Cross-Check
As you learned in the Prologue, reviewing and overlearning of material are important to the learning process. After you have written the definitions of the key terms in this chapter, you should complete the crossword puzzle to ensure that you can reverse the process—recognize the term, given the definition.

ACROSS
1. Example of motivated forgetting.
4. Sensory memories of auditory stimuli.
6. Encoding of information according to its meaning.
7. Activating associations in order to retrieve a specific memory.
11. Mental pictures.
14. Believed to be the neural basis for learning and memory.
19. Organizing material into familiar, meaningful units.
20. Unusually vivid memory of an emotionally important moment.
22. Effortful repetition of information.

DOWN
1. A measure of retention that requires identifying previously learned material.
2. The immediate, initial recording of information in memory.
3. An effect in which eyewitnesses to an event incorporate misleading information in their memories.
4. Type of processing that requires attention and some degree of work.
5. Brain area that processes explicit memories for storage.
8. Type of memory of skills, preferences, and dispositions.
9. Memory aids.
10. Encoding of information into memory according to its sound.
12. Unconscious encoding of incidental information into memory.
13. Type of interference in which old knowledge interferes with new learning.
16. Relatively permanent memory that is unlimited in capacity.
17. Encoding that uses imagery to process information into memory.
18. The false sense of having already experienced a situation.

ANSWERS
Chapter Review
The Phenomenon of Memory and Studying Memory: Information-Processing Models
1. memory
2. information-processing; encoding; storage; retrieval; connectionism; neural networks
3. three-stage processing; sensory memory; short-term; encoded; long-term
4. directly; automatically; conscious
5. working; active; stimuli; long-term

Encoding: Getting Information In
1. automatic processing; practice
Automatic processing includes the encoding of information about space, time, and frequency. It also includes well-learned information, such as words in your native language.
2. effortful processing
3. rehearsal
4. Hermann Ebbinghaus; fewer; overlearning
5. spacing effect
6. serial position effect
7. recency; better; primacy
8. semantic; acoustic; visual
9. semantic; self-reference
10. imagery
11. better
12. semantically; visually
13. rosy retrospection
14. mnemonic
15. peg-word
16. chunks; acronym
17. hierarchies

Storage: Retaining Information
1. sensory
2. about half; more; iconic
3. echoic; less; 3 or 4 seconds
4. rehearsal; active
5. 7; George Miller
6. digits; letters; better
7. 2
8. unlimited (limitless)
9. Karl Lashley; cortexes; remembered
10. memory trace; synapses
11. serotonin
12. less; receptor sites; long-term potentiation; drug; enzyme; LTP; faster
13. will not; will
14. facilitate
15. amygdala; limbic
16. disrupt
17. flashbulb; can
18. amnesia; is not
19. have not; implicit; are not; explicit
20. hippocampus; explicit; verbal; visual; spatial

Retrieval: Getting Information Out
1. recall
2. recall; recognize
3. relearn; more
4. encode
5. priming
6. the same

The déjà vu experience is most likely the result of being in a context similar to one that we have actually been in before. If we have previously been in a similar situation, though we cannot recall what it was, the current situation may present cues that subconsciously help us to retrieve the earlier experience.

7. state-dependent
8. mood-congruent

When happy, for example, we perceive things in a positive light and recall happy events; these perceptions and memories, in turn, prolong our good mood.

9. rejecting, punitive, and guilt-promoting; have never suffered depression

Forgetting
1. forget
2. forgetting; distortion; intrusion
3. encoding
4. enters the memory system
5. encoding; less
6. soon
7. storage decay; memory trace
8. retrieval
9. interference
10. proactive interference; retroactive interference
11. better
12. positive transfer
13. repression
14. less
Memory Construction

1. construction
2. misinformation effect; can; imagination inflation; vivid imaginations

When people viewed a film of a traffic accident and were quizzed a week later, phrasing of questions affected answers; the word "smashed," for instance, made viewers mistakenly think they had seen broken glass.
3. source amnesia; misattribute
4. cannot
5. does not; details; durable
6. is not
7. hypnosis
8. are; questioned
9. neutral; nonleading
10. are not
11. 3; infantile amnesia

Improving Memory

1. Survey; Question; Read; Rehearse; Review

Suggestions for improving memory include rehearsing material over many separate and distributed study sessions with the objective of overlearning material. Studying should also involve making the material meaningful rather than mindlessly repeating information. Using mnemonic devices that incorporate vivid imagery is helpful, too. Frequent activation of retrieval cues, such as the context and mood in which the original learning occurred, can also help strengthen memory. Studying should also be arranged to minimize potential sources of interference. And, of course, sleep more, so the brain has a chance to organize and consolidate information. Finally, self-tests in the same format (recall or recognition) that will later be used on the actual test are useful.

