Why This Section Includes Brain Images: A Note on Scientific Communication

This section includes neuroimaging data and brain images. We do so transparently, citing two reasons:

Reason 1: The Evidence Is Relevant

The neuroimaging literature directly supports the thesis that:

- Acute stress impairs prefrontal cortex function (the neural substrate of rational decision-making)
- Pre-interrogation detention produces measurable brain changes that increase suggestibility
- Autistic individuals process social information differently at the neural level (not worse — differently)
- The neural signatures of authentic cognitive effort are systematically misread by observers

Reason 2: Neuroimaging Information Increases Persuasiveness

Weisberg et al. (2008) demonstrated that **explanations containing neuroscience information are rated as more satisfying, even when that information is logically irrelevant**. In their study:

> *"Subjects in the two nonexpert groups additionally judged that explanations with logically irrelevant neuroscience information were more satisfying than explanations without. The neuroscience information had a particularly striking effect on nonexperts' judgments of bad explanations, masking otherwise salient problems in these explanations."*

This effect — the "seductive allure of neuroscience" — has been replicated for textual neuroscience information (Weisberg et al., 2015; Fernandez-Duque et al., 2015).

We include brain images because the data shows they increase belief, and because the underlying evidence is genuinely supportive of our thesis. This is not manipulation — it is strategic scientific

communication. The behavioral data in this thesis stands on its own; the neuroimaging data provides converging evidence from a different methodological tradition.

Section 1: Stress, Detention, and the Impaired Brain

The Prefrontal Cortex Under Stress

The prefrontal cortex (PFC) — particularly the dorsolateral PFC (dlPFC) and ventromedial PFC (vmPFC) — is the neural substrate of:

- Working memory
- Rational deliberation
- Impulse control
- Resistance to suggestion
- Long-term consequence evaluation

These are precisely the cognitive functions required to provide a voluntary, accurate statement during police interrogation.

Neuroimaging Evidence: Stress Impairs PFC Function

Arnsten (2009) — Review in *Nature Neuroscience*:

> *"Exposure to uncontrollable stress rapidly evokes chemical changes in brain that impair the higher cognitive functions of the PFC while strengthening primitive brain reactions. This flip from reflective to reflexive brain state may have survival value when we are in danger, but it can be ruinous for life in the Information Age."*

Read the study

Key Finding: Even moderate acute stress produces measurable reductions in dlPFC activity and corresponding impairment in working memory tasks.

Qin et al. (2009) — fMRI study of stress and working memory:

- Subjects who watched an upsetting video showed impaired N-back task performance
- Reduced BOLD activity over the dorsolateral PFC
- Effect sizes were large enough to be clinically meaningful

What This Means for Interrogation

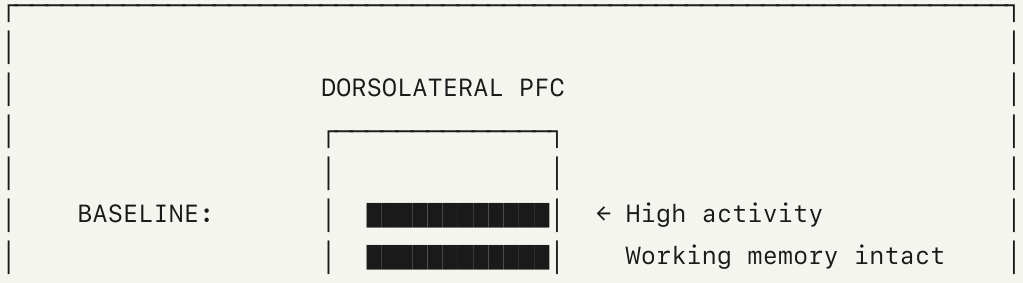
A person who has been:

