LOG ID	BOOK REFERENCE	RCT FILTER	CONFIDENCE TIER
SEC 12.1.3	CHAPTER 12: DATA SOVEREIGNTY & GLOBAL OS (Production Environment)	OFF	CONSENSUS

AUDITED CLAIM

BASE-LEVEL PHYSICS (QUANTUM ARCHITECTURE)

SYSTEMS MODEL — AS STATED IN THE BOOK

> Clinically, human conscious **sensory processing** is severely bottlenecked; the brain actively suppresses vast amounts of incoming data through **attentional filtering** and constructs simplified, inferred perceptual models of reality to manage cognitive load.

VALIDATION QUERY

Is human conscious sensory processing restricted to a fundamentally low informational bandwidth, requiring the brain to heavily filter inputs and construct simplified perceptual boundaries?

EMPIRICAL FINDING

Current cognitive neuroscience models establish that human conscious **sensory processing** is highly selective and severely bottlenecked. To manage massive data inputs, the brain relies on heavy **attentional filtering** and active inference to construct simplified, functional perceptual models of reality.

PRIMARY ANCHORS

→ **Dehaene & Changeux, 2011, Neuron**

→ **Tombu et al., 2011, Proceedings of the National Academy of Sciences**

ABOUT THIS RECORD

Each claim in the book is decompiled from its IT metaphor into a naked, falsifiable scientific claim, then anchored to a **primary peer-reviewed source**. Claim and anchor are queried against the Consensus academic database (200M+ papers) under a fixed protocol — top-tier **Q1/Q2 journals only**, preprints excluded, human studies only. If a hypothesis fails the audit, the build is rejected: the AI generates the syntax; the peer-reviewed grid validates the physics.

CONFIDENCE TIERS

- **CONSENSUS ◀ this log** — broadly established, highly replicated mechanics.
- **EMERGING** — plausible, actively researched; no universal consensus yet.
- **EXPERIMENTAL** — contested, extrapolated, or purely theoretical.

RCT FILTER — Controlled Studies is ON for interventions (a forced action must beat a control) and OFF for mechanisms (so foundational neuroscience isn't blocked).

Yes, **conscious sensory processing is capacity-limited**, but not by one fixed **low-bandwidth** bottleneck.

1. Introduction

Human conscious sensory processing is capacity-limited and heavily filtered, but the literature does not support a single simple claim that consciousness is restricted by one fundamental low-bandwidth channel. Instead, the strongest evidence points to multiple interacting bottlenecks: selective attention, recurrent cortical processing, thalamocortical and insular gating, working-memory limits, and state-dependent oscillatory dynamics that determine which inputs are amplified into reportable experience and which remain unperceived. Early sensory responses often survive without awareness, while conscious access typically appears later and depends on broader integration across cortical and subcortical networks (Mashour et al., 2020; Huang et al., 2021; Marois & Ivanoff, 2005).

The “filtering” part of the question is therefore well supported. Attention suppresses unattended input, alpha activity tracks inhibitory selection, and dual-task or attentional-blink paradigms reveal severe limits on what can be consciously encoded at once (Tombu et al., 2011; Händel et al., 2011; Marois & Ivanoff, 2005). The “simplified perceptual boundaries” part is only partly supported. Predictive and integrative accounts argue that perception is an inferred, organized representation rather than a raw copy of the world, and temporal binding work shows that perception groups continuous input into discrete events, but evidence against rigid discretization is substantial and some proposed oscillatory boundary mechanisms remain contested (Olcese et al., 2018; Walsh et al., 2020; Ronconi & Melcher, 2017; Buergers & Noppeney, 2022).

Is human conscious sensory processing restricted to a fundamentally low informational bandwidth, requiring the brain to heavily filter inputs and construct simplified perceptual boundaries?
Requires at least 5 papers that directly answer your question. Try adjusting your query to find more papers.

FIGURE 1 Research consensus on conscious sensory bandwidth limits

The meter should be read as a qualified yes. There is broad agreement that conscious access is selective, bottlenecked, and shaped by active filtering, but less agreement that this reflects one fundamental bandwidth constant or that perceptual boundaries are always strongly simplified in the same way across tasks and states (Luppi et al., 2019; Mudrik & Deouell, 2022).

2. Methods

This Deep Search ran over more than 170 million research papers indexed in Consensus, including Semantic Scholar, PubMed, and related scholarly sources. The workflow identified 77,710 directly matching papers, expanded citation networks from seed papers, and screened a broader relevance set using multiple query families covering bottlenecks, filtering, gating, predictive processing, attention, and perceptual boundaries.

