Kognitive Neuropsychologie

- 03.11. Geschichte der kognitiven Neurowissenschaft
- 10.11. Funktionelle Neuroanatomie
- 17.11. Methoden der kognitiven Neuropsychologie I
- 24.11. Methoden der kognitiven Neuropsychologie II
- **01.12. Visuelle Wahrnehmung**
- 08.12. Objekterkennung
- 15.12. Auditive Wahrnehmung
- 05.01. Sprache
- 12.01. Aufmerksamkeit und Selektion
- 19.01. Kognitive Kontrolle
- 26.01. Gedächtnis & Lernen
- 02.02. Kognitives Altern

Vorlesung KNP

In TEAMS

Zugangscode für Anwesenheitskontrolle

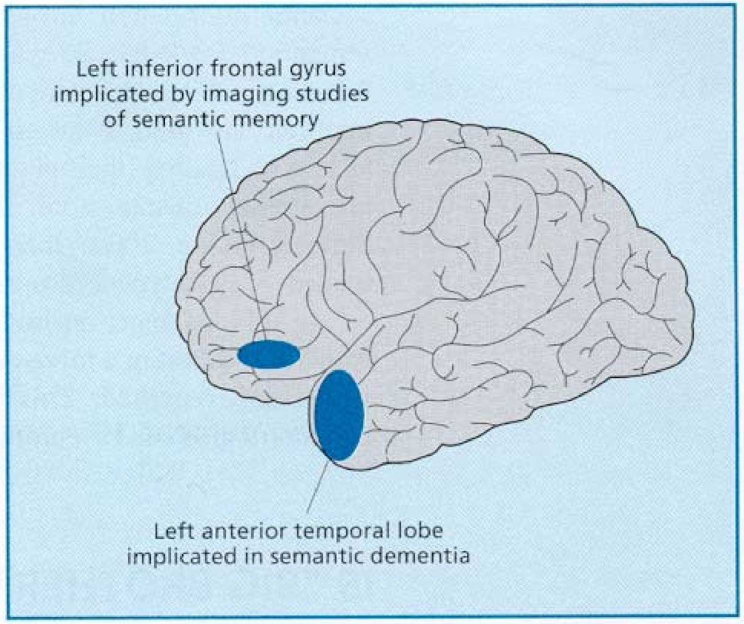
cv218me

Bitte um Angabe wer Wahlfach KNP wählen möchte!

Disagreements and solutions….

- Läsions-Defizit-Analyse:
  - Semantische Demenz nach Läsionen des anterioren Temporallappens

- Funktionelle Bildgebung:
  - Aktivierung im linken IFG bei semantischer Aufgabe (Verbgenerierung)



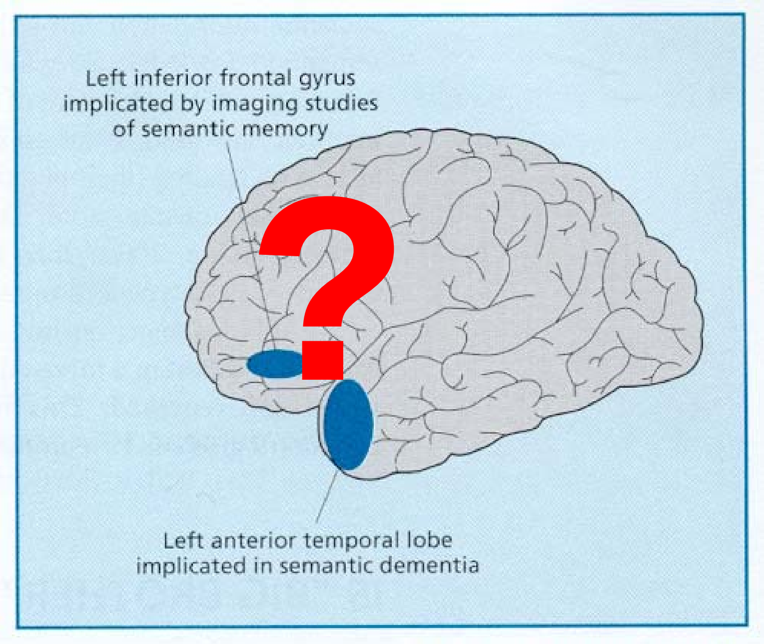
Disagreements and solutions....

Läsions-Defizit-Analyse:

Semantische Demenz nach Läsionen des anterioren Temporallappens

Funktionelle Bildgebung:

Aktivierung im linken IFG bei semantischer Aufgabe (Verbgenerierung)



Verb Generation Task: Generating vs reading

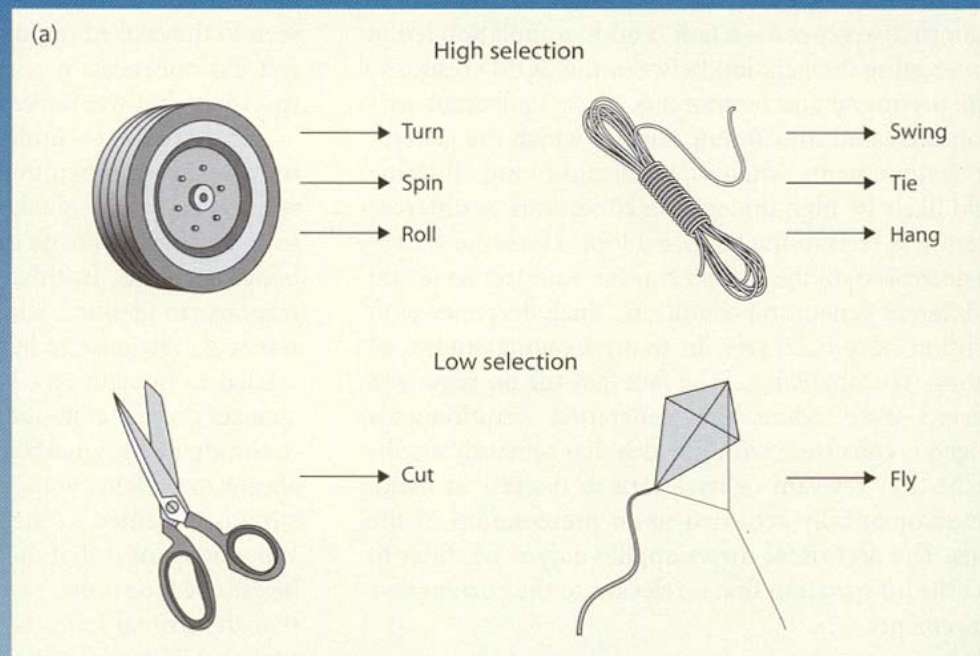


Figure 12.17 Involvement of inferior frontal cortex in response selection. **(a)** The verb generation task can be performed with nouns that are associated with many actions (high selection) or few actions (low selection). **(b)** Areas showing higher activity in the high-selection condition are shown in yellow. **(c)** Overlap in lesion location for patients who had difficulty in the high-selection condition. (b) From Thompson-Schill et al. (1997). (c) From Thompson-Schill et al. (1998).

Können Patienten mit IFG Läsionen diese Aufgabe? Warum zeigt sich bei Verbgenerierung keine anteriore Temporallappenaktivierung?

