

Supplementary Information

Supplementary Table S1. Regions positively correlated with the level of sympathy during circumstance phase ($p < 0.001$, $k > 10$).

<i>Region</i>	<i>Side</i>	<i>MNI coordinates</i>			<i>Z</i>	<i>k</i>	<i>SVC</i>
Dorsomedial Prefrontal Cortex (Superior Medial Gyrus)	L	-10	44	28	3.51	148	0.008
Dorsomedial Prefrontal Cortex (Superior Medial Gyrus)	L	-4	32	46	3.78	97	0.004
Middle frontal gyrus	L	-42	20	50	3.58	36	
Inferior frontal gyrus (p. Triangularis)	R	52	20	16	3.48	28	
Superior medial gyrus	R	10	28	54	3.37	24	
Precuneus	L	0	-64	40	3.17	11	0.021
Temporo-Parietal Junction	L	-48	-64	18	3.21	10	0.019

Supplementary Table S2. Regions positively correlated with the amount of reducing punishment during circumstance phase ($p < 0.001$, $k > 10$).

<i>Region</i>	<i>Side</i>	<i>MNI coordinates</i>			<i>Z</i>	<i>k</i>	<i>SVC</i>
Precuneus	R	2	-60	28	3.99	669	0.001
Superior frontal gyrus	R	18	32	58	4.65	187	
Superior frontal gyrus	R	28	26	58	3.54		
Caudate	R	12	18	12	3.91	106	
Superior frontal gyrus	L	-18	22	64	3.04	104	
Dorsomedial Prefrontal Cortex (Superior Medial Gyrus)	L	-8	28	64	3.33		0.008
Inferior Frontal Gyrus (p. Orbitalis)	L	-42	34	-12	3.91	49	
Hippocampus	L	-22	-36	6	3.68	39	
Thalamus	L	-16	-26	12	3.36	33	
Lingual gyrus	L	-8	-80	-10	3.29	28	
Middle Cingulate Cortex	R	2	-26	34	3.23	26	
Anterior Cingulate Cortex	L	-12	34	20	3.45	15	0.008

Supplementary Table S3. Correlation of mitigation with differential brain activations from the contrast sympathy scenarios minus no-sympathy scenarios ($p < 0.005$, $k > 15$).

<i>Region</i>	<i>Side</i>	<i>MNI coordinates</i>			<i>Z</i>	<i>k</i>	<i>SVC</i>
Precentral Gyrus	R	56	2	34	3.27	190	
Precentral gyrus	R	42	-20	68	3.57	174	
Insula	R	34	-8	12	3.10	74	0.023
Cerebellum	R	-14	-78	-24	3.04	46	
Fusiform gyrus	R	-20	-84	-6	3.10	29	

Supplementary Methods

[Scenarios were presented in Japanese. These are translated further from simple Japanese-to-English translation by Rahul Bui and Colin Camerer]

Sympathy scenarios

Case 01: On 14 March 2008, the defendant strangled the victim, her husband, in her house.

Circumstances: The defendant had devoted herself to caring for her husband who had become totally paralyzed due to a car accident. One day, the defendant was told by her doctor she had breast cancer which had metastasized throughout her whole body. She doubted that the victim could survive if she died, and so committed the murder.

Case 02: On 15 February 2006, the defendant strangled the victim, his mother, to death.

Circumstances: His mother had suffered from dementia, and he quit his job in order to take care of her. When his application for public assistance was rejected, he was no longer able to pay the bill for housing. Faced with the burden of caring for his elderly mother and the hardships of life, the defendant killed her in despair.

Case 03: On 7 February 7, in his house the defendant fatally stabbed his mother in the chest.

Circumstances: Due to his renal failure, the defendant could not get a regular job. Despite his illness, he had devotedly cared for his elderly mother, who needed intensive care due to post-stroke complications. Because of the deterioration of his renal failure, the defendant became depressed about the future. So he decided to euthanize her.

Case 04: On 16 June 2008, the defendant at her house stabbed the victim, her husband, in the neck.

Circumstances: The defendant had endured domestic violence by the victim for 10 years since their marriage. The defendant had been beaten by a hammer, and her husband threatened to slit her throat. One day, she found the victim drunk, thought it was now or never, and decided to commit the murder.

Case 05: On 1 May 2005, the defendant strangled the victim, her sister, who was sleeping in the bedroom.

Circumstances: The victim had no regular occupation, spent money on gambling and male host clubs, and put financial pressure on the defendant. The victim was violent towards the defendant when she had personal failures. Unable to bear the violence, the defendant decided to kill her sister.

Case 06: On 7 March 2005, the defendant stabbed the victim, the co-founder of the variety store, at the bar.

