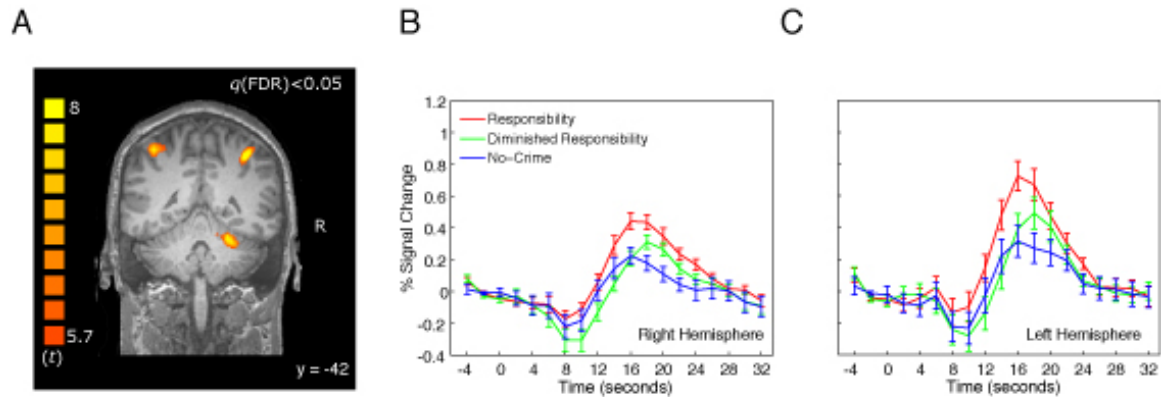
## **The Neural Correlates of Third-Party Punishment**

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### **Supplementary Results**

The pattern of activity in bilateral anterior intraparietal sulcus (aIPS) resembled that seen in rDLPFC. In both left and right aIPS, activity during Responsibility trials was significantly greater than in Diminished-Responsibility ( $p = 0.006$ , right;  $p = 0.004$ , left) and No-Crime trials ( $p = 0.002$ , right;  $p = 0.0000008$ , left). aIPS activity did not differ significantly between Diminished-Responsibility and No-Crime trials ( $p = 0.6$ , right;  $p = 0.25$ , left). This pattern of results remained after equating for arousal differences between the Responsibility and Diminished-Responsibility conditions: Responsibility > Diminished-Responsibility ( $p = 0.002$ , right;  $p = 0.006$ , left), Responsibility > No-Crime ( $p = 0.0006$ , right;  $p = 0.003$ , left), Diminished-Responsibility = No-Crime ( $p = 0.58$ , right;  $p = 0.25$ , left). This pattern of results was also evident after equating for reaction time differences between conditions: Responsibility > Diminished-Responsibility ( $p = 0.006$ , right;  $p = 0.0003$ , left), Responsibility > No-Crime ( $p = 0.02$ , right;  $p = 0.0002$ ), Diminished-Responsibility > No-Crime ( $p = 0.73$ , right;  $p = 0.57$ , left). As in rDLPFC, activity in “punished” Diminished-Responsibility trials was significantly greater than in “non-punished” Diminished-Responsibility trials ( $p = 0.01$ , right;  $p = 0.03$ , left) and activity in the “non-punished” Diminished-Responsibility trials was not significantly greater than in the No-Crime trials ( $p = 0.12$ , right;  $p = 0.55$ , left). Neither right or left

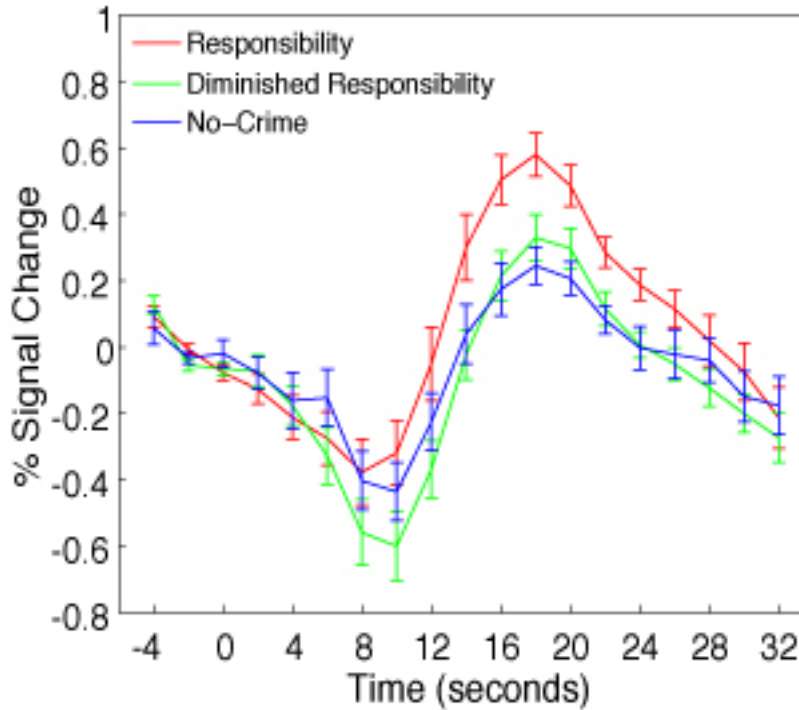
aIPS were significantly linearly correlated with punishment scores in the Responsibility condition ( $p = 0.17$ , right;  $p = 0.07$ , left).



Supplementary Figure 1.