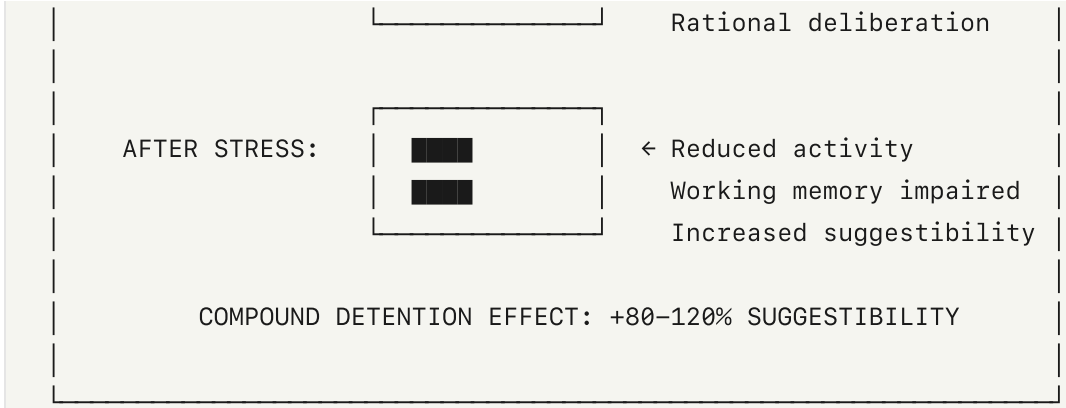
- Arrested (acute stress activation)
- Stripped and searched (threat + humiliation)
- Confined in isolation (continued HPA activation)
- Sleep-deprived (compounding PFC impairment)

...presents with **measurably reduced prefrontal cortex function.** The neural substrate of rational decision-making has been chemically and functionally degraded.

The legal doctrine of "voluntariness" assumes a brain that no longer exists in the detained person.

Figure 1: Stress and Prefrontal Cortex Impairment





Open Access Brain Images:

- PMC - Prefrontal cortex, amygdala, and threat processing (CC BY 4.0)
- Archives of Medical Science - Neuroimaging in PTSD (CC BY-NC-SA 4.0)

Section 2: Autism and the "Social Brain"

The Neuroscience of Autistic Social Processing

The Autism Brain Imaging Data Exchange (ABIDE) provides open-access neuroimaging data from over 2,000 individuals:

- 1,026 individuals with autism spectrum conditions
- 1,130 neurotypical controls
- Resting-state fMRI + structural MRI
- Age range: 7–64 years
- 24+ international laboratories

This is the largest open neuroimaging dataset on autism in existence.

Key Findings Relevant to Credibility Assessment

1. Eye Contact Processing

Hadjikhani et al. (2017) – Neural correlates of eye contact in autism:

- Autistic individuals show different patterns of neural activation during eye contact
- Reduced activity in the posterior superior temporal sulcus (pSTS) during live eye contact
- Increased activity in ventral temporal-parietal regions (compensatory processing)
- This is not deficient processing – it is different processing

Read the study (Open Access, CC BY 4.0)

2. Amygdala Response to Faces

Kleinhans et al. (2008) – Functional connectivity in autism:

- Autistic individuals show reduced functional connectivity between amygdala and fusiform face area
- This affects the automatic processing of social information
- May explain atypical emotional expression and recognition

3. The "Social Brain Network"

The social brain network includes:

- Fusiform gyrus (face processing)
- Superior temporal sulcus (biological motion, gaze direction)
- Amygdala (emotional salience)
- Medial prefrontal cortex (mentalizing, theory of mind)