Circumstances: The defendant and the victim had managed a variety store together for years. The store encountered financial difficulties. The victim began to treat the defendant as a slave, and forced her into prostitution in order to earn money. Unable to tolerate this any longer, she committed the murder.

Case 07: On 10 November 2002, the defendant stabbed her old classmate with a kitchen knife.

Circumstances: In her high school days, the victim made demands of the defendant. When she could not comply, the victim violently punished her. Bullying continued after they graduated from high school. The defendant was forced by the victim to have sex with his male friends, and was violent when she refused his commands. Unable to bear the victim's cruelty, she decided to kill him.

Case 08: On 28 October 2001, the defendant stabbed her father to death with a kitchen knife.

Circumstances: The defendant had been sexually abused by the victim since the age of fourteen. As a result of sexual abuse, the defendant had been forced to have 6 abortions and give birth 5 times. Hoping to be released from her father's sexual abuse, she decided to kill him.

Case 09: On 7 February 2001, the defendant stabbed her brother with a knife.

Circumstances: Due to a car accident, the victim had been totally paralyzed and bedridden for a year. To care for the victim, the defendant had given up the idea of becoming a cook and left her vocational school. Being exhausted from caring for her brother, who could not

even have a meal by himself, she thought it would be miserable for him to be kept alive for 10 or 20 more years. Feeling pity for the victim, she made up her mind to kill him.

Case 11: On 2 August 2005, the defendant strangled her mother.

Circumstances: The victim suffered from dementia, and was almost out of control, engaging in abnormal behavior including rubbing feces on the wall. However, the defendant did not want to leave her mother in the nursing home, and she devoted herself to caring for her mother at home. As the condition of dementia was getting worse, the defendant killed her mother in desperation.

Case 11: On 30 August 2008, the defendant strangled his mother with his bare hands.

Circumstances: The victim had been suffering from severe depression, and had attempted suicide many times. The victim was also suffering from terminal lung cancer, and complained to him that she could not endure her chest pain any longer. Intending to release his mother from suffering, the defendant decided to kill her.

Case 12: On 28 November 1998, the defendant strangled his son to death in his house.

Circumstances: The defendant had taken care of the victim who suffered from severe mental retardation. However, the defendant could not continue doing so because of her heart disease. Doubting that there would be anyone to take care of her son if she died, the defendant committed the murder in despair.

Case 13: On 2 November 1998, the defendant disconnected the breathing-tube from his wife at the hospital.

Circumstances: A month ago, his wife had been resuscitated after cardiopulmonary arrest caused by an asthma attack, and had been in a coma due to hypoxia. He had taken care of his wife in the daytime, and worked through the night at a construction site. One day, the defendant was told that there was little hope of recovery for his wife. Feeling pity for her, he decided to kill her.

Case 14: On 7 May 2007, the defendant strangled the victim, his elder brother.

Circumstances: The victim was emotionally unstable and often was violent towards the defendant, hitting him hard and smashing furniture. On that day, the victim got furious with

the defendant for having come home late at night. The victim abused the defendant and threw a chair at him. Fearful for his life, he killed the victim.

Case 15: On 16 April 2007, the defendant strangled the victim, his eldest son.

Circumstances: The victim did not have a regular occupation, demanded money from the defendant, and was violent. As a result of the victim's violence, the defendant suffered from hearing trouble in his right ear. Being afraid that his son would hurt another person someday, he decided to kill him.

Case 16: On 18 April 2007, in her house the defendant stabbed the victim, her father, in the chest.

Circumstances: In her junior high school days, her mother left home and did not come back. Since then, the defendant lived with her father and sister. Her father had no regular occupation and frequently was violent towards the defendant. Enduring his violence, she took care of her sister on behalf of their missing mother. On that day, the victim got angry about a meal which the defendant cooked and was violent again. At the end of her rope, she committed the murder.

No-sympathy scenarios

Case 01: On 6 April 2006, the defendant stabbed the victim, his father, with a knife in his house.

Circumstances: The defendant had been withdrawn from society and lived together with his father since he had graduated from the university. The defendant was unhappy that his father had blamed him for being unemployed. The defendant wished to kill his father and live alone. He had planned out the murder and bought a knife to carry out his plan.

Case 02: On 19 November 2007, the defendant hit his mother with a bat and murdered her.

Circumstances: Because the defendant had lost so much money gambling and shopping, he borrowed 3 million yen [about \$3,000]. The defendant had been employed since he had graduated from high school. However his salary was cut because of the economy cooling down. One day, the defendant had spent all his money on gambling. His mother blamed him for the debt and for his lifestyle. Then he got angry and decided to kill her.

Case 03: On 2 December 2001, in her house the defendant strangled the victim, her husband, to death with a necktie.

Circumstances: The defendant was 3 million yen in debt from gambling. Having been blamed for her debt by the victim, she was on bad terms with him. In addition, the defendant had maintained extramarital relations with another man. In order to marry him, she had developed a plan to kill her husband.