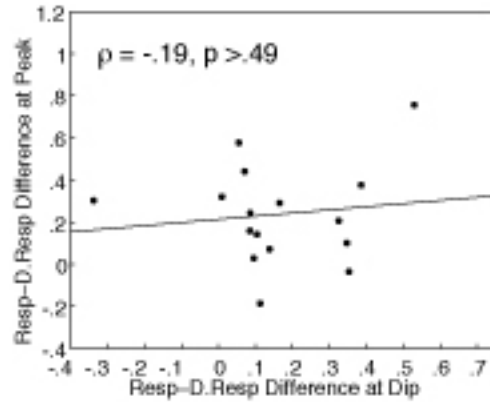
**Supplementary Figure 1. Relationship between Responsibility and bilateral anterior intraparietal sulcus (aIPS) activity.** **A)** SPM displaying the right and left aIPS VOIs (rendered on a single subject T1-weighted image), based on the contrast of BOLD activity in the Responsibility condition compared to the Diminished-Responsibility condition,  $t(15) > 3.5$ ,  $q < 0.05$ , random effects analysis. R = Right Hemisphere. **B)** BOLD activity time courses in right aIPS for the Responsibility, Diminished-Responsibility and No-Crime conditions. BOLD peak amplitude was significantly greater in the Responsibility condition compared to both the Diminished-Responsibility and No-Crime conditions ( $p = 0.006$ ,  $p = .0002$ , respectively). **C)** BOLD activity time courses in left aIPS for the Responsibility, Diminished-Responsibility and No-Crime conditions. BOLD peak amplitude was significantly greater in the Responsibility condition compared to both the Diminished-Responsibility and No-Crime conditions ( $p = 0.004$ ,  $p = 0.0000008$ , respectively). Peak was defined as the single TR with maximal signal change

from baseline within the first 13 volumes after scenario presentation onset. *t*-tests were performed on these peak volumes, which were defined separately for each condition and each subject.



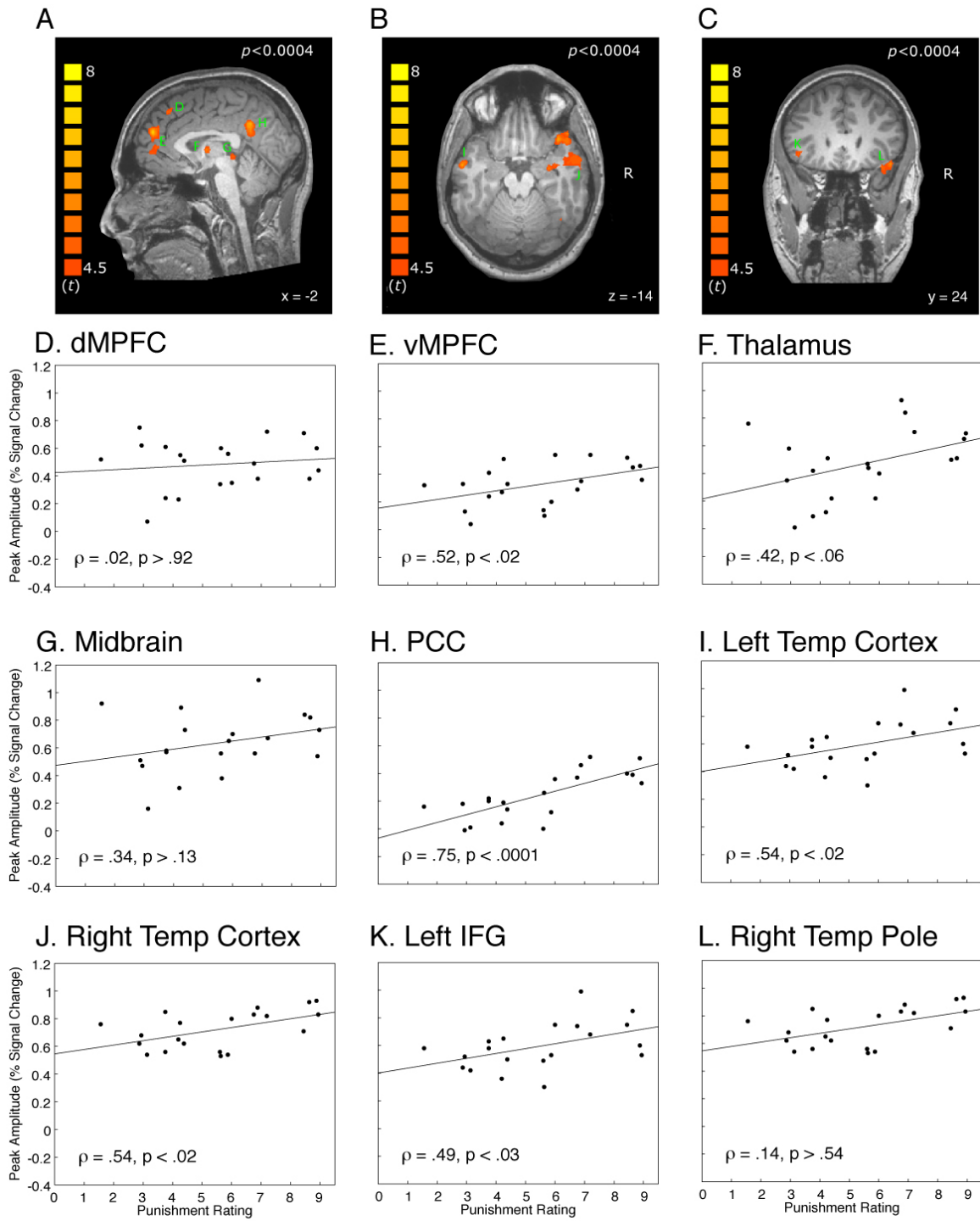
**Supplementary Figure 2. Reaction time equated right DLPFC time course.**

BOLD activity time course in right DLPFC after equating (per subject) for reaction time differences between conditions. Peak BOLD activity in right DLPFC was still significantly greater for Responsibility trials compared to Diminished-Responsibility ( $p = 0.006$ ) and No-Crime trials ( $p = 0.002$ ).



Supplementary Figure 3.