Progress Test 1

Multiple-Choice Questions

1. d. is the answer. Information must be encoded, or put into appropriate form; stored, or retained over time; and retrieved, or located and gotten out when needed. (p. 328)

2. a. is the answer. Iconic memory is our fleeting memory of visual stimuli. (p. 337)
b. Echoic memory is auditory sensory memory.
c. There is no such thing as photomemory.
d. Semantic memory is memory for meaning, not a form of sensory memory.

3. d. is the answer. Echoic memories last 3 to 4 seconds. (p. 338)

4. d. is the answer. Retrieval refers to the process of remembering. (pp. 328, 345)

5. c. is the answer. (p. 338)

6. d. is the answer. (pp. 335, 336)
   a. There is no such term as "consolidation techniques."
   b. & c. Imagery and encoding strategies are important in storing new memories, but mnemonic device is the general designation of techniques that facilitate memory, such as acronyms and the peg-word system.

7. d. is the answer. (p. 336)
   a. There is no such process of "consolidating."
   b. Organization does enhance memory, but it does so through hierarchies, not grouping.
   c. Encoding refers to the processing of information into the memory system.

8. c. is the answer. Kandel and Schwartz found that when learning occurred in the sea slug Aplysia, serotonin was released at certain synapses, which then became more efficient at signal transmission. (p. 340)

9. b. is the answer. In essence, we construct our memories, bringing them into line with our biases and assumptions, as well as with our subsequent experiences. (p. 356)
   a. If this were true, it would mean that memory construction does not occur. Through memory construction, memories may deviate significantly from the original experiences.
   c. There is no evidence that such chemical transfers occur.
   d. Many long-term memories are apparently unlimited in duration.

10. d. is the answer. In general, being in a context similar to that in which you experienced something will tend to help you recall the experience. (pp. 347, 348)
   a & b. The learning environment per se—and its familiarity or exoticness—did not affect retention.

11. a. is the answer. (p. 332)
   b. & d. The text does not suggest that there is an optimal interval between encoding and retrieval.
c. Learning increases the efficiency of synaptic transmission in certain neurons, but not by altering the size of the synapse.

12. c. is the answer. (p. 340)

13. d. is the answer. When asked to recall all the letters, participants could recall only about half; however, if immediately after the presentation they were signaled to recall a particular row, their recall was near perfect. This showed that they had a brief photographic memory—so brief that it faded in less time than it would have taken to say all nine letters. (p. 337)

14. b. is the answer. Because amnesia victims lose their fact (explicit) memories but not their skill (implicit) memories or their capacity to learn, it appears that human memory can be divided into two distinct types. (pp. 342–343)

As studies of amnesia victims show, memory losses following damage to the hippocampus are quite predictable.

15. d. is the answer. (p. 343)

a. & b. Explicit memory (also called declarative memory) is memory of facts and experiences that one can consciously know and declare.

c. There is no such thing as prime memory.

16. d. is the answer. (p. 348)

a. State-dependent memory is the phenomenon in which information is best retrieved when the person is in the same emotional or physiological state he or she was in when the material was learned.

b. Encoding failure occurs when a person has not processed information sufficiently for it to enter the memory system.

c. Priming is the process by which a memory is activated through retrieval of an associated memory.

17. b. is the answer. When the words were organized into categories, recall was two to three times better, indicating the benefits of hierarchical organization in memory. (p. 337)

d. This study did not examine the use of mnemonic devices.

18. a. is the answer. (pp. 328–329)

b. Herman Ebbinghaus conducted pioneering studies of verbal learning and memory.

c. Loftus and Palmer conducted influential research studies of eyewitness memory.

d. George Sperling is known for his research studies of iconic memory.