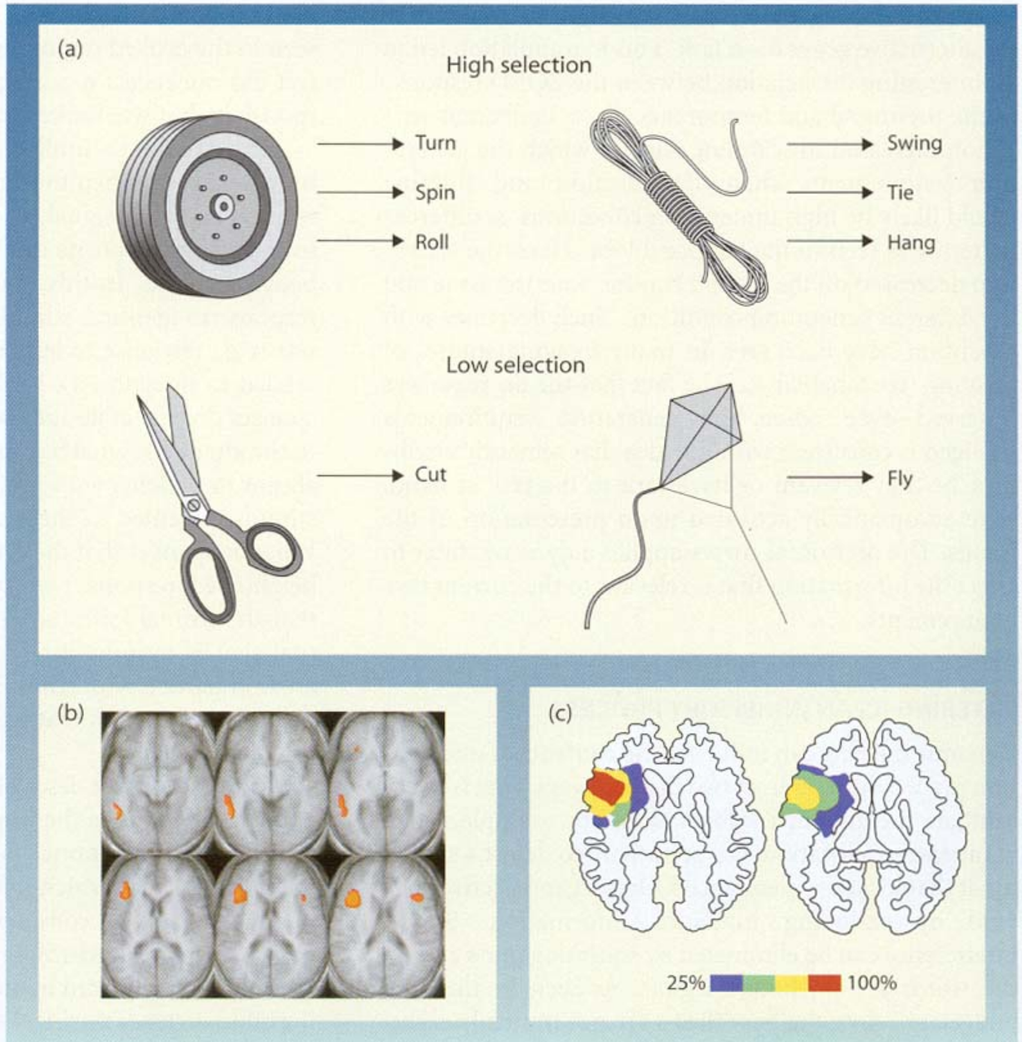
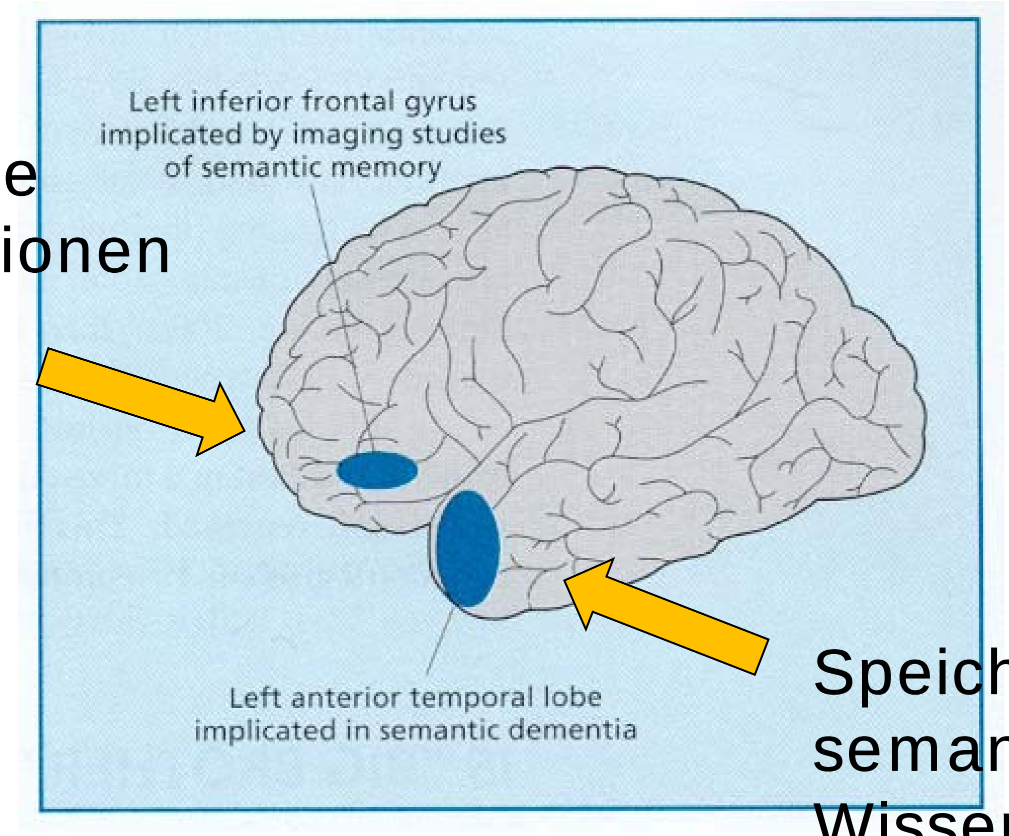


Figure 12.17 Involvement of inferior frontal cortex in response selection. **(a)** The verb generation task can be performed with nouns that are associated with many actions (high selection) or few actions (low selection). **(b)** Areas showing higher activity in the high-selection condition are shown in yellow. **(c)** Overlap in lesion location for patients who had difficulty in the high-selection condition. (b) From Thompson-Schill et al. (1997). (c) From Thompson-Schill et al. (1998).

Semantic Memory Revisited

Strategische Abrufoperationen



Speicher für semantisches Wissen

„Mir ist die Differenzierung der drei "Prinzipien" Scaling, Superposition, Linear Addition bewusst allerdings habe ich mich gefragt ab wann sich der Effekt der Superposition vs. der Linear Addition breit macht. Gibt es einen, sagen wir mal zeitlichen Schwellenwert hinsichtlich der zeitlichen Aufeinanderfolge zweier Reize sodass man entweder von dem einen oder dem anderen Prinzip sprechen kann?“

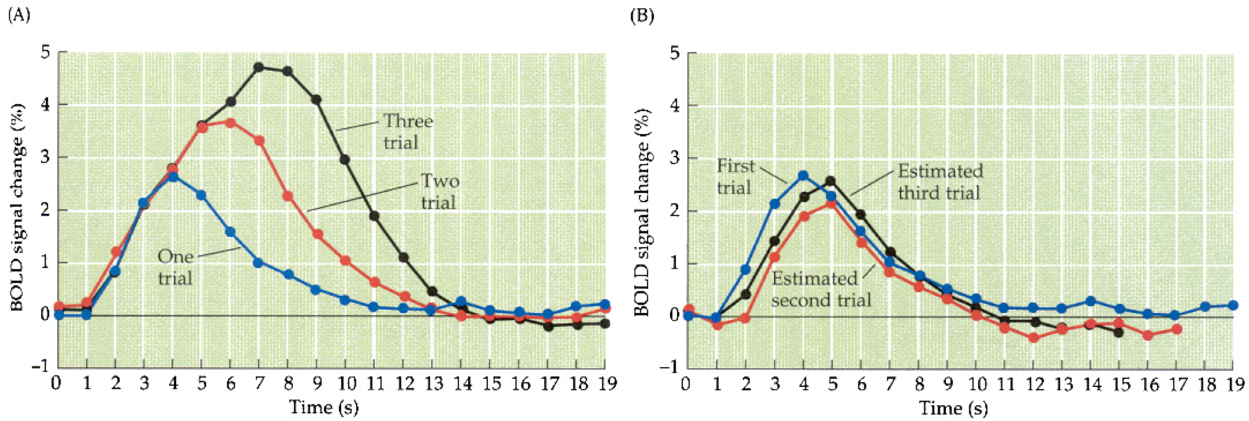
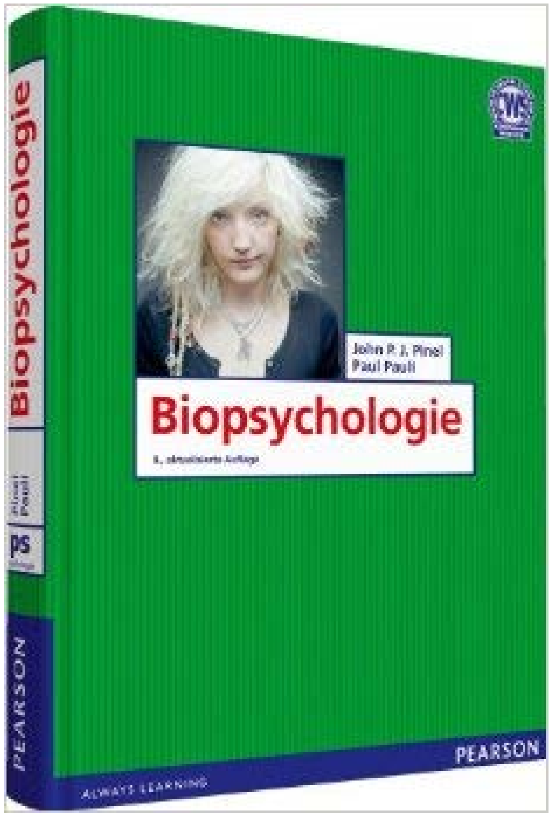