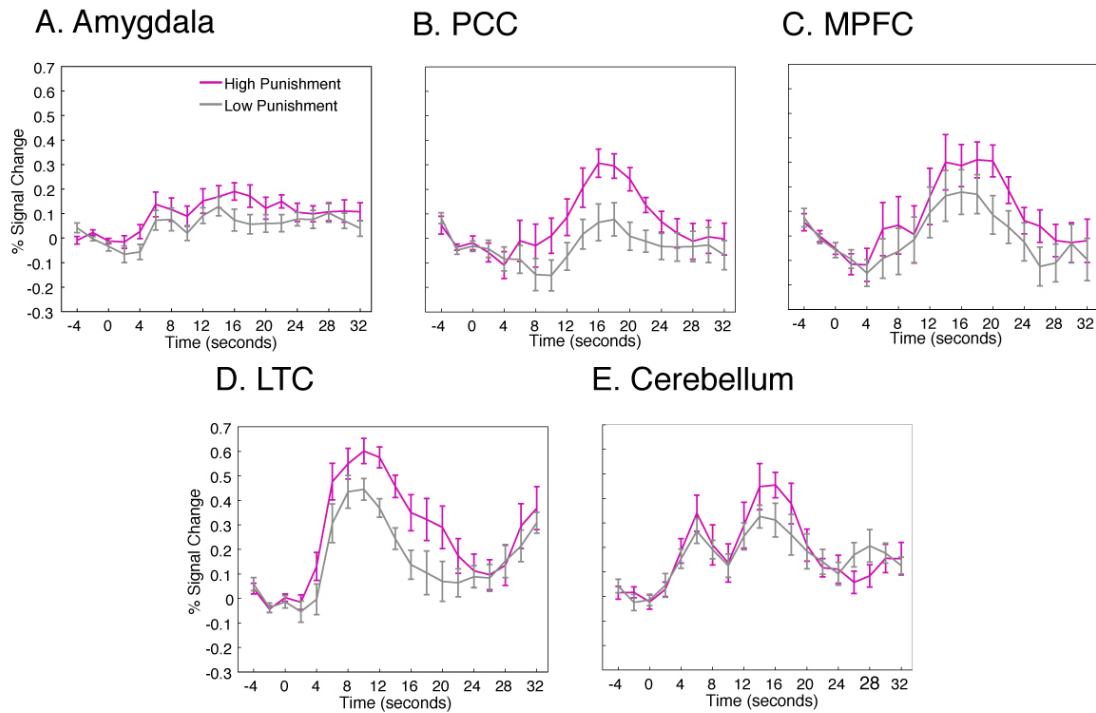
**Supplementary Figure 3. Correlation of Peak (activation) and ‘Dip’ (deactivation) condition differences in right DLPFC.** Scatterplot depicts the correlation of (per-subject) peak right DLPFC BOLD signal differences between Responsibility and Diminished-Responsibility scenarios and dip right DLPFC BOLD signal differences between Responsibility and Diminished-Responsibility scenarios. These variables were not significantly correlated ( $p = .69$ ).



Supplementary Figure 4.

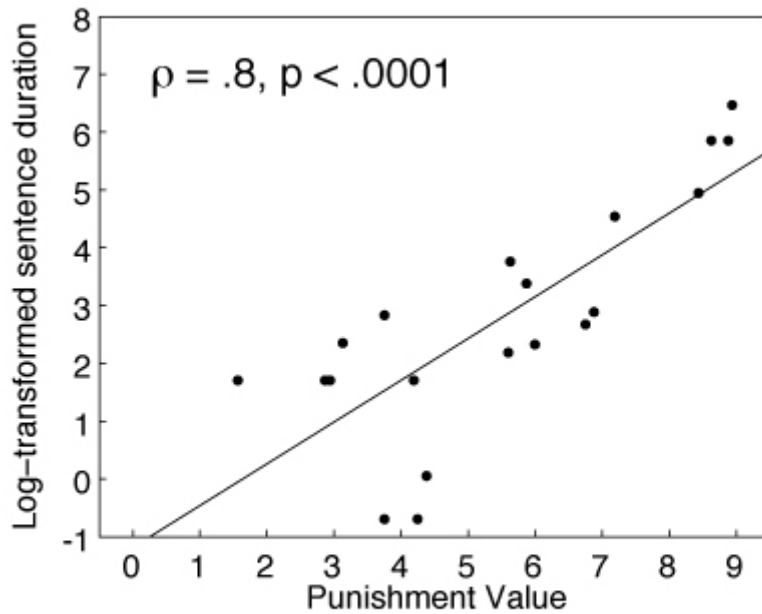
**Supplementary Figure 4. Regional activity associated with punishment magnitude.**

(A-C) SPMs displaying dorsomedial and ventromedial prefrontal cortex, posterior cingulate cortex, thalamus, midbrain, amygdala, right temporal pole, right and left lateral temporal cortex and left inferior frontal gyrus VOIs (rendered on a single subject T1-weighted image), based on the high punishment versus low punishment contrast in Responsibility scenarios, thresholded at  $t(15) > 4.5$ ,  $p < 0.0004$  (uncorrected) for visualization. All VOIs survive correction for multiple comparisons,  $q(\text{FDR}) < 0.05$ ; random-effects analysis. R = Right Hemisphere. (D-L) Scatterplots depict for each of these VOIs the relationship between peak BOLD signal and punishment magnitude for each Responsibility scenario.



Supplementary Figure 5.

**Supplementary Figure 5. BOLD signal time courses for selected punishment magnitude VOIs.** BOLD activity time courses for high punishment and low punishment Responsibility scenarios, based on the median split analysis of punishment scores. Amygdala (A), posterior cingulate (B), ventromedial prefrontal cortex (C), lateral temporal cortex (D) and cerebellum (E). Peak BOLD Responsibility and Responsibility-difference (Responsibility minus Diminished-Responsibility) responses in each of these VOIs are significantly correlated with punishment and punishment-difference scores, respectively.



Supplementary Figure 6.

**Supplementary Figure 6. Relationship between punishment scores and sentence duration for Responsibility scenarios.** Recommended mean sentence durations (natural log-transformed) for crimes depicted in the Responsibility condition were positively correlated with (subject-averaged) punishment scores for each Responsibility scenario ( $p = 0.0001$ ).



## Responsibility Scenarios

### Set 1

1-20 = Responsibility

20-40 = Diminished-Responsibility

40-50 = No Crime

1) At the town bus station, John notices in a small gift shop a T-shirt of his favorite rock band. When no one appears to be looking in his direction, John takes a \$15 T-shirt, places it in his coat and walks out, with no intention of paying for it

2) John visits a fair, where a local company has masseuses offering “Free Massages” as an advertising tool. The person registering customers tells all clients that the limit is one massage per customer. John has a massage. Hours later, he returns using a false name, and gets another massage from a different masseuse.