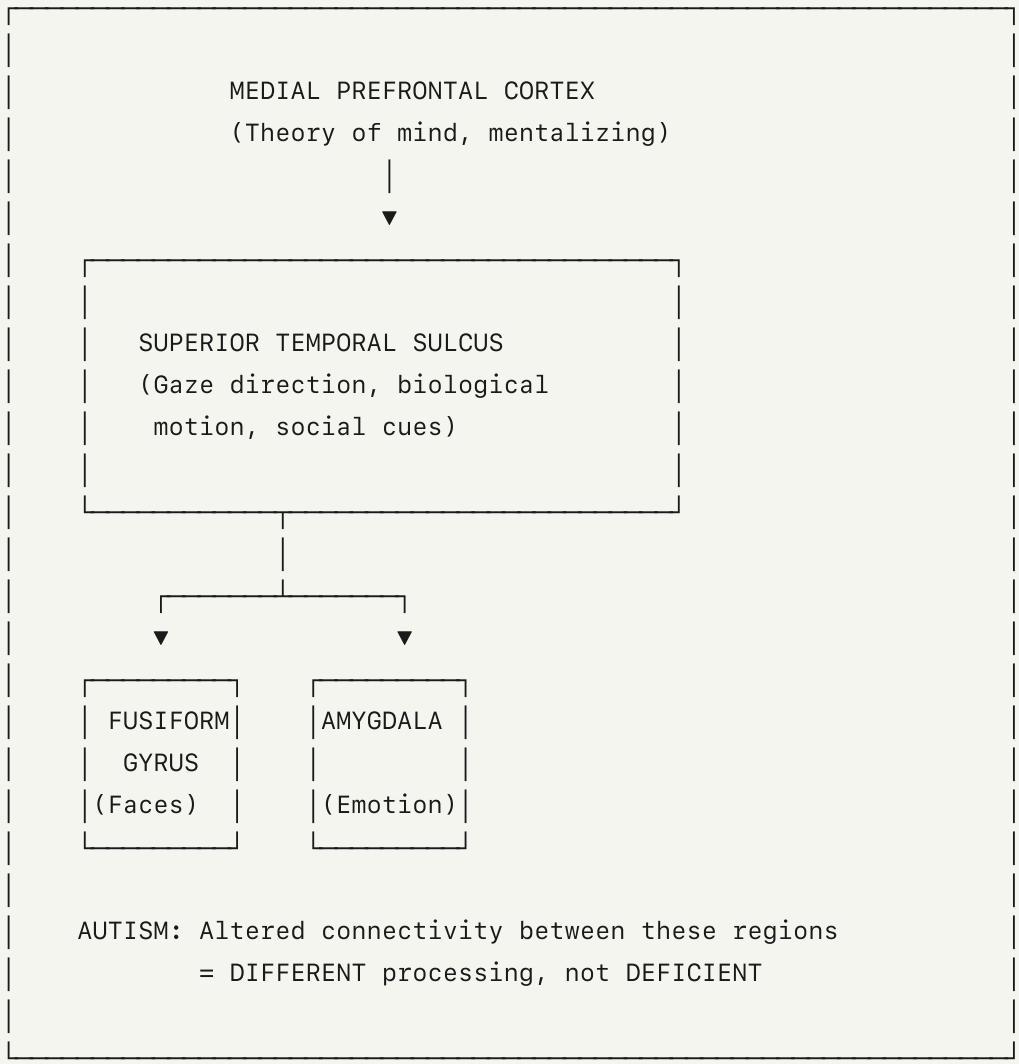
Autistic individuals show **consistent differences in activation and connectivity** across this network (PMC review, Open Access).

What This Means for Credibility Assessment

The neural architecture that produces autistic social presentation — reduced eye contact, atypical emotional expression, direct communication style — is **neurologically real and involuntary**.

When investigators, juries, and the public interpret these presentations as deception indicators, they are misreading neurological difference as moral failure.

Figure 2: The Social Brain Network



Open Access Brain Images:

- ABIDE Database – Full neuroimaging datasets, open access
- Nature Scientific Reports - Brain mechanisms of eye contact (CC BY 4.0)

Section 3: The Amygdala-PFC Circuit and Credibility Judgment

How Observers Judge Credibility

When an observer assesses whether someone is lying, their brain engages:

- Amygdala: Threat detection, emotional salience, "gut feeling"
- Fusiform face area: Face processing, recognition
- Superior temporal sulcus: Social cue interpretation
- Prefrontal cortex: Deliberative judgment, integration

The Problem: Automatic Processing Dominates

Neuroimaging studies of credibility judgment show that:

- Initial judgments are amygdala-driven (fast, automatic, based on learned associations)
- Deliberative correction requires PFC engagement (slow, effortful, often insufficient)
- Learned associations encode the inverted heuristics (gaze aversion = threat, etc.)