From 229 screened papers, 167 were judged eligible by machine-learned relevance filtering, and the top 50 were included for synthesis. The corpus intentionally mixed foundational theory reviews, no-report consciousness paradigms, EEG/MEG timing studies, intracranial recordings, psychophysics, and computational perspectives.

Search Strategy

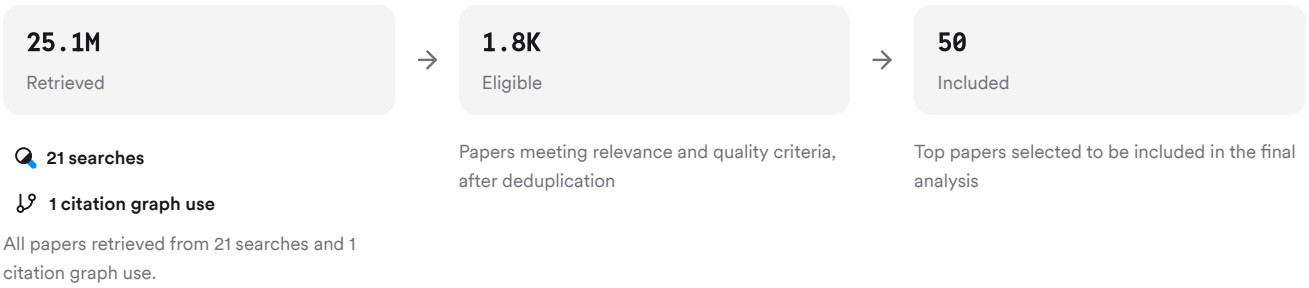

FIGURE 2 Deep search screening and inclusion workflow

Searches targeted bandwidth limits, conscious access, filtering, gating, predictive inference, temporal binding, and cross-modal generalization in human studies.

3. Results

3.1 Key Papers

A small set of papers anchors the corpus because they define the dominant empirical frame: conscious access is later than early sensory encoding, requires recurrent or global integration, and is capacity-limited by attention and central bottlenecks (Mashour et al., 2020; Dehaene & Changeux, 2011; Marois & Ivanoff, 2005).

Paper	Summary
(Huang et al., 2021)	Late ignition supports conscious access (Mashour et al., 2020)
(Händel et al., 2011)	Conscious perception integrates over time (Dehaene & Changeux, 2011)
(Dehaene & Changeux, 2011)	Brain shows severe capacity bottlenecks (Marois & Ivanoff, 2005)

FIGURE 3 Foundational papers anchoring the included literature

3.2 Filtering And Bottlenecks

Across paradigms, the literature strongly supports the idea that the brain filters more input than reaches awareness. Attention selects relevant signals and suppresses distractors, with alpha oscillations linked to functional inhibition of unattended input (Gilbert & Sigman, 2007; Händel et al., 2011). Dual-task and attentional-blink work identifies bottlenecks that impair conscious perception, short-term retention, and action selection, with convergent evidence for common frontoparietal and prefrontal limitations (Marois & Ivanoff, 2005; Tombu et al., 2011).

Dimension	Attention-Based Filtering	Central Bottleneck	Citations
Main function	Select relevant input	Limit serial access	(De Santana Correia & Colombini, 2021; Tombu et al., 2011)
Neural correlate	Alpha-linked inhibition	Prefrontal bottleneck	(Händel et al., 2011; Tombu et al., 2011)

Dimension	Attention-Based Filtering	Central Bottleneck	Citations
Behavioral signature	Worse unattended detection	Dual-task interference	(Händel et al., 2011; Tombu et al., 2011)
Level affected	Sensory selection	Perception and action	(Van Moorselaar & Slagter, 2019; Tombu et al., 2011)

Key difference: filtering can occur early and selectively, whereas central bottlenecks constrain later conscious encoding and flexible action.

3.3 Constructed Perception

Perception is not treated in this corpus as a literal readout of incoming energy. Predictive coding accounts argue that conscious experience reflects inferred causes of sensory input rather than exact physical features, making illusions and misperceptions expected rather than exceptional (Olcese et al., 2018). Reviews of predictive processing similarly describe perceptual experience as assembled from noisy, ambiguous signals using prior knowledge and descending predictions, although the neurophysiological evidence for strong predictive claims remains incomplete (Walsh et al., 2020).

At the same time, simplification is not equivalent to impoverishment. Multisensory integration and working-memory multiplexing show that perception can combine signals across modalities and maintain remembered and incoming information in parallel under some conditions (Stein et al., 2019; Rademaker et al., 2019). Ecological adaptation work also shows that local sensory operators can tune to large-scale environmental statistics that exceed the nominal bandwidth of local detectors (Neri, 2024).