Figure 8.20 Linear addition of hemodynamic responses to individual stimulus events. (A) The hemodynamic responses evoked by presentation of one, two, or three identical stimuli (short-duration visual flashes) at short interstimulus intervals were measured. Shown here are data from a 2-s interval. The total hemodynamic response increased in a regular fashion as the number of stimuli in a trial increased. (B) By subtracting the one-stimulus trial from the two-stimulus trial, and the two-stimulus from the three-stimulus, the contributions of the second and third stimuli in a trial were estimated. To a first approximation, the responses to the second and third stimuli were similar to that to the first, suggesting that the BOLD response scales in a roughly linear fashion. (From Dale and Buckner, 1997.)

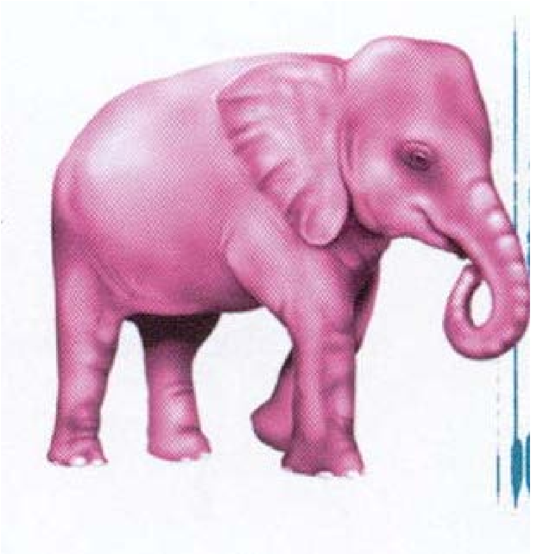
Literatur

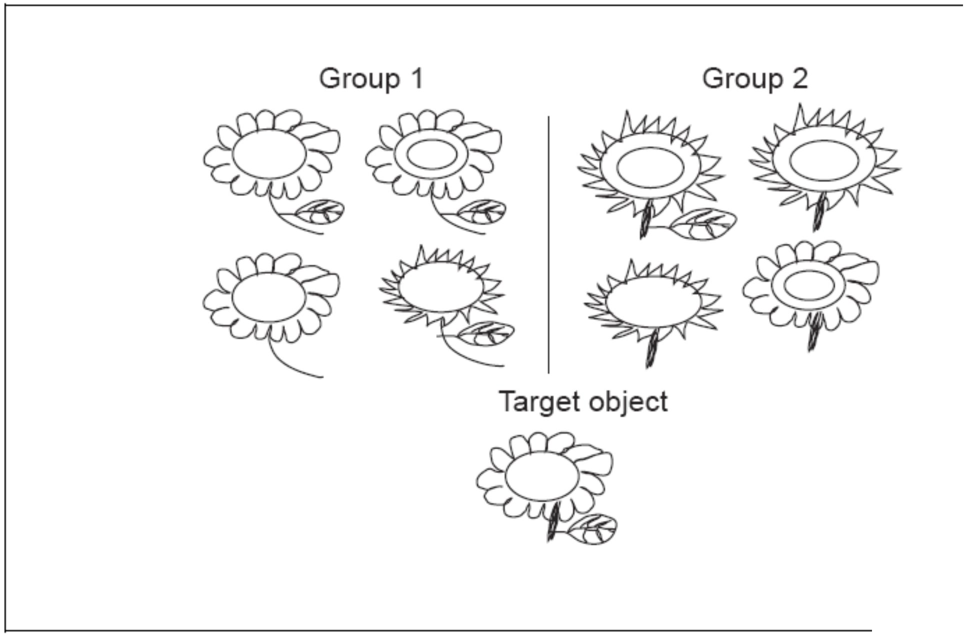


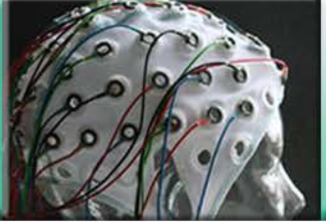
Ward, J. (2010). The student's guide to cognitive neuroscience. (2nd Edition) Psychology Press. New York. (Kap. 6)

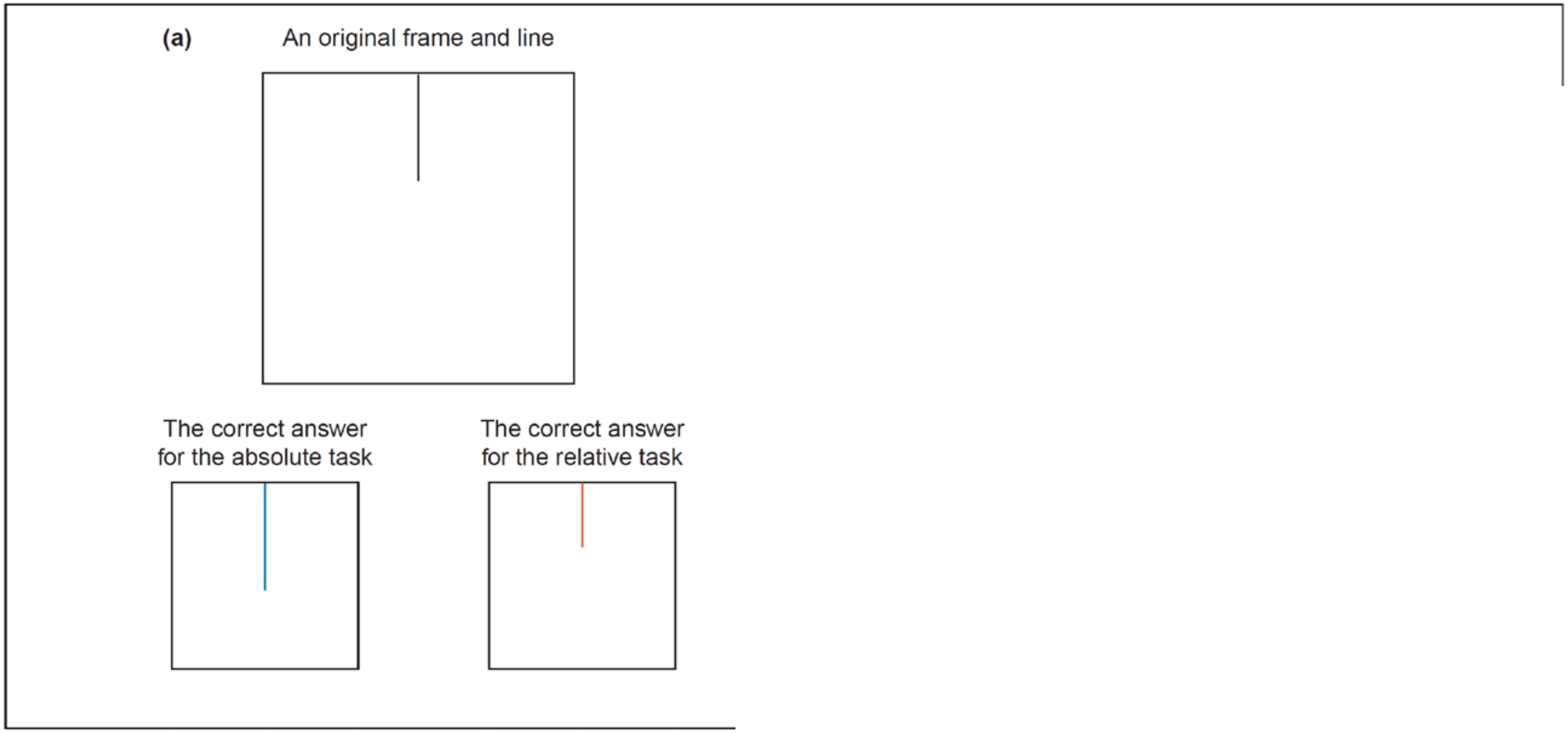
Gazzaniga, M.S., Ivry, R.B. & Mangun, G.R. (2009). Cognitive Neuroscience (3rd Edition). W.W. Norton & Company: NewYork (Kap. 5&6)