3) John develops a plan to kill his 60-year-old invalid mother for the inheritance. He drags her to her bed, puts her in, and lights her oxygen mask with a cigarette, hoping to make it look like an accident. His mother screams as her clothes catch fire and she burns to death.

4) John is bored one week-end evening, as he is driving around the outskirts of his hometown. As John comes upon a farmer’s cornfield, he decides it would be a lot of fun to set the entire field on fire. He manages to get a large fire started and sticks around to watch the whole field burn.

5) John has been living with Heather for nearly six months. On Wednesday night, Heather tells him that it is over, and that she is breaking up with him. John pleads at first, but when that does not work, he gets very angry. John then gags Heather, firmly ties her to the bed, and rapes her.

6) John is a lifelong drug dealer who is always looking for ways to get more clients hooked on heroin. John knows of an acquaintance, Charlie, who is diabetic and regularly in need of insulin shots. One day, John manages to surreptitiously replace insulin with heroin for a single dose, hoping Charlie will become addicted to the drug.

7) John is parking his car in the parking lot of a local football stadium, where he plans to watch a game. In the car next to his, he sees a hat with his team logo in the back seat. Seeing that the door is unlocked, John opens the door, and takes the hat.

8) Angry after overhearing the derogatory remarks made by the coach towards his son during a little league soccer game, John approaches the coach, grabs him, knocks him down, then kicks him several times while he is on the ground. This knocks the man unconscious for several minutes and causes cuts that require five stitches.

9) John has just been fired by his boss, who gives John one week's notice to leave the company. John decides to hurt her badly. At work the next day, when no one else is around, he picks up a letter opener from his desk, goes to his boss's office, and stabs her. She later dies from the wound.

10) John plans to be a gangster for a Halloween office party. He buys suitable clothing, as well as a small loaded gun. The gun looks like a toy, and John plans to use it to kill a rival, and then claim it was an accident. He later shoots his rival, who dies of the injuries.

11) John has seen a nice set of golf clubs for sale at a local golf course. He does not have enough money to buy them. So John gets a friend to distract the store owner while he grabs the set of clubs and slips out through the back door of the store, and stashes the clubs in his car.

12) John approaches a home whose owners are absent, intending to take valuables. Although the back door is locked, the locking mechanism is not very secure. John pulls hard on the door, the lock gives way, and the door opens. John steps into the kitchen, sees a cell phone on the counter, and carries it away.

13) Two vicious pit bulls that John keeps for illegal dog fighting escaped and attacked a person who came to John's house. The police tell John he must destroy the dogs, which he agrees to do but does not intend to do. The next day, the dogs escape again and maul to death a delivery man.

14) One night John is bored. He approaches a neighbor's home while she is away, and vandalizes the house and yard. First, he breaks five windows with rocks. Then he knocks over an expensive gas grill. Then he throws a bicycle into the pool. Finally, he breaks a child's swing set before walking away.

15) While attending a football game of his favorite team, John becomes angry as he overhears a fan of the opposing team continuously make disparaging remarks about John's team. After the game, John sticks his face up in the man's face -- and head-butts him, causing a black-eye and a gash that requires two stitches.

16) A record store patron, standing next to John, is wearing a cap that mocks John's political party. John follows the man from the store, confronts him, and then slaps him in the face hard, causing him to stumble. The man's face develops a black and yellow bruise that persists for one week.

17) One day at a local park, John approaches a man walking a dog and demands money from him. When the man refuses to turn over his money, John punches the man in the face, breaking his jaw and causing several cuts that each require stitches. John then runs off without getting any money.

18) John kidnaps an 8 year-old girl for ransom, rapes her, then records the child's screams as he burns her with a cigarette lighter, sending the recording to her parents to induce them to pay his ransom demand. Even though they pay as directed, John strangles the child to death to avoid leaving a witness.

19) John is baby-sitting a neighbor's eight-month old son, who he takes on an errand. John thinks it may be too hot to safely leave the toddler in the car, but he decides to leave him there anyway as he will be returning soon. However, John strikes a conversation with a shop-owner, forgetting about the toddler, who passes out and dies.

20) John is a cab driver in town. On Saturday, a seemingly unsophisticated customer enters the cab. John, who knows that his electronic meter is working fine, pretends it is broken, so that he can overcharge the customer by \$5.00. The customer is unaware of this, and pays the amount John requests.

21) John attends a party hosted by a hypnotist. Under hypnosis, John does uncharacteristic and comical deeds, until something goes wrong. Attempting to demonstrate that hypnotized people are harmless, the hypnotist tells John to strike a nearby woman. John grabs a lamp and hits the woman, who dies of the injuries. When brought out of hypnosis, John has no recollection.

22) John visits a local bookstore, carrying a large shopping bag with goods from another store. While the store clerk is preoccupied with inventory, another customer, hoping to use John unwittingly in a theft, sneaks a book into John's shopping bag. Without realizing what has happened, John walks out without paying for the book.

23) John has a license to hunt deer with his licensed rifle. One day, he sees a deer, takes aim, and shoots – missing the deer but killing a distant hunter. The deceased hunter had not complied with important state safety regulations. In particular, he was not wearing "hunter orange" to distinguish himself from target animals.

24) John's friend Gregory is training for a boxing match. He has been working on his abdominal muscles, and asks John to hit him there repeatedly to help Gregory "toughen up." John repeatedly punches Gregory in the stomach until Gregory asks him to stop, at which point John stops. Gregory suffers bruises and one broken rib.

25) John fills his new prescription at the pharmacy. Unbeknownst to John and his doctors, this prescription interacts with John's other medications to induce severe acute psychoses. That day, John comes home, pours gasoline around his house and sets it on fire while the wife he adores is inside. She consequently dies.

26) John has recently experienced delusions. He had checked himself into a mental hospital to get treatment, but he was released yesterday due to a clerical error. Today, he wanders into a clothing store, and walks out with twelve children's shorts without paying. The proprietor does not see him, and there are no children among John's friends or family

27) A brain tumor is causing increasingly erratic, violent, and callous behavior in John. Soon, he develops an uncontrollable urge to kill. John abducts a boy, puts a broomstick in the boy's rectum, and lashes him with a whip until he dies. When the tumor is later found and removed, John's behavior returns to normal.