3.4 Boundaries, Timing, And Gating

Several papers support the idea that conscious perception is segmented by timing windows and gating thresholds rather than continuously mirroring all input. Conscious access often emerges after 200 ms or later, and perception can integrate information over roughly 100 ms or more (Mashour et al., 2020; Dehaene & Changeux, 2011). Sensory entrainment studies show that temporal segregation can be shifted by theta/alpha-range oscillatory dynamics, suggesting that perception samples or groups information in discrete windows (Ronconi & Melcher, 2017).

Yet the boundary story is mixed rather than settled. One high-quality null study found that prestimulus alpha frequency did not affect two-flash temporal binding, directly challenging strong claims that alpha sets perceptual event boundaries (Buergers & Noppeney, 2022). Other work instead points to aperiodic excitation-inhibition balance and sensory noise as contributors to temporal resolution (Deodato & Melcher, 2023).

Results Timeline

Conscious sensory processing research has moved from bottlenecks to network gating and theory tests.

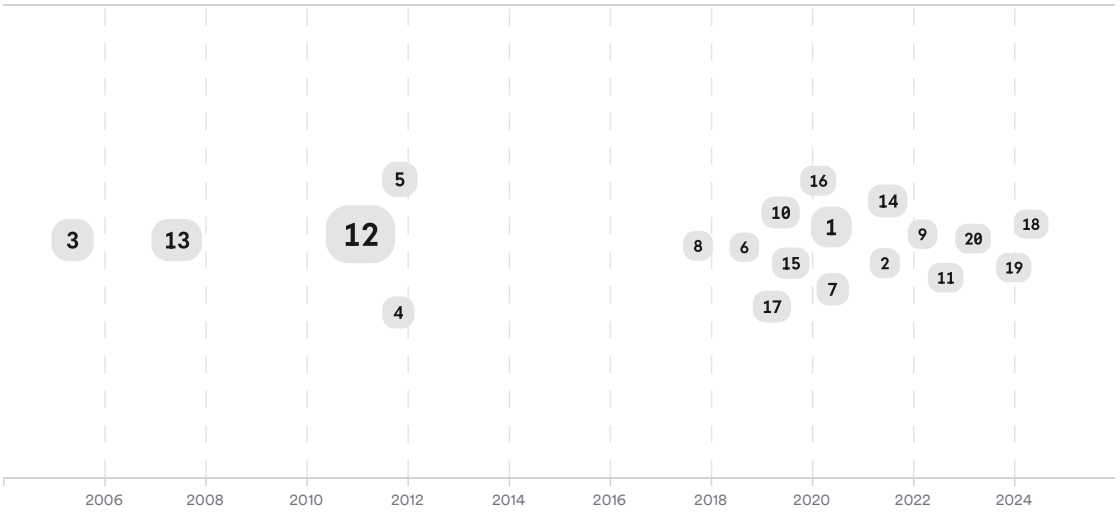

FIGURE 4 Timeline of consciousness studies; larger markers indicate more citations

The arc runs from early demonstrations of capacity limits and late conscious access to more recent no-report, intracranial, and adversarial-theory studies. Recent work broadens the picture from cortical broadcasting alone to distributed cortical-subcortical gating and state-dependent network control (Kronemer et al., 2022; Ferrante et al., 2025).

Top Contributors

Within this corpus, authors associated with global workspace, no-report paradigms, and capacity-limit research appear most often.

Type	Name	Papers
Author	S. Dehaene	[a5c9ef9cbcba5284b17d2b25870812f7][c9c22cf09ae35f3691c016590c2e9f43] [b17d470ecfd55367b83c242ec201e219]
Author	G. Mashour	[a5c9ef9cbcba5284b17d2b25870812f7][0dc03e9b82875361b133165f8750a5ed]
Author	M. A. Pitts	[b17d470ecfd55367b83c242ec201e219][eb25365f94cc5039ac1f04b1b0c99ac4] [9714db6b9b235136831c13e575a459a5]
Journal	*Neuron*	[a5c9ef9cbcba5284b17d2b25870812f7][c9c22cf09ae35f3691c016590c2e9f43] [06b39d2550b55a23be9a18a419ba265e]
Journal	*Nature Communications*	[73bda9341c3e530989ccabd18da4e490][4b272e1ce7545e0ab1ff97714887f562] [3715d30d4a705bb791f7a19d2fd8bd7a]
Journal	*The Journal of Neuroscience*	[5838c1d0a51356faa3c97dd8ed7e11ac][f9b520aa763d51ad860672566f0326cb] [04874dcc00805eaa92f944bed8c2f307]