Visuelle Wahrnehmung




Group 1
Group 2
Target object

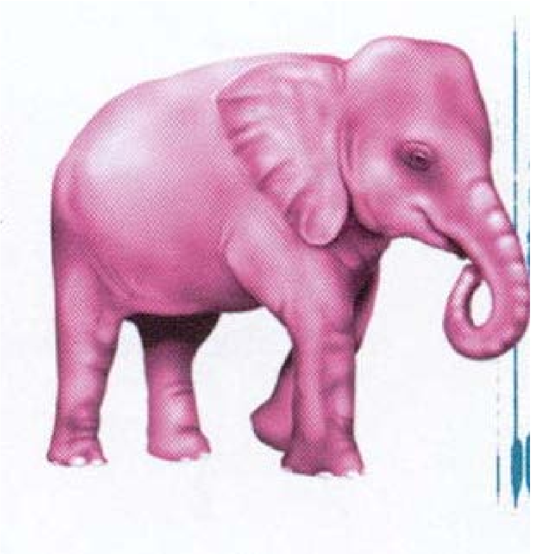




(a)
An original frame and line
The correct answer
for the absolute task
The correct answer
for the relative task

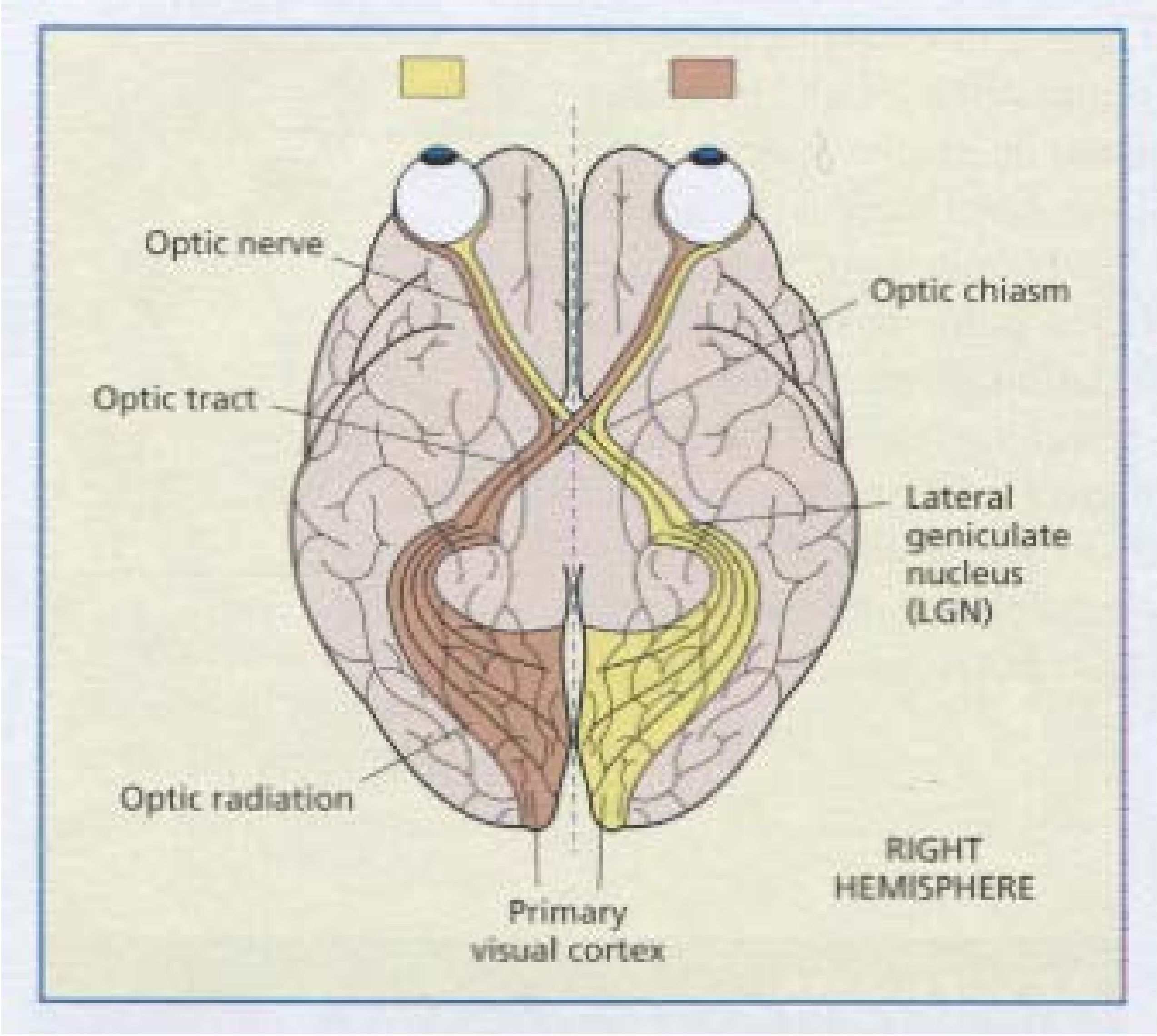
(a) (b)

Visuelle Wahnehmung



- Der visuelle Kortex
- Aufbau und hierarchische Struktur
- Farbe und Bewegung
- Das „was“ und „wo“ System
- Formkodierug
- Sind Gesichter etwas Besonderes?