Case 04: On 18 August 2006, the defendant stabbed the victim, his employer, to death with a knife at the studio which the victim had managed.

Circumstances: The defendant had been employed in the studio as a craftsman, and had received a decent salary. However, the defendant wanted more money and demanded that the victim increase his salary. Because the victim refused this request, the defendant got furious and committed the murder.

Case 05: On 19 April 2000, the defendant stabbed the victim, his ex-girlfriend, to death with a kitchen knife in a parking lot.

Circumstances: The defendant had been dating the victim for a year. A month before the incident, she told him it was over and that she was breaking up with him. Unable to accept the breakup, the defendant started stalking her. He called her every day and waited in ambush for her. On that day, the defendant lay in wait for her and begged her to come back to him. Because she refused, he got furious and decided to kill her.

Case 06: On 24 May 2001, the defendant suffocated his friend to death by hitting him on the head with a flower pot.

Circumstances: The defendant and the victim got to know each other a year ago, and started to live together soon after. The defendant became angry over trivial matters and behaved violently when he was drunk. On that day, while drinking, the defendant got into the quarrel with the victim and murdered him.

Case 07: On 10 May 2007, the defendant beat the victim's head with a liquor bottle and killed him at a bar.

Circumstances: The victim, an old friend of the defendant, was the manager of the bar, where the defendant often visited. On that day, the defendant complained that he had not

gotten on well with his live-in partner, then the victim gave him some advice. However, under the impression that he was being insulted, he got enraged, and murdered him.

Case 08: On 15 May 2006, the defendant stabbed her husband to death in the neck at home.

Circumstances: She had been completely absorbed in a male host club and neglected her family. On that day, running out of patience with the defendant, the victim proposed a divorce. Although she apologized for her behavior, he refused to accept it. When it became clear that he would not change his mind, she got angry and killed him.

Case 09: On 28 December 2004, the defendant strangled the victim, his university classmate, with a rope.

Circumstances: Since the defendant had been wrapped up in an equity investment, his funding was difficult. The defendant owed the victim 2 million yen. Being pressed to repay his debt to the victim, he decided to kill him in order to avoid payment.

Case 10: On 17 November 2005, the defendant broke into the victim's room and stabbed her to death with a knife.

Circumstances: The defendant was a swindler who had earned money illegally by gambling. However, after a gambling house took measures to protect against cheating, he could not make money and had to part with his house. In his childhood, he killed animals to distract himself. When he was scolded by parents, he took it out on his dog and beat the dog to death by a baseball bat. Then he felt it was fun to kill an animal. Wishing to experience the feeling of killing again, he committed a murder.

Case 11: On 30 April 2001, the defendant stabbed the victim to death with a kitchen knife in the street.

Circumstances: The defendant bought a kitchen knife and carried it with him in order to threaten and rape a woman. The defendant found a target woman who suited his preferences. When he got close enough to rape her, she glared angrily at him. Feeling that he was despised, he got angry. Then he took her into the alley and murdered her.

Case 12: On 27 July 1998, the defendant beat his friend with a club and killed him at the bar.

Circumstances: The defendant spent money carelessly and was jobless. The defendant asked his friend to lend some money, his friend refused. In addition, the victim bugged him for the payment of an earlier debt.

Then the defendant got angry and committed the murder.

Case 13: On 22 April 2008, the defendant hailed a taxi and stabbed the driver to death in the neck with a knife inside the car.

Circumstances: The defendant worked at the Ground Self-Defense Force. He deserted the army when he was scolded by his boss. During the desertion, he spent all his money, and became desperate. Because he had been interested in knowing what a murder felt like, and wanted to be sentenced to death, he committed the murder.

Case 14: On 2 December 2007, the defendant strangled his ex-girlfriend to death inside his car.

Circumstances: Keeping it a secret that he was married, the defendant had lived with the victim until a half year ago. While going out, the defendant borrowed 300,000 yen from the victim. After breaking up, she often visited the defendant to press him for payment of the debt. On that day, being pressed to pay back his debt, the defendant killed her.

Case 15: On February 2005, the defendant bound the victim, and killed her via charcoal burner in a sealed car.

Circumstances: The defendant met the victim through an online dating website. The defendant had developed a desire to see a person dying agonizingly. One day, the defendant found from the web that death from carbon monoxide poisoning is painful, and so he arranged the crime.

Case 16: On 24 October 1996, the defendant broke into the victim's room and slashed her to death with a knife.

Circumstances: The defendant and the victim had dated romantically for about 3 months, then they broke up. Unable to accept being separated from her, the defendant had tried to get back together with the victim. One week before the crime, the defendant got angry about being rebuffed by her. Then he decided to kill her.