28) John is at the batting cage, down in the park. John is unaware that a man has thoughtlessly entered the cage and is walking up behind him. On John's next back-swing, he hits the man behind him in the head, breaking the man's nose and giving him cuts that require several stitches to close.

29) John is in the crowded elevator of a local apartment building, on his way to visit a friend who lives there. He suddenly has an epileptic seizure, with uncontrollable muscle convulsions. He has never had these before. A man unknown to John, who is standing next to him, is hit in the arm and bruised.

30) John purchases a snake from a pet store owner who mistakenly believes and explains that the snake is non-poisonous. John has no reason to think otherwise, although the snake is actually poisonous. It bites one of John's guests as she reaches into the tank to pick the snake up. The guest dies from the venom.

31) Hiking in the backcountry, John and his boy scouts get lost. Making matters substantially worse, one of the boys steps on a rattlesnake and is bitten. The troop then stumbles upon an abandoned house, which John sets on fire to draw rescuers. The plan works and the kid is saved, but the house is destroyed.

32) John owns an ice cream truck, which he drives to the city park. One customer gives John a \$50.00 bill for a \$2.00 ice cream. John intends to give correct change, but he miscounts and returns \$5.00 less than the customer was owed. Neither John nor the customer notices the discrepancy.

33) One morning, John's house was burglarized. One of the items taken was a distinctive framed picture of the Jamaican Olympic Bobsled Team. Later that day, John is walking in the neighborhood and notices his framed picture in the back seat of an unlocked car. He opens the door and takes the picture.

34) John is walking home one night. A man wearing a ski-mask jumps from the bushes, holding a knife and demanding John's wallet. After John presents his wallet, the man tries to stab John. In the scuffle, John succeeds in knocking out the thug, who is hospitalized with a head injury and cuts needing five stitches.

35) John attends a local concert at which the sponsor has a table clearly labeled "Free CDs," to promote the musical band. A small separate sign stating "Limit: One per Customer" had fallen to the ground behind the table, and John has not seen it. He takes two CDs and leaves.

36) John is at home, baby-sitting a neighbor's two-year old daughter. Local laws require a fence around pools to prevent infant drownings. John had previously arranged for professional installation of extra-strong fencing exceeding local requirements. Unbeknownst to John, a section of the fence is defective. The girl later pushes through that section, falls into the pool, and drowns.

37) A dishonest cop keeps pressuring John for "protection money", meaning he can keep John from "getting hurt" so long as John keeps paying him. When John runs out of cash, the cop orders him to buy alcohol at the liquor store, and then resell it to minors for a \$1,000 profit. John does so.

38) At a party, and unbeknownst to John, the host slips John some illegal drugs as a joke. John starts hallucinating wildly. He goes into the street and attacks an empty car with rocks, bottles, bricks, his fists, and his feet. The car is considerably damaged. The next day, he has no recollection of the evening.

39) While kart racing, John suddenly notices a stalled kart racer ahead of him. John attempts to veer around the kart, but due to a mechanical failure, the wheel locks and he crashes into the other kart. That kart's driver suffers a large bump on the head and needs two stitches to close an associated cut.

40) John is walking with his daughter when a well-known and frequently violent drug-dealer confronts them. Showing a gun, he instructs John to steal from the house across the street, "or else you won't ever get to walk your little daughter again." John, believing him, immediately breaks a window, takes two brass candlesticks, and turns them over

41) One day, John picks up some allergy medicine at his local pharmacy. The label on the medication clearly states: "Store in a cool, dry place." John is aware of what the label says, and knows his bathroom can be hot and humid. But he stores his medicine in the bathroom anyway.

42) John goes to the house of his best friend, Gus, to borrow a screwdriver. Gus says: "Please take and keep this one. I have many more than I need." John says "Thanks, but I only need it this once." Although John plans to return the screwdriver, he later forgets and ends up keeping it.

43) John buys a variety of different kinds of flowers and bushes, and plants them in his backyard. For several weeks, John cares for them diligently and waters them regularly. Eventually John enters a busy period at work, during which he forgets about the plants. By the time he pays attention again, they have all died

44) Early one morning, John arrives at his place of work, and realizes that he has left his key at home. He goes around the building exterior, trying to find a door that may be unlocked. He tries all of them, unsuccessfully. A co-worker finally arrives, and lets John in with her own key.

45) John has dinner one night at local restaurant he has not visited before. Although the food arrives promptly and tastes quite good, John finds the service wholly unacceptable. At various times, the waiter was rude, neglectful, confrontational, and even verbally abusive. When leaving, John pays for his meal, but leaves no tip.

46) A friend invited John to dinner. John is on his way but is stuck in traffic caused by an accident. He has no opportunity to detour, and no way to contact his friend to let him know he'll be late. When John arrives 2 hours late, the meal has unavoidably dried out and is ruined.

47) The manual to John's new car states: "The oil must be changed no less frequently than every 4,000 miles." John reads the manual and is aware of what it says. However, John drives the car for 4,023 miles before taking it to a service station for the car's first oil change.

48) John and his best friend have played golf together for more than ten years. They used to be evenly matched, but recently John's friend has consistently outplayed him. Growing frustrated, John responded by taking private golf lessons from the local pro. The next time John played against his friend, he soundly beat him.

49) John is out walking when he sees a five-dollar bill on the sidewalk. John looks around to see if there is anyone who might have dropped it. Because it is very early in the morning, there is no one around. John picks up the money, and puts it in his pocket, intending to keep it.

50) On Halloween, John hangs a scary-looking plastic monster from the creepiest tree in the front yard of his home. Most of his evening's visitors seem to enjoy it. However, several of the youngest children out trick-or-treating with their parents are so scared that their parents have to take them straight home.