19. d. is the answer. It is in both encoding and retrieval that we construct our memories, and as Loftus' studies showed, leading questions affect people's memory construction. (p. 359)

a. The memory encoding occurred at the time of the event in question, not during questioning by the hypnotist.

b. State-dependent memory refers to the influence of one's own emotional or physiological state on encoding and retrieval, and would not apply here.

c. Proactive interference is the interfering effect of prior learning on the recall of new information.

20. b. is the answer. (p. 345)

a. The hippocampus is a temporary processing site for explicit memories.

c. & d. These areas of the brain are not directly involved in the memory system.

21. b. is the answer. Blocking is an example of retrieval failure. Each of the others is an example of a "sin of distortion," in which memories, although inaccurate, are retrieved. (p. 350)

Matching Items

1. n (p. 338) 6. c (p. 332) 11. g (p. 353)
2. o (p. 328) 7. e (p. 335) 12. j (p. 358)
3. l (p. 335) 8. f (p. 336) 13. h (p. 350)
4. a (p. 335) 9. i (p. 353) 14. k (p. 350)
5. m (p. 349) 10. b (p. 347) 15. d (p. 350)

Progress Test 2

Multiple-Choice Questions

1. c. is the answer. As Ebbinghaus and Bahrick both showed, most of the forgetting that is going to occur happens soon after learning. (pp. 351–352)

2. d. is the answer. (pp. 353–354)

a. & b. This study did not find evidence that memories fade (decay) with time.

c. When one is awake, there are many more potential sources of memory interference than when one is asleep.

3. a. is the answer. A test of recall presents the fewest retrieval cues and usually produces the most limited retrieval. (p. 345)

4. d. is the answer. (p. 344)

5. d. is the answer. According to the serial position effect, items at the beginning and end of a list tend to be remembered best. (p. 332)

6. a. is the answer. (p. 333)

b. In the serial position effect, the items in the middle of the list always show the poorest retention.

c. & d. Delayed recall erases the memory facilitation for items at the end of the list.
7. c. is the answer. Processing a word in terms of its meaning (semantic encoding) produces much better retention than does visual or acoustic encoding. (p. 334)

8. d. is the answer. Surprisingly, Lashley found that no matter where he cut, the rats had at least a partial memory of how to solve the maze. (p. 340)
   a. & b. Lashley's studies did not investigate the significance of the interval between learning and cortical lesioning.

9. a. is the answer. A blow to the head wipes out recent experiences because information in STM did not have time to consolidate into LTM. (p. 341)
   b. Such injuries disrupt the formation, rather than the retrieval, of memories.
   c. Although nutrition plays an important role in neural functioning, the effects of such injuries are independent of nutrition.

10. d. is the answer. (p. 340)
11. c. is the answer. According to Freud, we repress painful memories to preserve our self-concepts. (p. 355)
   a. & b. The fact that repressed memories can sometimes be retrieved suggests that they were encoded and have not decayed with time.

12. d. is the answer. When misled by the phrasings of questions, subjects incorrectly recalled details of the film and even "remembered" objects that weren't there. (pp. 356–357)
13. c. is the answer. Speed reading, which entails little active rehearsal, yields poor retention. (pp. 364–365)
14. b. is the answer. (p. 328)
   a. Encoding is the process of getting information into memory.
   c. Rehearsal is the conscious repetition of information in order to maintain it in memory.
   d. Storage is the maintenance of encoded material over time.

15. b. is the answer. Amnesia patients typically have suffered damage to the hippocampus, a brain structure involved in processing explicit memories for facts. (p. 344)
   a. Amnesia patients do retain implicit memories for how to do things; these are processed in the cerebellum.
   c. & d. Amnesia patients generally do not experience impairment in their iconic and echoic sensory memories.

16. b. is the answer. (p. 331)
   a. Information in short-term memory has already been encoded.
   c. Iconic and echoic are types of sensory memory.
   d. Retrieval is the process of getting material out of storage and into conscious, short-term memory. Thus, all material in short-term memory has either already been retrieved or is about to be placed in storage.

17. c. is the answer. By breaking concepts down into subconcepts and yet smaller divisions and showing the relationships among these, hierarchies facilitate information processing. Use of main heads and subheads is an example of the organization of textbook chapters into hierarchies. (p. 337)
   a. Mnemonic devices are the method of loci, acronyms, and other memory techniques that facilitate retention.
   b. Chunks are organizations of knowledge into familiar, manageable units.
   d. Recognition is a measure of retention.