Von der Retina zum primären visuellen Cortex



Das M- und P-System

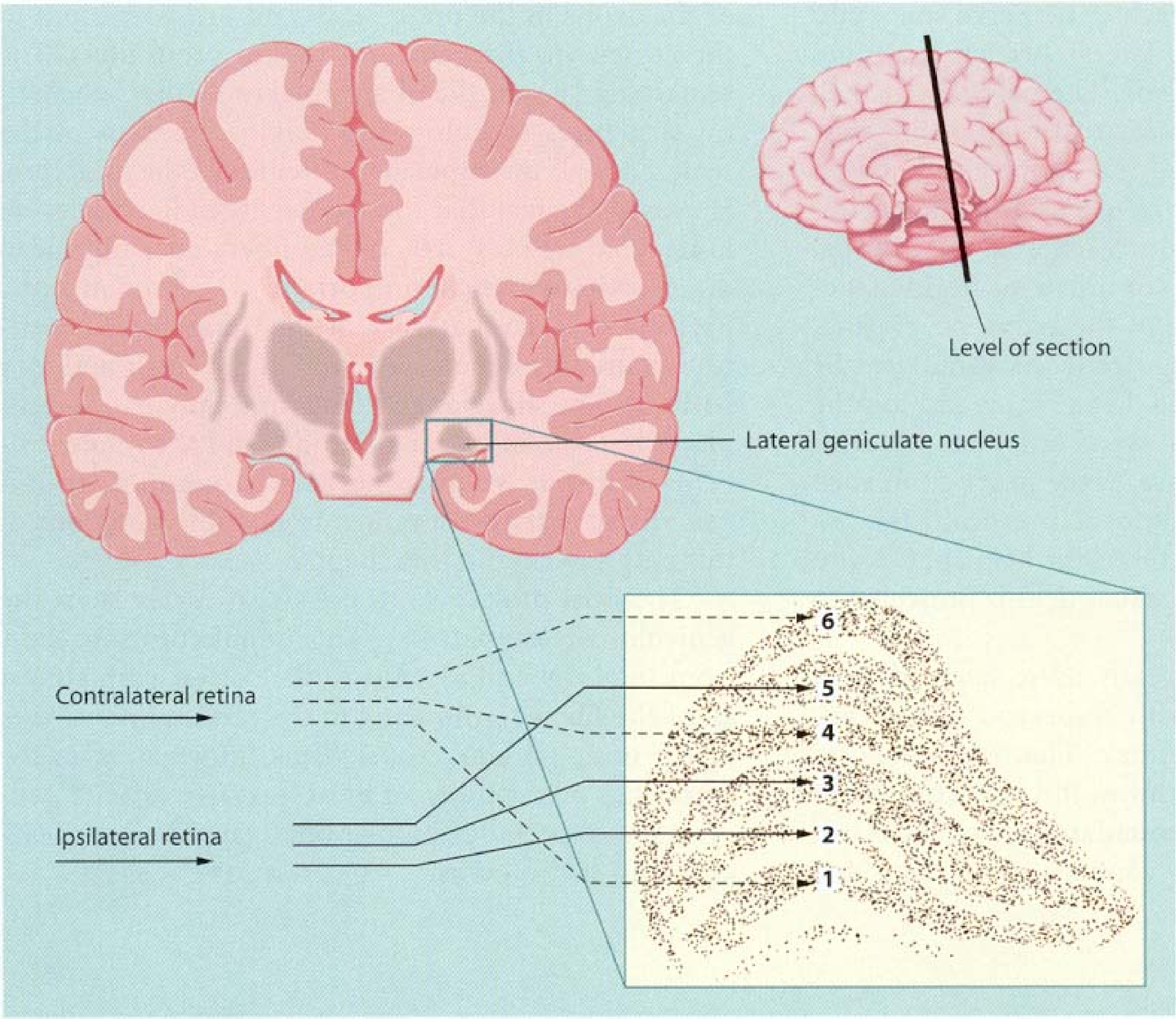
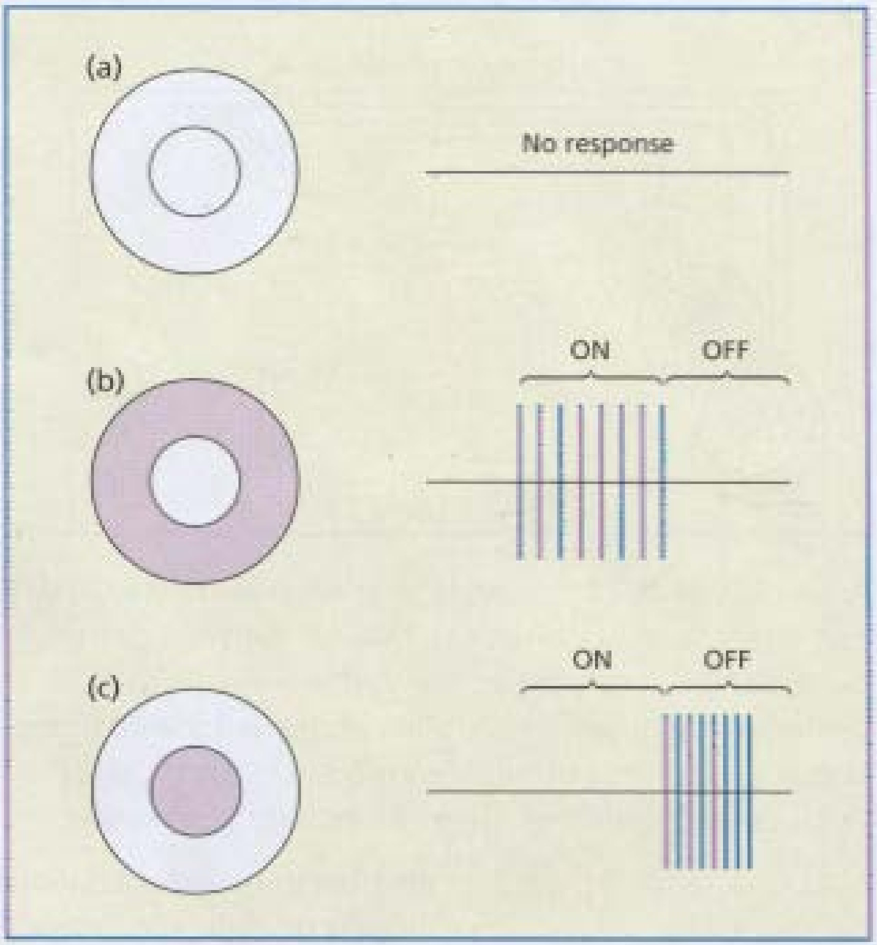
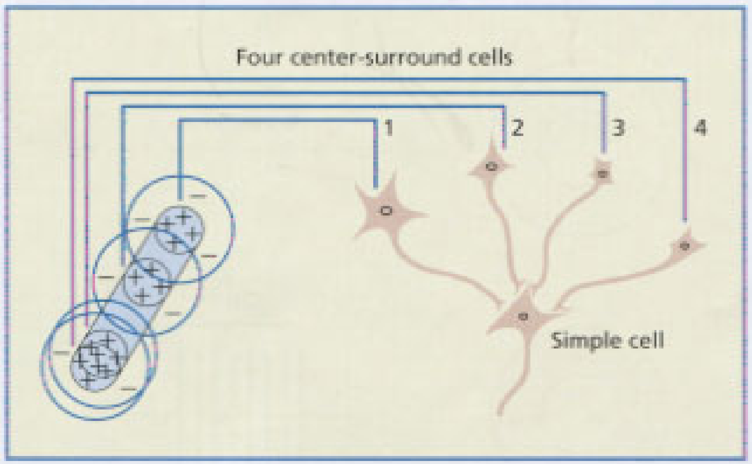


Figure 5.5 The lateral geniculate nucleus, located in the most lateral, inferior region of the thalamus. It is composed of six layers, with the ipsilateral eye projecting to layers 2, 3, and 5 and the contralateral eye projecting to layers 1, 4, and 6. Layers 3 through 6 contain the smaller neurons of the parvocellular system; layers 1 and 2 contain the larger neurons of the magnocellular system.

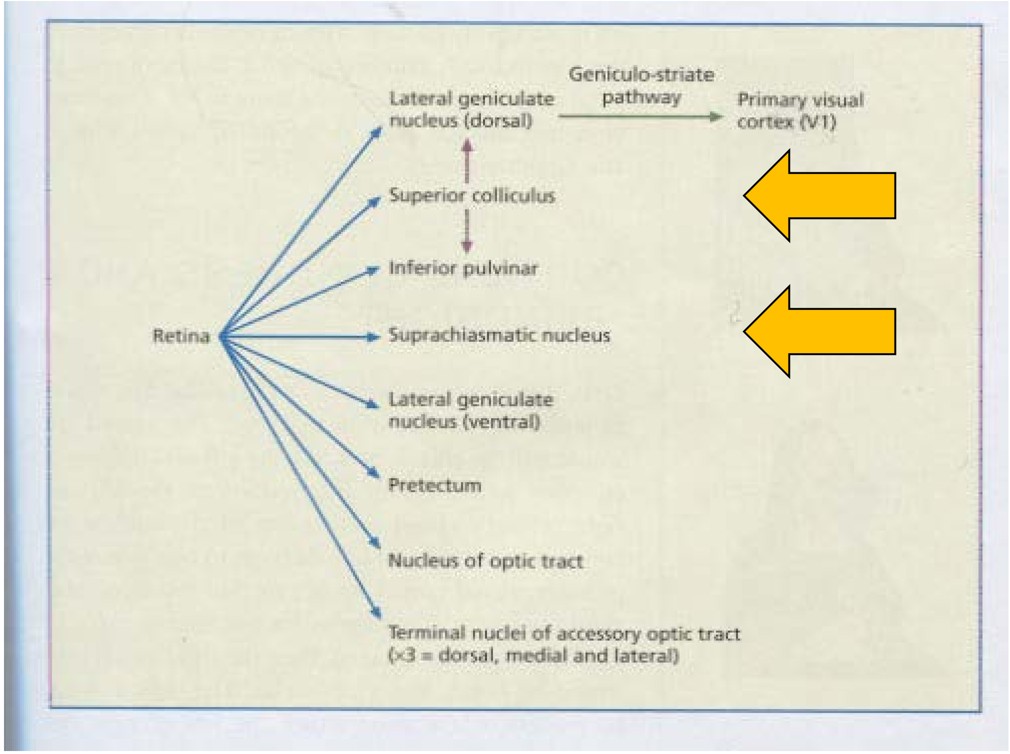
Rezeptive Felder



A center-surround receptive field of the lateral geniculate nucleus. Light over the entire receptive field yields no response (a). The presence of light over the center (b) yields excitation, whereas the surround responds to the absence of light (c). From Zeki (1993).