## Set 2

1-20 = Responsibility

20-40 = Diminished-Responsibility

40-50 = No Crime

- 1) John owns an ice cream truck, which he drives to the city park. One customer gives John a \$50.00 bill for a \$2.00 ice cream. Hoping that the customer will not bother counting her change, John provides \$5.00 less in change than the customer is owed. The customer walks away without noticing the discrepancy
- 2) After careful planning, John abducts a boy for a “snuff” video (a video recording, to be sold on the black market, of someone being killed in a gruesome way). On camera, John binds the boy, puts a broomstick in his rectum, and lashes him with a whip until he dies. John then sells the recording.
- 3) John goes down to the park at night, carrying a baseball bat. He demands money from a man walking a dog. When the man refuses, John hits the man with the bat, breaking his nose and giving him cuts that require several stitches to close. John then runs off without getting any money.
- 4) John is at home, baby-sitting a neighbor’s two-year old daughter. Local laws require fencing around pools to prevent infant drownings. John knew but ignored the requirement. John leaves his back door open for air circulation while watching television and drinking beer. The girl crawls out and drowns in the pool, where John finds her forty minutes later.
- 5) One night John is bored. He decides it would be fun to vandalize a car. He finds one on the street in the neighborhood and attacks it. First, he kicks it and pelts it with rocks. Then he breaks bottles on it. Then he hurls bricks, and the like. The car is considerably damaged.
- 6) One day, John is in a crowded elevator of a local apartment building, and sees a man wearing a T-shirt with a political slogan John finds offensive. John pursues the man off the elevator, abuses him verbally, then pushes him hard against the wall. The man’s arm is bruised by the encounter.
- 7) One night, John decides to steal some brass candlesticks that he sees through the window of a house whose owners appear to be away. John tries several windows but finds them all locked. He finally breaks one, and climbs into the house. He then takes the candlesticks and leaves the house.
- 8) John and his friend have longed for the expensive leather jackets on sale at a local clothing store. One day, they decide to act. While the friend distracts the owner in the front of the shop, John quickly gathers up four leather jackets. John then slips out the back of the store and stashes the jackets in his car

9) On Saturday, John attends a local concert at which the sponsor has a table clearly labeled "Free CDs," to promote a new musical band. John sees and understands a small separate sign stating "Limit: One per Customer." When the attendant is looking the other way, John takes two CDs and leaves.

10) John is bored one week-end evening, and decides it would be fun to start a fire in the empty room of an old abandoned building in his home town. John hopes that the whole building will go up in flames. John lights the fire and the entire building burns, as he watches from a distance.

11) While kart racing, John notices Jake, a long-time rival, to his right. Remembering old grudges, John tries to cause Jake to crash, veers his vehicle toward Jake's. Jake's car consequently slams into a wall. Jake suffers a large bump on his head and needs two stitches to close a cut he received in the crash.

12) John, who lives at home with his father, decides to kill him for the insurance money. After convincing his father to help with some electrical work in the attic, John arranges for him to be electrocuted. His father survives the electrocution, but he is hospitalized for three days with injuries caused by the electrical shock.

13) John knows very well that it is illegal to keep a poisonous snake at home. But he does so anyway, because deadly snakes are cool, and laws are dumb. One night, the snake escapes, travels to the guest room, and bites John's house-guest. Shortly thereafter, the guest dies from the poison.

14) John, wearing a dark suit and ski-mask, jumps up from behind some bushes and confronts a man on his way home from work. John, holding a knife, demands that the man turn over his wallet. After getting the wallet, John knocks the man unconscious, and the man later requires 5 stitches.

15) John develops a plan to kill his ex-wife so that he no longer has to pay alimony. One day, John enters her home, pretending to be a burglar. He stabs his ex-wife repeatedly. Hoping to cover his tracks, he then pours gasoline around her house and sets it on fire. She dies in the blaze.

16) After work, John hosts a party at his house that Lucy attends. During the evening, and unbeknownst to Lucy, John keeps spiking Lucy's lemonade with vodka, hoping that she will become drunk and willingly have sex with him. After numerous drinks, Lucy gets alcohol poisoning and has to be rushed to the hospital.

17) Things have been going badly for John at work. He feels persecuted by one person, in particular. John follows her for several days, learning her routes between work and home. Intending to hurt her badly, John comes from behind in an alley and strikes her over the head with a club. The woman later dies from her wounds.



18) John has a passionate affair with the girlfriend of an acquaintance, and has been plotting to get rid of him. John invites the acquaintance to a deer hunt, planning to shoot and kill him under circumstances that could make it look like an accident. Finding his opportunity, he shoots and kills the man.

19) John visits a local bookstore, carrying a large shopping bag that contains goods from another store. John sees a book he would like to have. When no one appears to be looking his way, John quickly slips a book into his shopping bag. John leaves the store without paying for that book.

20) John is walking one morning and sees a framed picture of the Jamaican Olympic Bobsled Team in the back of a car. John returns to the car later, and checks to see if the doors are locked. Finding one of the doors unlocked, he opens the door and takes the picture with him.

21) At the bus station, John notices in a small gift shop a T-shirt of his favorite rock band. While the store clerk is preoccupied with inventory, another customer, hoping to use John unwittingly in a theft, sneaks the T-Shirt into John's coat pocket. John walks out without paying for the T-shirt.

22) John's undetected brain tumor causes him to believe he hears angel voices. He thinks the angels have identified a demon-girl who could bring about a global apocalypse. Following the angels' exact instructions, John kidnaps and ritualistically rapes, tortures, and strangles the girl. When the tumor is later found and removed, John no longer hears voices.

23) John has recently experienced delusions. He had checked himself into a mental hospital to get treatment, but he was released yesterday due to a clerical error. Today, he wanders into a golf store, picks up a bag of clubs, and walks out with them without paying. The proprietor does not see him, and John does not play golf.

24) John is successfully hypnotized by his inexperienced psychiatrist, who is trying to help John control his feelings by first visualizing himself committing violent acts, and then visualizing himself overcoming his desire to do them. While visualizing, John grabs a letter-opener and stabs the psychiatrist, who later dies from the wound. Later, John has no recollection of the event.

25) John plans to be a gangster for a Halloween office party. His friend offered to lend John a gangster costume, complete with a gun, and John accepted. John assumes the gun is a harmless toy, but it is actually real and loaded. John playfully shoots it at a co-worker, who then dies of the injuries.

26) John is a cab driver in town. On Saturday, a seemingly unsophisticated customer enters the cab. John is unaware that his electronic meter is malfunctioning. Reading from the meter, and assuming that the meter is accurate, John in fact overcharges the customer by \$5.00. Both he and the customer are unaware.