18. d. is the answer. (p. 362)
19. c. is the answer. Short-term recall is slightly better for information we hear rather than see, because echoic memory momentarily outlasts iconic memory. (p. 338)
   a. Meaningful stimuli, such as words, are usually remembered more easily than meaningless stimuli, such as random letters.
   b. Iconic memory does not last as long as echoic memory in short-term recall.
   d. Although context is a powerful retrieval cue, there is no general facilitation of memory in an unusual context.

20. c. is the answer. Loftus and Palmer found that eyewitness testimony could easily be altered when questions were phrased to imply misleading information. (p. 357)
   a. Although memories are constructed during encoding, the misinformation effect is a retrieval, rather than an encoding, phenomenon.
   b. & d. In fact, just the opposite is true.

21. d. is the answer. (p. 350)
   a. This defines absent-mindedness.
   b. This is misattribution.
   c. This is bias.

True–False Items

1. T (p. 364)  6. F (p. 359)
2. T (p. 338)  7. F (pp. 353–354)
3. T (pp. 360–361)  8. T (p. 365)
5. T (pp. 351–352)  10. F (p. 364)
Psychology Applied

Multiple-Choice Questions

1. d. is the answer. (p. 345)
   a. & b. In order to correctly answer either type of
      question, the knowledge must have been encoded
      and stored.
   c. With fill-in-the-blank questions, the answer
      must be recalled with no retrieval cues other than
      the question. With multiple-choice questions, the
      correct answer merely has to be recognized from
      among several alternatives.

2. d. is the answer. (p. 347)
   a. & b. A serial position effect would presumably
      occur whether the study and retrieval contexts
      were the same or different.
   c. As researchers found, when recall is delayed,
      only the first items in a list are recalled more
      accurately than the others. With immediate recall,
      both the first and last items are recalled more
      accurately.

3. d. is the answer. That all four mistakes are based
   on a sound confusion suggests that the letters
   were encoded acoustically. (p. 333)
   a. Memorizing a list of letters would involve
      effortful, rather than automatic, processing.
   b. The mistakes do not involve letters that are
      similar in appearance.
   c. Semantic encoding would have been suggested
      by errors based on similarities in meaning.

4. b. is the answer. Retroactive interference is the
   disruption of something you once learned by new
   information. (p. 353)
   a. Proactive interference occurs when old informa-
      tion makes it difficult to correctly remember
      new information.
   c. & d. Interference produces forgetting even
      when the forgotten material was effectively
      encoded and stored. Janice’s problem is at the
      level of retrieval.

5. b. is the answer. (p. 353)
   a., c., & d. Involvement in other activities, even
   just eating or listening to music, is more disrup-
   tive than sleeping.

6. c. is the answer. Susan’s memories are affected by
   her bad mood. (p. 349)
   a. Priming refers to the conscious or unconscious
      activation of particular associations in memory.
   b. Memory construction refers to changes in
      memory as new experiences occur.
   d. Although Susan’s difficulty in recalling the
      good could be considered retrieval failure, it is
      caused by the mood-congruent effect, which is
      therefore the best explanation.

7. a. is the answer. Priming is the conscious or uncon-
   scious activation of particular associations in
   memory. (p. 347)
   b. Déjà vu is the false impression of having previ-
      ously experienced a current situation.
   c. That Martina is able to retrieve her former
      classmates’ names implies that they already have
      been encoded.
   d. Relearning is a measure of retention based on
      how long it takes to relearn something already
      mastered. Martina is recalling her former class-
      mates’ names, not relearning them.

8. b. is the answer. Being back in the context in
   which the original experiences occurred triggered
   memories of these experiences. (p. 347)
   a. The memories were triggered by similarity of
      place, not mood.
   c. Retroactive interference would involve difficul-
      ties in retrieving old memories.
   d. Echoic memory refers to momentary memory
      of auditory stimuli.

9. a. is the answer. Time and space—and therefore
   sequences of events—are often automatically
   processed. (p. 330)
   b. That she had little difficulty indicates that the
      processing was automatic, rather than effortful.
   c. & d. State-dependent memory and priming
      have nothing to do with the automatic processing
      of space and time.