A simple cell in V1 responds to lines of particular length and orientation. Its response may be derived from a combination of responses from different cells with center-surround properties such as those located in the lateral geniculate nucleus. From Zeki (1993). Copyright © Blackwell Publishing. Reproduced with permission.



Visual Cortex

Merkmalsrepräsentation im primären visuellen Kortex

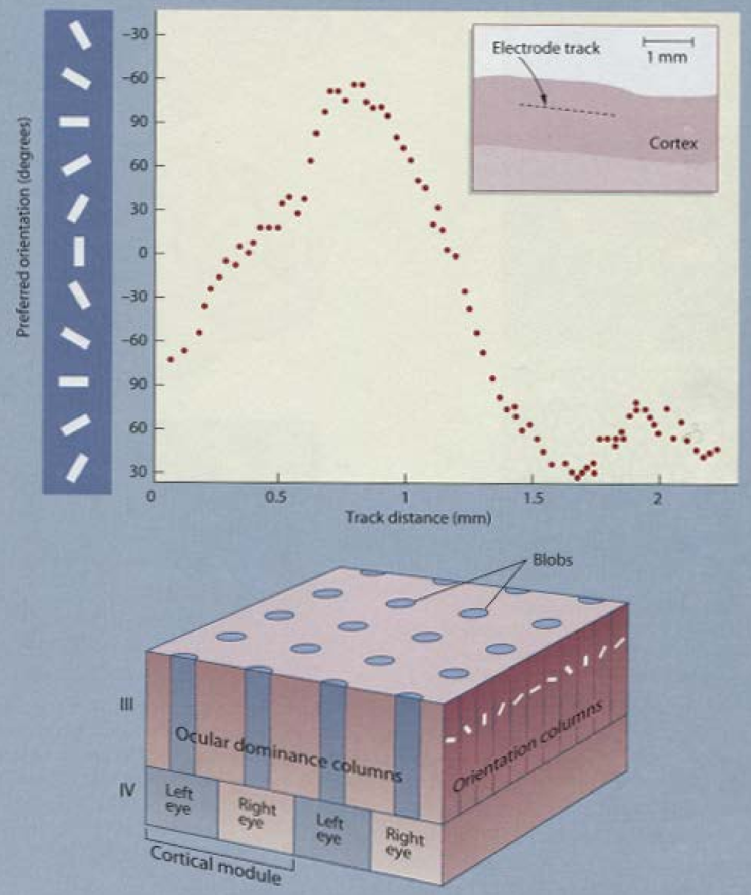
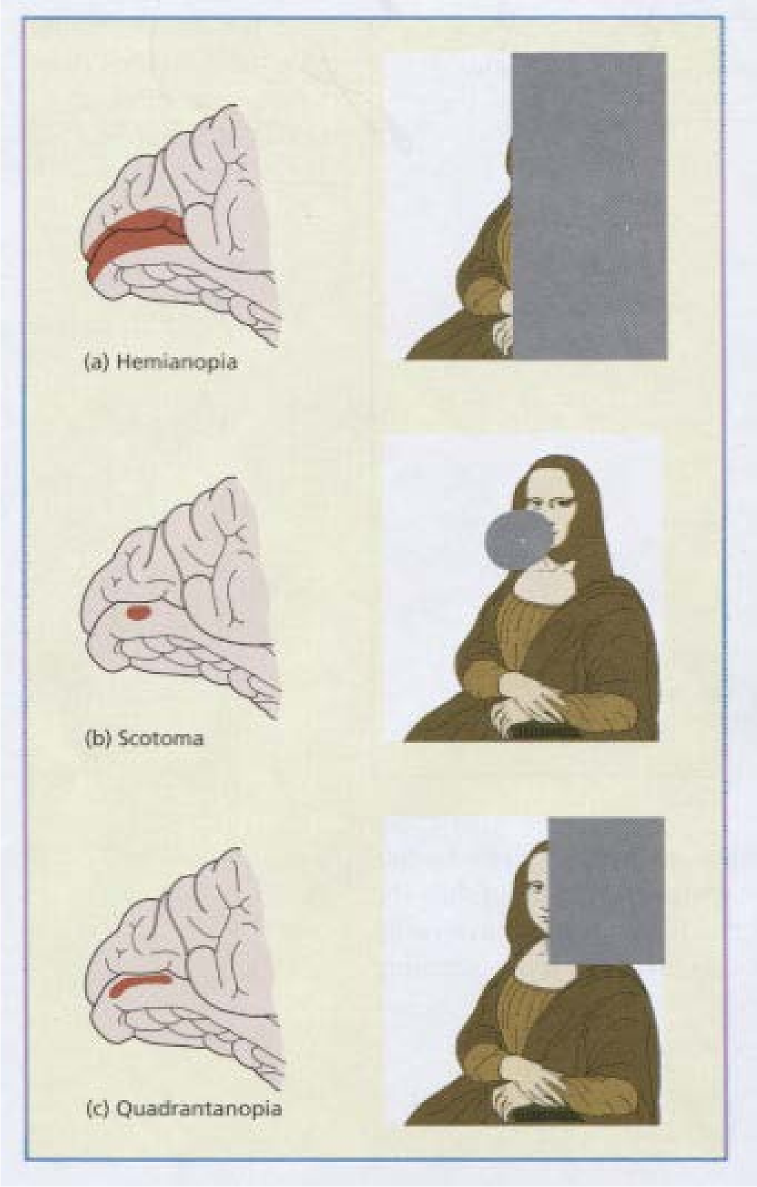


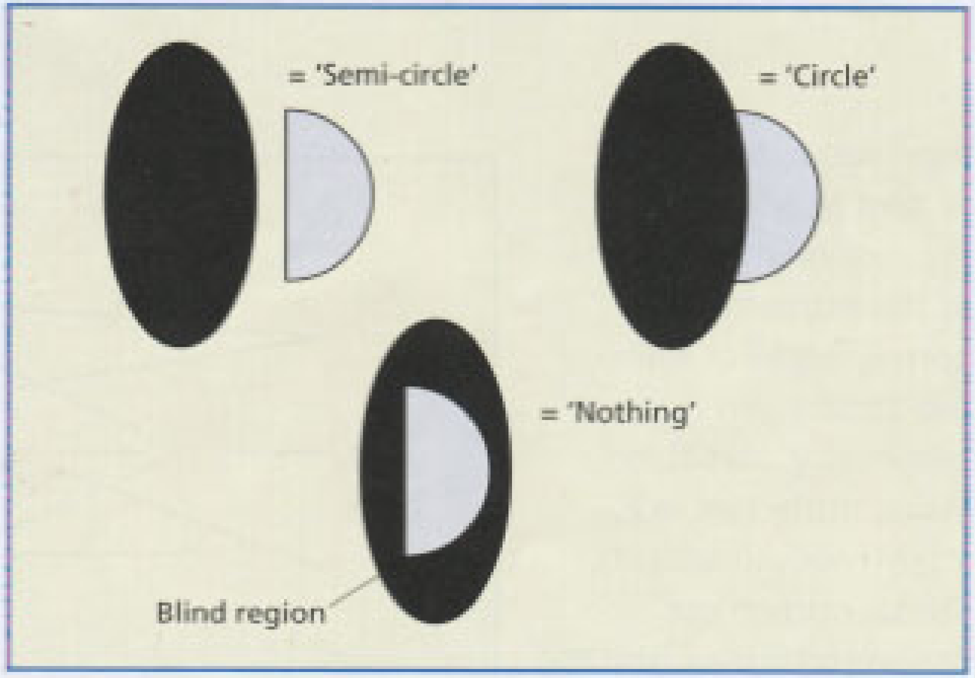
Figure C Feature representation within the primary visual cortex. **Top:** As the recording electrode is moved along the cortex, the preferred orientation of the cells varies in a continuous manner. The preferred orientation is plotted as a function of the location of the electrode. **Bottom:** The orientation columns are crossed with ocular dominance columns to form a cortical module. Within a module, the cells have similar receptive fields (location sensitivity), but vary in terms of input source (left or right eye), orientation sensitivity, color sensitivity, and size sensitivity (not shown). This organization is repeated for each location. Adapted from Bear et al. (1996). Top panel after Hubel and Wiesel (1968).