FIGURE 5 Authors and journals appearing most in corpus

4. Discussion

The strongest consensus is that conscious sensory access is selective and resource-limited, not that the sensory brain as a whole has uniformly low information capacity. The distinction matters because many studies show extensive unconscious or preconscious processing that survives without report, including preserved early sensory responses, category-level processing, and local recurrent processing under some forms of inattention (Mashour et al., 2020; Mudrik & Deouell, 2022; Noorman et al., 2025). Consciousness therefore seems to reflect a second-stage restriction on globally available, behaviorally flexible information rather than a blanket failure of early sensory encoding (Dehaene & Changeux, 2011; Huang et al., 2021).

The corpus is also increasingly hostile to simple single-locus models. No-report and intracranial studies implicate widespread cortical-subcortical systems, including thalamus, insula, salience networks, and frontoparietal loops (Kronemer et al., 2022; Fang et al., 2025; Christison-Lagay et al., 2025). At the same time, adversarial tests show that both GNW and IIT capture parts of the data while failing key predictions, so no dominant theory yet fully explains how filtering, integration, and conscious content fit together (Ferrante et al., 2025).

Evidence for “constructed boundaries” is moderate rather than definitive. Predictive and filling-in frameworks support the claim that phenomenology can diverge from raw stimulus structure (Olcese et al., 2018; Levinson & Baillet, 2022). But strong claims that perception is discretized by a single oscillatory clock are weakened by mixed alpha findings and by evidence that expectations often act post-perceptually rather than by changing early sensory coding (Buergers & Noppeney, 2022; Rungratsameetaweemana et al., 2018).

Claim	Evidence Strength	Reasoning	Papers
Conscious access is capacity-limited and selective	 Strong	Replicated across attention, dual-task, and access studies	(Marois & Ivanoff, 2005; Tombu et al., 2011)
Early sensory processing often survives without awareness	 Strong	Reportable awareness dissociates from initial sensory responses	(Mashour et al., 2020; Palva et al., 2005; Christison-Lagay et al., 2025)
Conscious perception is constructed by inference and integration	 Moderate	Strong theoretical and some empirical support, but mechanisms remain debated	(Olcese et al., 2018; Walsh et al., 2020; Canales-Johnson et al., 2019)
Perceptual boundaries are discretized by alpha rhythms	 Weak	Positive entrainment evidence coexists with direct null findings	(Ronconi & Melcher, 2017; Buergers & Noppeney, 2022)
A single universal bottleneck explains consciousness	 Weak	Data favor multiple gating sites and mechanisms	(Huang et al., 2021; Fang et al., 2025; Ferrante et al., 2025)

FIGURE 6 Key claims and supporting evidence in corpus

5. Conclusion

The literature supports a qualified yes: human conscious sensory processing is strongly limited, filtered, and selectively organized, but not by one simple low-bandwidth pipe. Early sensory systems can encode more than reaches awareness, and consciousness appears when selected information is gated, integrated, stabilized, and made globally or at least widely available for flexible use (Dehaene & Changeux, 2011; Kronemer et al., 2022).

Research Gaps

The main unresolved issue is not whether filtering exists, but which filtering mechanisms are necessary for consciousness across tasks, modalities, and states.

Topic/Outcome	RCT-like causal perturbation	No-report paradigms	Cross-modal generalization	Long-timescale naturalistic tests
Thalamic and insular gating	2	3	2	GAP
Oscillatory boundary formation	4	1	2	1
Predictive construction of percepts	2	1	2	3
Sensory capacity under natural behavior	1	GAP	2	1

Open Research Questions

Future work needs to test the same claim across perturbation, naturalistic, and no-report designs.

Question	Why
Which neural gate is most necessary for conscious access across vision, audition, and touch: thalamus, insula, or frontoparietal recurrence?	Current studies implicate all three, but mostly in modality-specific or state-specific designs.
Do temporal perceptual boundaries arise from oscillatory sampling, aperiodic excitation-inhibition balance, or both?	Positive alpha entrainment findings and null alpha-binding results currently support competing mechanisms.
How much sensory detail is represented nonconsciously during natural, continuous behavior?	Most evidence comes from threshold or masking tasks rather than ecologically realistic environments.

In sum, conscious sensory processing is clearly filtered and bottlenecked, but the evidence favors dynamic multi-stage selection over a single fundamentally low-bandwidth conscious channel.

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