10. d. is the answer. Flashbulb memories are unusu-
    ally clear memories of emotionally significant
    moments in life. (p. 342)

11. a. is the answer. Proactive interference occurs
    when old information makes it difficult to recall
    new information. (p. 353)
    b. If Carlos were having trouble remembering the
       old extension, this answer would be correct.
    c. & d. Carlos has successfully encoded and
       stored the extension; he’s just having problems
       retrieving it.

12. a. is the answer. (p. 343)
    b., c., & d. Explicit memory, also called declar-
    ative memory, is the memory of facts that one can
    consciously “declare.” Nondeclarative memory is
    what Mr. Flanagan has retained.

13. b. is the answer. (p. 333)
    a. & c. Your failure to recall the answer indicates
       that it was never encoded semantically.
    d. Spatial information, such as the location of an
       answer (but not the actual answer) on a textbook
       page, is often encoded automatically.
14. c. is the answer. (p. 353)
   a. & b. The name of your homeroom teacher, which you probably heard at least once each day of school, was surely processed into memory (encoded) and maintained there for some time (stored).
   d. State-dependent memory is the tendency to recall information best in the same emotional or physiological state as when it was learned. It is unlikely that a single state was associated with learning your homeroom teacher’s name.
15. a. is the answer. Short-term memory capacity is approximately seven digits. (p. 338)
   b. Because iconic memory lasts no more than a tenth of a second, regardless of how much material is experienced, this cannot be the explanation for Brenda’s difficulty.
   c. The final four digits should be no more difficult to organize into chunks than the first five digits of the address code.
   d. Memory for digits is an example of explicit, rather than implicit, memory.
16. a. is the answer. (p. 355)
   b. Although Lewis’ difficulty in recalling these memories could be considered retrieval failure, it is caused by repression, which is therefore the best explanation.
   c. This answer is incorrect because it is clear that Lewis fails to remember these experiences because they are painful memories and not because he is in a different emotional or physiological state.
   d. Flashbulb memories are especially vivid memories for emotionally significant events. Lewis has no memory at all.
17. d. is the answer. (p. 357)
   a. This is an example of proactive interference.
   b. This is an example of the disruptive effects of depressant drugs, such as alcohol, on the formation of new memories.
   c. This is mood-congruent memory.
18. d. is the answer. (p. 344)
   a., b., & c. Damage to the right side, not the left side, of the hippocampus would cause these types of memory deficits.
19. c. is the answer. Blows to the head usually disrupt the most recent experiences, such as this one, rather than long-term memories like those in choices a. and b., or new learning such as that in choice d. (p. 341)
20. c. is the answer. The hippocampus is involved in processing new facts for storage. (p. 344)

a., b., & d. Studies of amnesia victims with hippocampal damage show that neither classical conditioning nor skill memory are impaired, indicating that these aspects of memory are controlled by other regions of the brain.

21. d. is the answer. In this example, the questions Frank was asked to answer created misinformation that later became part of his memory. (p. 350)
   a. This answer would have been correct if Frank had been molested by the counselor but had failed to encode it in his memory.
   b. This answer would have been correct if Frank had been molested but the memory trace had faded with time.
   c. Misattribution might have occurred if Frank had witnessed another camper being molested and later recalled himself as the actual victim.

Essay Question

Experts agree that child abuse is a real problem that can have long-term adverse effects on individuals. They also acknowledge that forgetting of isolated events, both good and bad, is an ordinary part of life. Although experts all accept the fact that recovered memories are commonplace, they warn that memories “recovered” under hypnosis or with the use of drugs are unreliable, as are memories of events before age 3. Finally, they agree that memories can be traumatic, whether real or false.

Key Terms

Writing Definitions

1. Memory is the persistence of learning over time through the storage and retrieval of information. (p. 327)
2. Encoding is the first step in memory; information is translated into some form that enables it to enter our memory system. (p. 328)
3. Storage is the process by which encoded information is maintained over time. (p. 328)
4. Retrieval is the process of getting information out of memory storage. (p. 328)
5. Sensory memory is the immediate, very brief recording of sensory information in the memory system. (p. 329)
6. Short-term memory is activated memory, which can hold about seven items for a short time. (p. 329)
7. **Long-term memory** is the relatively permanent and unlimited capacity memory system into which information from short-term memory may pass. It includes knowledge, skills, and experiences. (p. 329)