27) John owns two dogs of a very popular breed that is widely considered to be extremely docile and harmless. One day a neighborhood bully sneaks into John's yard while John is away, and repeatedly shoots the dogs with a BB-gun. Irritated, the dogs rush the man, who stumbles and dies of bite wounds.

28) While at a local record store, John has a sudden epileptic seizure with uncontrollable muscle convulsions. He has never had these before. A customer in the store, who had been standing next to John, is hit and hurt. The man's face develops a black and yellow bruise that persists for one week.

29) While attending a football game, John realizes he's forgotten his team hat. He returns to the parking lot, and mistakes a car of the same make, model, and color for his own. The car is unlocked and also has a similar hat in the back seat. John takes it, believing it is his.

30) At a party, and unbeknownst to John, the host slips him some illegal drugs as a joke. John starts hallucinating wildly. He goes next door, breaks windows with rocks, knocks over a gas grill, throws a bicycle into the pool, and breaks a child's swing set. The next day, he has no recollection of this.

31) John is baby-sitting a neighbor's eight-month old son. With that neighbor's prior consent, John takes the child on an errand. John gets out of the car, closes his door, and prepares to retrieve the child. Although John has never fainted before, he suddenly faints and falls. By the time he awakens, the child has died from heat buildup in the car.

32) Unbeknownst to John and his doctors, his new prescription interacts with his other medications to induce severe acute psychoses. During that interaction, John returns home to his 60-year old invalid mother, who he has always adored. John lights her oxygen mask with a cigarette, and watches as his mother catches fire, screams, and burns to death.

33) John is attending a football game. When his team scores a touchdown John stands up to celebrate, as do the other fans in front. At that instant, the person behind John bends forward to pick up a soda. John strikes heads with the man behind, who gets a black-eye and a gash requiring two stitches.

34) John is out driving one evening and is the first to see a forest fire raging toward a town of 10,000 people. John intentionally sets fire to a farmer's cornfield, which is located right in between the fire and the town. The burned field then serves as a firebreak, and the fire does not reach the town.

35) While cheering for his son at a soccer match, John is attacked by a parent of a child on the opposing team, who knocks John down and jumps on top of him. John struggles, but eventually hits the man hard enough to knock him unconscious for several minutes and leave cuts requiring five stitches.

36) One night, John sleepwalks to the home of an absent neighbor. John pulls on the back door, the lock gives way, and the door opens. John enters the kitchen, takes a cell phone from the counter, and carries it away. The next morning, John has no recollection of the event, or the origin of the phone.

37) John is home one night, watching TV, when his girlfriend sneaks up to the house, intending to scare him. Wearing a trench coat and a hat, she slips in through the back door, stomping heavily toward the living room. Frightened, John leaps up and stabs her with a kitchen knife. Her injured arm requires surgery.

38) John visits a fair, where a local company has masseuses offering “Free Massages” as an advertising tool. The person registering customers forgets to tell John that the limit is one massage per customer. John remains unaware of the policy. John has a massage. Hours later, he returns and gets another massage from a different masseuse.

39) John is practicing his martial arts moves at a local park. Unbeknownst to John, an acquaintance walking a dog comes behind him to surprise John. As John shifts to his next move, he accidentally punches the man in the face, breaking the man’s jaw and causing several cuts that each require stitches.

40) John and his wife have been using prescription fertility drugs, in an effort to have a baby. Unbeknownst to either of them, their houseguest placed a syringe of heroin in the refrigerator, near the fertility drugs. That night, John mistakenly injects his wife with heroin, instead of the fertility drug.

41) On Halloween, John hangs a scary-looking plastic monster from the creepiest tree in the front yard of his home. Most of his evening’s visitors seem to enjoy it. However, several of the youngest children out trick-or-treating with their parents are so scared that their parents have to take them straight home.

42) Early one morning, John arrives at his place of work, and realizes that he has left his key at home. He goes around the building exterior, trying to find a door that may be unlocked. He tries all of them, unsuccessfully. A co-worker finally arrives, and lets John in with her own key.

43) John buys a variety of different kinds of flowers and bushes, and plants them in his backyard. For several weeks, John cares for them diligently and waters them regularly. Eventually John enters a busy period at work, during which he forgets about the plants. By the time he pays attention again, they have all died.

44) John is out walking when he sees a five-dollar bill on the sidewalk. John looks around to see if there is anyone who might have dropped it. Because it is very early in the morning, there is no one around. John picks up the money, and puts it in his pocket, intending to keep it.

45) A friend invited John to dinner. John is on his way but is stuck in traffic caused by an accident. He has no opportunity to detour, and no way to contact his friend to let him know he'll be late. When John arrives 2 hours late, the meal has unavoidably dried out and is ruined.

46) John has dinner one night at local restaurant he has not visited before. Although the food arrives promptly and tastes quite good, John finds the service wholly unacceptable. At various times, the waiter was rude, neglectful, confrontational, and even verbally abusive. When leaving, John pays for his meal, but leaves no tip.

47) John and his best friend have played golf together for more than ten years. They used to be evenly matched, but recently John's friend has consistently outplayed him. Growing frustrated, John responded by taking private golf lessons from the local pro. The next time John played against his friend, he soundly beat him.

48) The manual to John's new car states: "The oil must be changed no less frequently than every 4,000 miles." John reads the manual and is aware of what it says. However, John drives the car for 4,023 miles before taking it to a service station for the car's first oil change.

49) One day, John picks up some allergy medicine at his local pharmacy. The label on the medication clearly states: "Store in a cool, dry place." John is aware of what the label says, and knows his bathroom can be hot and humid. But he stores his medicine in the bathroom anyway.

50) John goes to the house of his best friend, Gus, to borrow a screwdriver. Gus says: "Please take and keep this one. I have many more than I need." John says "Thanks, but I only need it this once." Although John plans to return the screwdriver, he later forgets and ends up keeping it.

Supplemental Tables

**Supplementary Table 1.** Anatomical location and Statistical Assessment of Activation for VOIs identified from Responsibility SPMs,  $p < .05$  (corrected).

