COG250 Test 2 Prep: Cheat Sheet

Short Answer Concepts (Choose 4 of 10)

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1) Optical Acceleration Cancellation (OAC)

Definition

OAC is a control strategy where an agent keeps the rate of change of an object's visual angle (its optical acceleration) at or near zero in order to successfully intercept or avoid it, instead of computing an internal trajectory.

Importance

Shows how skilled action can rely on continuous sensorimotor coupling and real-time information rather than stored internal models, supporting a dynamical, embodied picture of cognition.

Possible Criticism / Connection

- *Criticism*: OAC does not obviously generalize to abstract reasoning or offline cognition where there is no immediate perceptual feedback.
- *Connection*: Links nicely to sensorimotor loops and self-organization as examples of real-time control without central symbolic planning.

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2) Self-Organization

Definition

Self-organization is the emergence of stable patterns or behavior in a system through local interactions among its components, without a central controller micromanaging every step.

Importance

Dynamical systems and embodied approaches use self-organization to explain how coordinated behavior, perception, or cognition can arise from brain-body-world interactions rather than explicit programs.

Possible Criticism / Connection

- *Criticism*: "Self-organization" can be used too loosely; without quantitative models it risks becoming a vague label for "complex stuff happens".
- *Connection*: Central to dynamical systems accounts of cognition and ties directly into the essay on "Dynamical Systems and Cognition".

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3) Constructed Theory of Emotions (Lisa Feldman Barrett)

Definition

The constructed (constructionist) theory says emotions are not hard-wired modules, but dynamically constructed from core affect, bodily states, prior experience, and conceptual / linguistic categories.

Importance

This view fits an embodied, distributed model of emotion where body, brain, and context jointly generate emotional episodes over time, challenging simple "one brain region = one emotion" models.

Possible Criticism / Connection

- *Criticism*: Some worry it underplays relatively stable affective patterns or makes emotions look "too arbitrary".
- *Connection*: Strong evidence case for the "Role of the Body in Cognition" essay, and for the idea that language as a cognitive tool partly builds emotional categories.

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4) Cognitive Offloading

Definition

Cognitive offloading is the practice of using the body or environment (notes, diagrams, tools, phone, gestures) to reduce internal cognitive load and support memory, attention, or problem solving.

Importance

Clark's slogan "we make the world smart so we can be dumb in peace" captures how offloading shows cognition as distributed across brain, body, and world, not confined inside the skull.

Possible Criticism / Connection

- *Criticism*: Heavy offloading (e.g., constant smartphone use) may undermine capacities like working memory, self-insight, or tolerance for boredom.
- *Connection*: Central to extended mind, cognitive technology, and natural-born cyborgs.

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5) Extended Mind

Definition

The extended mind thesis (Clark & Chalmers) claims that parts of the environment (like notebooks, phones) can literally be parts of a cognitive system when they are reliably integrated and play the same functional role as internal processes.

Importance

It challenges "brain chauvinism" by arguing that, in cases like Otto's notebook, the external resource is part of remembering, not merely a helpful aid, pushing cognitive science to study brain-tool systems.

Possible Criticism / Connection

- *Criticism*: Worries about "cognitive bloat" – if any useful tool is part of cognition, the mind seems to sprawl uncontrollably.
- *Connection*: Parity principle is the key argument form; glue and trust are the constraints that keep the view scientifically disciplined.

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6) "Glue" and "Trust" (in Extended Cognition)

Definition

"Glue and trust" are Clark's informal conditions specifying when an external resource counts as genuinely cognitive: the brain must be glued to it via fast, reliable access, and must trust it enough to treat it as automatic and taken-for-granted, like internal memory.

Importance

They help avoid cognitive bloat by distinguishing a random tool from a resource that is so well-

integrated that the system uses it as if it were internal.

Possible Criticism / Connection

- *Criticism*: "Glue" and "trust" are somewhat qualitative; critics ask for sharper, testable criteria.
- *Connection*: Directly operationalizes the extended mind thesis and supports the "Natural-Born Cyborgs" essay.

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7) Parity Principle

Definition

The parity principle says: if an external process plays the same functional role in a task as an internal process would, we should treat it as part of the cognitive process unless there is a good reason not to.