Retinotopie und Läsionen in V1



Partial damage to the primary visual cortex (V1) can result in blindness in specific regions. This is because this region of the brain is retinotopically organized. Area V1 is at the back of the brain and on the middle surface between the two hemispheres. Adapted from Zeki (1993).

Läsionen in V1: Filling in



If a visually presented semi-circle abuts a cortical scotoma (the shaded area), then the patient might report a complete circle. Thus, rather than seeing a gap in their vision, patients with blindsight might fill in the gap using visual information in the spared field. If the semi-circle is presented inside the scotoma, it isn't seen at all, whereas if it is away from the scotoma, it is perceived normally. Adapted from Torjussen (1976).

Gesichtsfelduntersuchungen (Perimetrie)

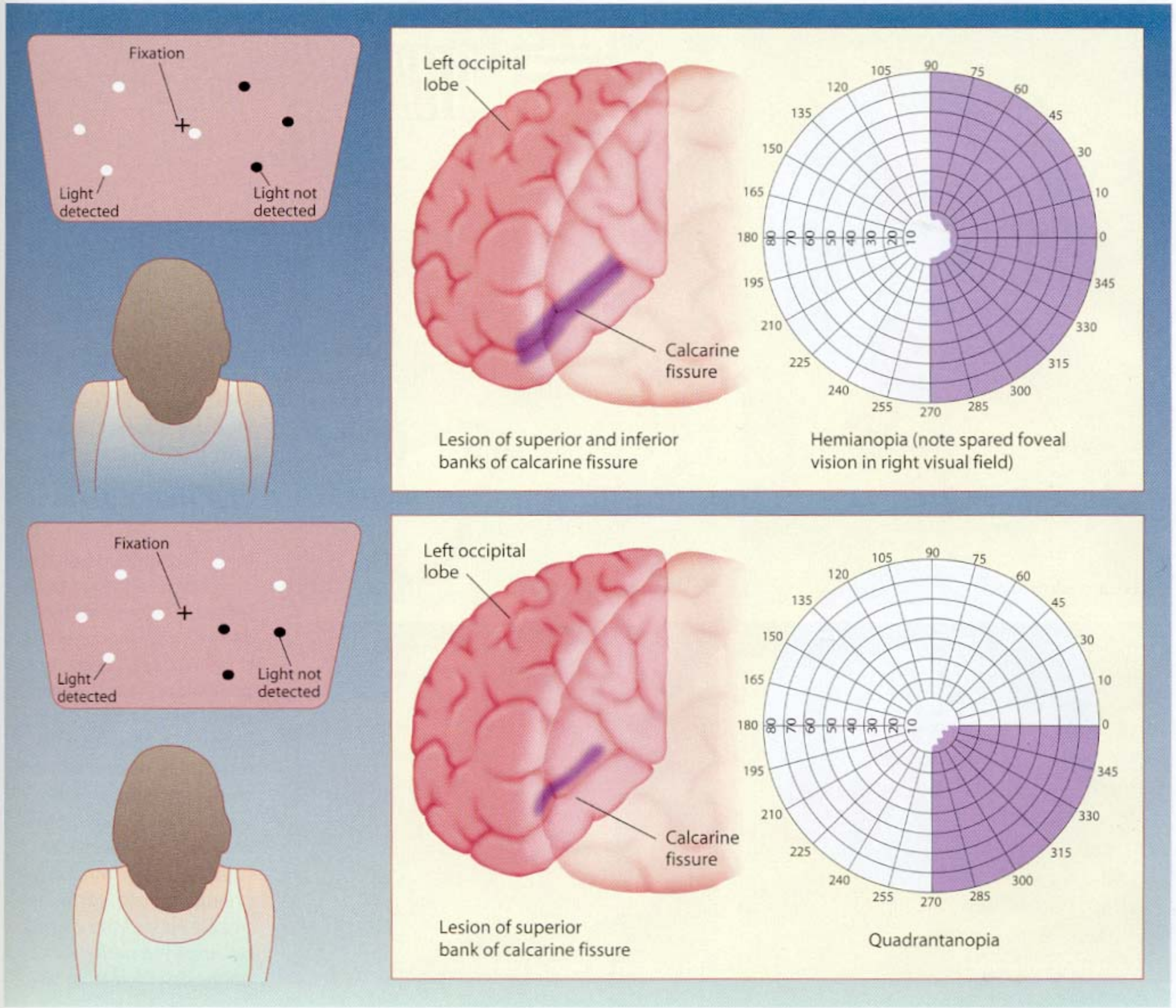


Figure 5.29 Plotting the scotoma in patients with lesions of the primary visual cortex. While the patient fixates on a central marker, a small light is flashed at various locations. The patient is asked to report when she sees the stimulus. If the lesion includes tissue on both the upper and lower banks of the calcarine fissure, the scotoma will include the entire contralesional hemifield. This is referred to as a *hemianopia*. If the lesion is restricted to the upper bank, the patient will have a *quadrantanopia*, referring to the fact that she only misses targets in one quadrant, the lower region of the contralesional hemifield. Although each eye is tested separately, the scotoma will be essentially identical because the lesions are in the cortex.