Contrast	Region	Talairach Coordinates (X, Y, Z)	t value (peak)	p value (peak)			Arousal- equated p value (peak)		
				R>DR	DR>NC	R>NC	R>DR	DR>NC	R>NC
<b>Responsibility &gt; Diminished- Responsibility (<math>t &gt; 5.7</math>)</b>	<b>R. Anterior Intraparietal Sulcus</b>	35,-44,47	11.1	0.006	0.6	0.002	0.002	0.58	0.0006
	<b>L. Anterior Intraparietal Sulcus</b>	-37,-45,53	8.7	0.004	0.25	0.0000008	0.006	0.25	0.0003
	<b>R. Dorsolateral Prefrontal Cortex</b>	39,38,18	5.8	0.0009	0.33	0.001	0.0005	0.14	0.0002
	R. Cerebellum	23,-45,-21	9.8	0.004	0.45	0.02	0.07	0.45	0.15
	L. Motor Cortex	-42,-24,46	11.3	6E-05	0.12	0.01	0.007	0.19	0.13
	R. Precuneus	12,-62,35	6.4	0.06	0.04	0.002	0.04	0.04	0.001
	L. Precuneus	-16,-67,34	6.8	0.18	0.95	0.3	0.16	0.95	0.25
Dorsal Anterior Cingulate Cortex	-2,1,42	8.2	0.005	0.57	0.16	0.11	0.57	0.36	
<b>Diminished- Responsibility &gt; Responsibility (<math>t &gt; 5.7</math>)</b>	R. Temporoparietal Junction	55,-53,27	7.8	0.0005	0.9	0.001	0.003	0.93	0.008
	L. Temporoparietal Junction	-48,-57,25	8.1	0.001	0.44	0.006	0.002	0.44	0.007

**Supplementary Table 2.** Anatomical location and Statistical Assessment of Activation for VOIs identified from Punishment SPMs,  $p < .05$  (corrected).

<b>Contrast</b>	<b>Region</b>	<b>Talairach Coordinates (X, Y, Z)</b>	<b>t value (peak)</b>	<b>Correlation with Punishment</b>	<b>Correlation with Arousal</b>	<b>Punishment Difference Score Correlation</b>	
<b>High &gt; Low Punishment</b> ( $t > 4.7$ )	<b>Ventromedial Prefrontal Cortex</b>	-3,49,24	9.4	$\rho = .52, p < .02$	$\rho = .57, p < .01$	$\rho = .43, p < .06$	
	Dorsomedial Prefrontal Cortex	-3,33,46	5.6	$\rho = .02, p < .93$	$\rho = .07, p < .77$	$\rho = .18, p < .45$	
	<b>R. Amygdala</b>	29,-7,-13	6	$\rho = .67, p < .001$	$\rho = .67, p < .001$	$\rho = .66, p < .001$	
	R. Temporal Pole	43,21,12	6.6	$\rho = .14, p < .55$	$\rho = .24, p < .31$	$\rho = .36, p < .12$	
	R. Lateral Temporal Cortex	51,1,-12	6.5	$\rho = .54, p < .02$	$\rho = .55, p < .01$	$\rho = .32, p < .17$	
	<b>L. Lateral Temporal Cortex</b>	-54,-3,-15	6.6	$\rho = .54, p < .02$	$\rho = .55, p < .01$	$\rho = .65, p < .002$	
	Midbrain	-6,-31,-1	5.6	$\rho = .34, p < .14$	$\rho = .32, p < .17$	$\rho = .25, p < .29$	
	<b>Posterior Cingulate</b>	-3,-48,31	7.2	$\rho = .75, p < .0001$	$\rho = .75, p < .0001$	$\rho = .52, p < .02$	
	Thalamus	-2,-5,7	5.8	$\rho = .42, p < .06$	$\rho = .41, p < .08$	$\rho = .24, p < .31$	
	L. Inferior Frontal Gyrus	-42,25,-1	5.7	$\rho = .49, p < .03$	$\rho = .48, p < .03$	$\rho = .36, p < .12$	
	<b>R. Cerebellum</b>	29,-41,-20	6.7	$\rho = .51, p < .03$	$\rho = .50, p < .02$	$\rho = .50, p < .02$	
	<b>Low &gt; High Punishment</b> ( $t > 4.7$ )	R. Motor Cortex	46,-18,51	7.1	$\rho = -.61, p < .005$	$\rho = -.61, p < .004$	$\rho = -.47, p < .04$

**Supplementary Table 3. Internal Punishment Scale**

	Punishment Rating				
Participant	1	3	5	8	9
AA	Small Fine	Large Fine	Short Jail Sentence	Long Jail Sentence	Life Imprisonment
BB	Small fine	Short Jail Sentence	Long Jail Sentence	"Humane Execution"	"Cruel Execution"
CC	Social Penalty	Public Ostracism	Short Jail Sentence	Long Jail Sentence	Life Imprisonment/Execution
DD	Victim Compensation	Community Service	Short Jail Sentence	Long Jail Sentence	execution
EE	Victim Compensation	Short Jail Sentence	Medium Jail Sentence	Long Jail Sentence	Life Imprisonment
FF	Victim Compensation	Small Fine	Large Fine	Jail Sentence	Life Imprisonment
GG	Victim Compensation	Probation	Short Jail Sentence	Long Jail Sentence	Life Imprisonment
HH	Probation	Short Jail Sentence	Medium Jail Sentence	Long Jail Sentence	Life Imprisonment
II	Fine	Short Jail Sentence	Medium Jail Sentence	Long Jail Sentence	Life Imprisonment
JJ	None	Social Ostracism	Jail (NOS)	Life Imprisonment	execution
KK	Social Penalty	Community Service/Fine	Fine/Short Jail Sentence	Jail (NOS)	Life Imprisonment
LL	Social Penalty	Community Service	Short Jail Sentence	Long Jail Sentence	Life Imprisonment
MM	Social Penalty	Fine/Short Jail Sentence	Medium Jail Sentence	Life Imprisonment	execution
NN	None	Small Fine	Medium Fine	Jail (NOS)	Long Jail Sentence
OO	Social Penalty	Community Service	Large Fine	Life Imprisonment	execution

NOS = relative sentence not otherwise specified