Importance

It is the core argumentative move for extended mind: in Tetris or the Otto-Inga example, external operations can be "on a par" with internal computation.

Possible Criticism / Connection

- *Criticism*: Some argue parity is too liberal and does not respect important differences between neural and non-neural processes.
- *Connection*: Use it in any answer on extended mind or natural-born cyborgs, especially when contrasting with traditional, brain-bounded models.

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8) Sensorimotor Loops

Definition

Sensorimotor loops are continuous cycles in which action changes sensory input, which in turn guides further action, creating a closed feedback loop between organism and environment.

Importance

They exemplify the dynamical, embodied view: cognition is not passive input followed by inner processing, but ongoing sensorimotor engagement where control is distributed across body and

world.

Possible Criticism / Connection

- *Criticism*: By itself, a sensorimotor story may not explain abstract, offline reasoning or language.
- *Connection*: Good bridge term between dynamical systems, embodiment, OAC, and self-organization.

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9) Language as a Cognitive Tool

Definition

Language is treated not just as a way to communicate, but as a cognitive technology: labels, inner speech, and external symbols that restructure attention, memory, and problem spaces.

Importance

Mark emphasizes language as "augmented reality" and "thinking about thinking" – material symbols let us categorize, rehearse, reframe, and plan in ways that simpler animals cannot.

Possible Criticism / Connection

- *Criticism*: Risk of human-exceptionalism; must be careful not to ignore rich non-linguistic cognition in animals.
- *Connection*: Crucial for the "body in cognition" essay (gesture, self-talk), and for extended mind, since writing and notation systems are paradigmatic cognitive extensions.

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10) Subsumption Architecture

Definition

Subsumption architecture (Brooks-style robots) uses layered, simple behavior modules (e.g., avoid obstacles, wander, explore) that directly couple perception to action, where higher layers subsume lower ones, without a central world model.

Importance

It is an alternative to classical symbolic AI: intelligence can emerge from layered sensorimotor

routines rather than internal representations of the whole world, supporting an embodied, dynamical approach.

Possible Criticism / Connection

- *Criticism*: Pure subsumption may struggle with long-term planning, language, or abstract reasoning.
- *Connection*: Great for the "Dynamical Systems and Cognition" essay as a concrete alternative to GOFAI; also pairs well with self-organization and sensorimotor loops.

Essay Frameworks

Essay 1: Dynamical Systems and Cognition

Prompt: Explain how Dynamical Systems Theory provides an alternative to earlier computational models of cognition. Does it provide a better explanation of minds like ours?

Key Concepts to Use

- OAC, sensorimotor loops, self-organization, subsumption architecture

Essay Skeleton

1. **Paragraph 1 – The Problem**: Contrast classical computational/representational picture (mind as a symbol-processing computer) with dynamical systems approaches (continuous time, state spaces, trajectories)
2. **Paragraph 2 – Example 1: Real-Time Control**: OAC and sensorimotor loops as examples of real-time control without stored plans; the agent couples to the environment continuously
3. **Paragraph 3 – Example 2: Alternative Architecture**: Self-organization and subsumption architectures as alternative design principles (layered behaviors, emergent stability; no central world model needed)
4. **Paragraph 4 – Evaluation**: Dynamical approaches are better for online control and embodiment, but may need supplementation for language, abstract thought, and long-term planning

Thesis Example

"While dynamical systems theory successfully explains real-time sensorimotor cognition through self-organization and continuous feedback, it faces challenges explaining abstract reasoning and symbolic

thought, suggesting a hybrid rather than purely dynamical view is most plausible."

Essay 2: The Role of the Body in Cognition

Prompt: Critically evaluate the role of the body in shaping cognition. How does the embodied approach to cognition differ from earlier computational and representational models?