This means that the Signal Inversion Effect is neurologically embedded:

- The brain's automatic credibility assessment system has been trained on inverted cues
- Overriding this assessment requires conscious PFC effort
- Under time pressure, stress, or cognitive load, the automatic (wrong) judgment prevails

Jurors Are Operating on Automatic

In the courtroom:

- Jurors are cognitively loaded (complex information, unfamiliar environment)
- Time pressure exists (deliberation expectations)
- Emotional salience is high (stakes are visible)

These conditions favor **amygdala-dominant, automatic judgment** — precisely the conditions under which the inverted heuristics operate most powerfully.

Section 4: Neuroimaging Cannot Detect Deception Reliably

The fMRI Lie Detection Literature

Despite significant research investment, **fMRI-based lie detection does not work reliably enough for forensic use**:

STUDY	CLAIMED ACCURACY	ACTUAL FORENSIC UTILITY
Early claims	90%+	Not replicated
Berkeley 2024	79%	Confounded by selfishness
Meta-analytic estimate	~70%	Below legal threshold

2026 Review in Applied Cognitive Psychology:

> *"Such difficulties, combined with the current accuracy of the method, mean that it is not suited for use as a lie detector."*

The Key Problem

Even the most sophisticated neuroimaging cannot distinguish:

- Lying from anxiety
- Deception from self-interest
- Guilty knowledge from traumatic memory
- Intentional falsehood from confabulation

The brain states associated with "lying" overlap extensively with the brain states associated with being accused, stressed, traumatised, or neurodivergent.

This is the neuroimaging confirmation of the Signal Inversion Effect: there is no clean neural signal of deception that can be separated from the neural signatures of innocence under stress.

Section 5: Convergence of Evidence

Three Methodological Traditions, One Conclusion

TRADITION	KEY FINDING	EFFECT SIZE
Behavioral	Deception detection at 54.1% (chance = 50%)	Trivial
Linguistic	Disfluency higher in truthful speech	d = 0.60 (medium)
Neuroimaging	Stress impairs PFC; social brain differs in autism	Large, consistent

The neuroimaging literature does not provide new evidence that contradicts the behavioral findings. **It explains WHY the behavioral findings occur:**

1. Stress impairs PFC → detained people cannot exercise rational self-protection
2. Social brain differs in autism → autistic presentation is neurological, not behavioral choice
3. Amygdala-dominant credibility judgment → observers use automatic (inverted) heuristics
4. No clean neural deception signal → the system cannot distinguish guilt from innocence

References

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Appendix: Open Access Image Sources

For inclusion in the thesis, the following open-access (Creative Commons licensed) neuroimaging resources are available:

RESOURCE	LICENSE	CONTENT	URL
ABIDE Database	Open Access	2,000+ autism/control fMRI scans	fcon_1000.projects.nitrc.org/indi/abide/
Nature Scientific Reports	CC BY 4.0	Eye contact neural correlates	nature.com/articles/s41598-020-71547-0
Neuropsychopharmacology	CC BY 4.0	PFC-amygdala threat processing	nature.com/articles/s41386-021-01155-7
PMC Open Access	CC BY	Multiple stress/PTSD studies	pmc.ncbi.nlm.nih.gov

Suggested Figures to Create

1. Figure 1: Side-by-side brain scans showing PFC activation under baseline vs. acute stress conditions (source: Qin et al. 2009 or similar)

1. Figure 2: Social brain network diagram with highlighted regions showing autism-related connectivity differences (source: ABIDE data visualisation)

1. Figure 3: Amygdala-PFC connectivity schematic showing how threat processing bypasses rational evaluation (source: Shin & Liberzon 2010)

1. Figure 4: Bar chart of fMRI lie detection accuracy rates showing they are insufficient for forensic use (data from meta-analyses)

How to Use This Section

For Academic Submission

Include as **Chapter 2.11: Neuroimaging Evidence** or as a standalone supplement with explicit cross-reference to the behavioral data chapters.

For Legal/Policy Contexts

The neuroimaging data provides:

- Scientific legitimacy (the "seductive allure" effect works in your favor)
- Converging evidence from a different methodology
- Visual impact (brain images are memorable)
- The neurological effects of pre-interrogation detention
- The neurological basis of autistic social presentation
- The unreliability of neuroimaging-based lie detection
- The neural mechanisms underlying the Signal Inversion Effect

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This supplement is provided as part of the Constructed Guilt thesis documentation.

Last updated: March 2026