8. **Working memory** is the newer way of conceptualizing short-term memory as a work site for the active processing of incoming auditory and visual-spatial information, and of information retrieved from long-term memory. (p. 329)

9. **Automatic processing** refers to our unconscious encoding of incidental information such as space, time, and frequency and of well-learned information. (p. 330)

10. **Effortful processing** is encoding that requires attention and conscious effort. (p. 331)

11. **Rehearsal** is the conscious, effortful repetition of information that you are trying either to maintain in consciousness or to encode for storage. (p. 331)

12. **The spacing effect** is the tendency for distributed study or practice to yield better long-term retention than massed study or practice. (p. 332)

13. **The serial position effect** is the tendency for items at the beginning and end of a list to be more easily retained than those in the middle. (p. 332)

14. **Visual encoding** is the use of picture images to process information into memory. (p. 333)

15. **Acoustic encoding** is the processing of information into memory according to its sound. (p. 333)

16. **Semantic encoding** is the processing of information into memory according to its meaning. (p. 333)

17. **Imagery** refers to mental pictures and can be an important aid to effortful processing. (p. 335)

18. **Mnemonics** are memory aids (acronyms, peg-words, etc.), which often use vivid imagery and organizational devices. (p. 335)

19. **Chunking** is the memory technique of organizing material into familiar, meaningful units. (p. 336)

20. **Iconic memory** is the visual sensory memory consisting of a perfect photographic memory, which lasts no more than a few tenths of a second. (p. 337)

   *Memory aid: Icon means “image” or “representation.”* **Iconic memory** consists of brief visual images.

21. **Echoic memory** is the momentary sensory memory of auditory stimuli, lasting about 3 or 4 seconds. (p. 338)

22. **Long-term potentiation (LTP)** is an increase in a synapse's firing potential following brief, rapid stimulation. LTP is believed to be the neural basis for learning and memory. (p. 340)

23. A **flashbulb memory** is an unusually vivid memory of an emotionally important moment or event. (p. 342)

24. **Amnesia** is the loss of memory. (p. 342)

25. **Implicit memories** are memories of skills, preferences, and dispositions. These memories are evidently processed, not by the hippocampus, but by a more primitive part of the brain, the cerebellum. They are also called **nondeclarative memories**. (p. 343)

26. **Explicit memories** are memories of facts, including names, images, and events. They are also called declarative memories. (p. 343)

27. **The hippocampus** is a temporal lobe neural center located in the limbic system that is important in the processing of explicit memories for storage. (p. 344)

28. **Recall** is a measure of memory in which the person must retrieve information, with few retrieval cues, information learned earlier. (p. 345)

29. **Recognition** is a measure of memory in which one need only identify, rather than recall, previously learned information. (p. 345)

30. **Relearning** is also a measure of memory in that the less time it takes to relearn information, the more that information has been retained. (p. 345)

31. **Priming** is the activation, often unconsciously, of a web of associations in memory in order to retrieve a specific memory. (p. 347)

32. **Déjà vu** is the false sense that you have already experienced a current situation. (p. 348)

33. **Mood-congruent memory** is the tendency to recall experiences that are consistent with our current mood. (p. 349)

34. **Proactive interference** is the disruptive effect of something you already have learned on your efforts to learn or recall new information. (p. 353)

35. **Retroactive interference** is the disruptive effect of new learning on the recall of old knowledge. (p. 353)

   *Memory aid: Retro means “backward.”* **Retroactive interference** is “backward-acting” interference.

36. **Repression** is an example of motivated forgetting in that painful and unacceptable memories are prevented from entering consciousness. In
psychoanalytic theory, it is the basic defense mechanism. (p. 355)

37. The **misinformation effect** is the tendency of eyewitnesses to an event to incorporate misleading information about the event into their memories. (p. 357)

38. At the heart of many false memories, source **amnesia** refers to attributing an event to the wrong source. (p. 358)

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**Cross-Check**

**ACROSS**

1. repression
2. echoic
3. semantic
4. priming
5. imagery
6. LTP
7. iconic
8. chunking
9. flashbulb
10. amnesia
11. rehearsal
12. recognition
13. sensory
14. misinformation
15. effortful
16. hippocampus
17. implicit
18. mnemonics
19. acoustic
20. automatic
21. proactive
22. long term
23. visual
24. déjà vu