Key Concepts to Use

- Constructed theory of emotions, sensorimotor loops, OAC, embodied memory, language as cognitive tool, gesture

Essay Skeleton

1. **Paragraph 1 – The Shift**: Earlier computational models treated body as peripheral "input device" and "output device"; embodied approaches treat body as constitutive of cognition itself
2. **Paragraph 2 – Emotions as Embodied**: Emotions and slow bodily dynamics (heart, breathing, gut) as part of the cognitive process, not just outputs; Lisa Feldman Barrett's constructed theory as key evidence
3. **Paragraph 3 – Action-Oriented Perception**: "Brains are made for acting" – sensorimotor loops, OAC, and the dorsal/ventral distinction show perception is shaped by action capacities
4. **Paragraph 4 – Language and Gesture**: Language and gesture as bodily tools that shape attention and problem solving; self-talk in sports, labels restructuring problem spaces
5. **Paragraph 5 – Evaluation**: Body is clearly central, but we still need some representational / computational resources for certain tasks (language, planning); a nuanced embodied-but-not-purely-embodied view

Thesis Example

"The body is not merely a vehicle for the brain but a constitutive part of cognitive systems, as shown by emotion theory, sensorimotor coupling, and language's embodied origins; however, the brain's representational capacities also remain essential for abstract thought."

Essay 3: Natural-Born Cyborgs

Prompt: Discuss the concept of humans as "natural-born cyborgs." How do technologies function as cognitive extensions, and what are the implications for how we define cognition?

Key Concepts to Use

- Cognitive offloading, extended mind, glue and trust, parity principle, language as cognitive tool, memory / smartphone examples

Essay Skeleton

1. **Paragraph 1 – The Core Claim**: Explain "natural-born cyborgs" and Clark's idea that humans routinely integrate tools into their cognitive routines; we are not unique in using tools, but we do so "promiscuously"
2. **Paragraph 2 – Offloading Mechanisms**: Cognitive offloading – notebooks, signage, phones, Fitbits; world as "its own best model"; examples like ant pheromone trails and human "externalisms"
3. **Paragraph 3 – Extended Mind Formalized**: Extended mind, parity principle, and the Otto-Inga notebook case; glue and trust as constraints that distinguish real cognitive extensions from mere aids
4. **Paragraph 4 – Benefits and Costs**: Upsides (new cognitive powers, distributed reasoning, cultural inheritance); downsides (attention fragmentation, reduced self-insight, privacy concerns, over-reliance on smartphones)
5. **Paragraph 5 – Implications for Cognition**: Conclusion – "cyborg" is not sci-fi but a good description of ordinary human cognition in a technological niche; redefines mind as brain-body-world system

Thesis Example

"Humans are natural-born cyborgs whose minds extend into tools and technologies via cognitive offloading and the parity principle, yet the benefits of this cognitive expansion come with costs to autonomy and self-knowledge that demand careful design and ethical reflection."

Quick Reference: Which Concepts Fit Which Essays?

Concept	Essay 1	Essay 2	Essay 3
OAC	✓✓	✓	

Self-Organization	✓✓		
Constructed Theory of Emotions		✓✓	
Cognitive Offloading		✓	✓✓
Extended Mind			✓✓
Glue & Trust			✓✓
Parity Principle			✓✓
Sensorimotor Loops	✓✓	✓✓	✓
Language as Cognitive Tool	✓	✓✓	✓
Subsumption Architecture	✓✓		

General Test Strategies

For Short Answers (Choose 4 of 10)

1. **Start with the definition** – be precise, cite the author/framework
2. **Explain importance** – why does this concept matter to cognitive science? How does it challenge or support key debates?
3. **Add a hook** – offer either a novel criticism (what are the limits?) or a novel connection (how does this relate to other course concepts?)
4. **Be concise** – aim for 4-6 sentences per answer; clarity over length

For Essays

1. **Formulate a clear thesis** – not just a topic statement, but an argument (e.g., "X is better than Y because Z")
2. **Use your short answer concepts as mini-arguments** – each paragraph should plug in one or two concepts to build your larger case
3. **Include concrete examples** – not just abstract definitions; Otto's notebook, Fitbit data, sensorimotor loops in baseball catching
4. **Address counterarguments** – show you know the limits (e.g., dynamical systems can't fully

explain language)

5. **Conclude with implications** – what does this mean for how we think about minds?

General Reminders

- **Professional language** – avoid casual phrasing; use "suggests," "indicates," "demonstrates" rather than "basically" or "like"
- **Draft ruthlessly** – first drafts should be "embarrassing"; revise multiple times
- **Connect back to course themes** – the big picture is brain-body-world integration, not brain-bounded computation
- **No plagiarism** – paraphrase lectures and readings; cite when you use exact phrases

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Good luck on the test! Remember: clarity of thought is more important than fancy language.