Blindsehen

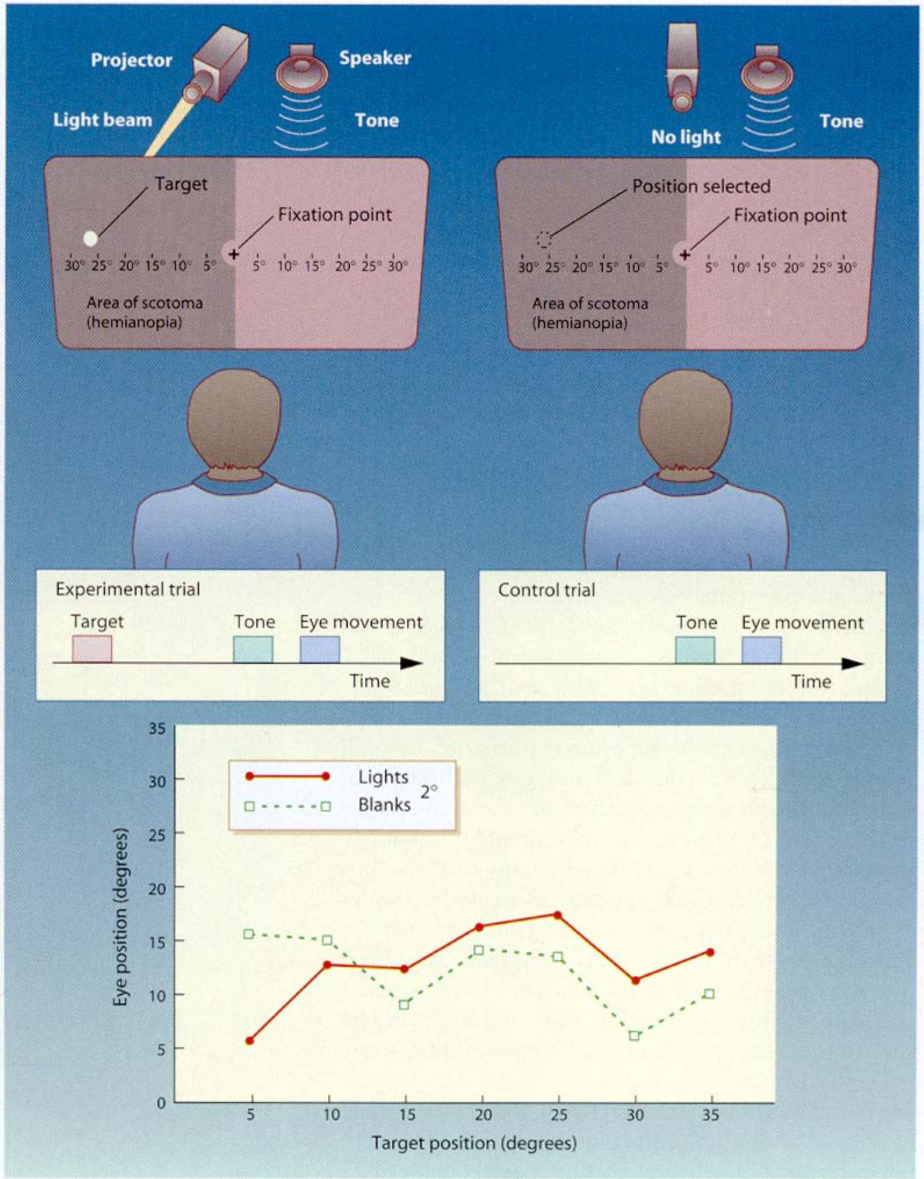
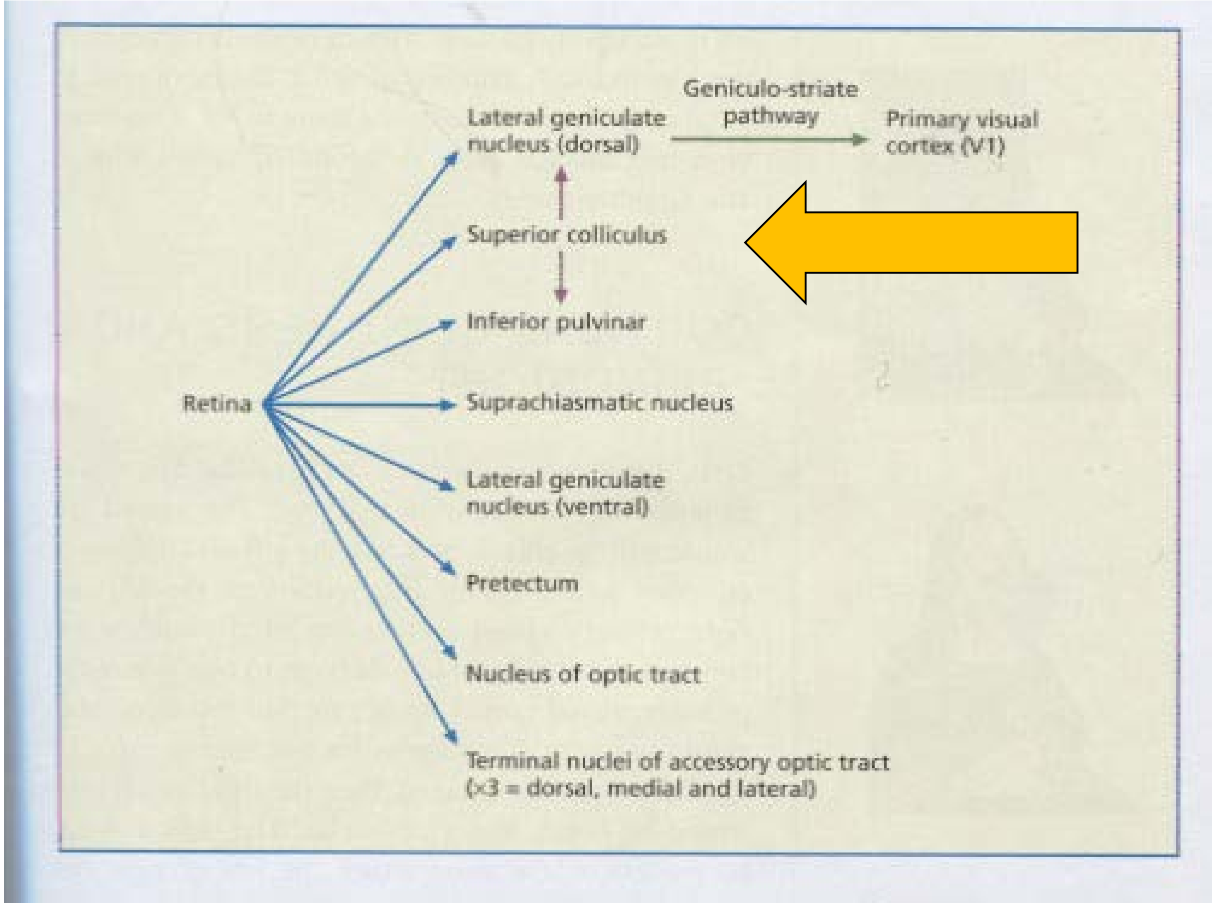


Figure 5.31 Experimental conditions to demonstrate blindsight. In the experimental trials, a light beam is projected at one of seven locations within D.B.'s scotoma. Upon hearing a tone, D.B. was required to move his eyes to the target location. In the control conditions, a target was selected but not illuminated prior to the tone. To D.B., the two conditions seemed identical, and he had to be encouraged to move his eyes since he reported not seeing anything in either condition. Nonetheless, D.B.'s eye movements showed a systematic relationship to the target position in the experimental condition, at least for the targets within 20 degrees of fixation. Adapted from Weiskrantz (1986).

Blindsehen



Geniculo-striate pathway
Lateral geniculate nucleus (dorsal)
Primary visual cortex (V1)
Superior colliculus
Inferior pulvinar
Retina
Suprachiasmatic nucleus
Lateral geniculate nucleus (ventral)
Pretectum
Nucleus of optic tract
Terminal nuclei of accessory optic tract
(×3 = dorsal, medial and lateral)

Hierachischer Aufbau visueller Areale

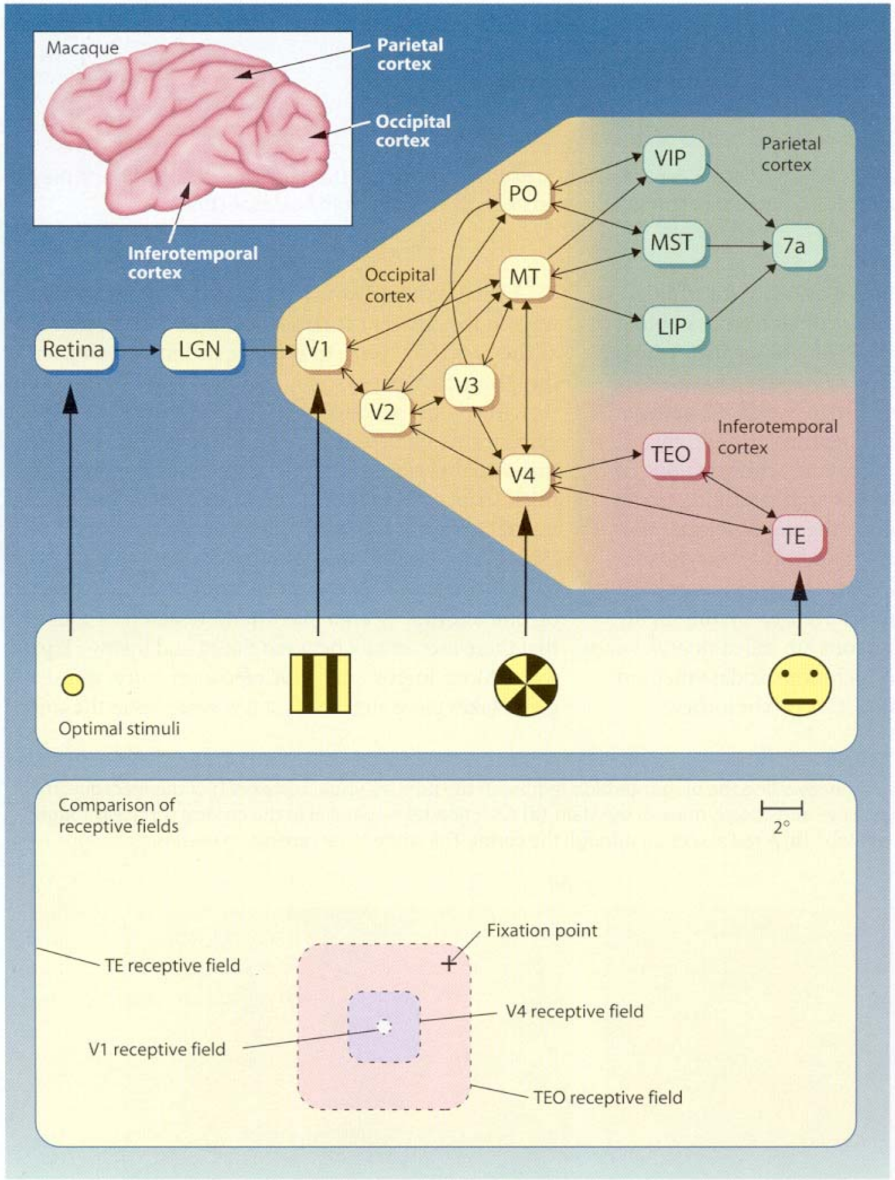
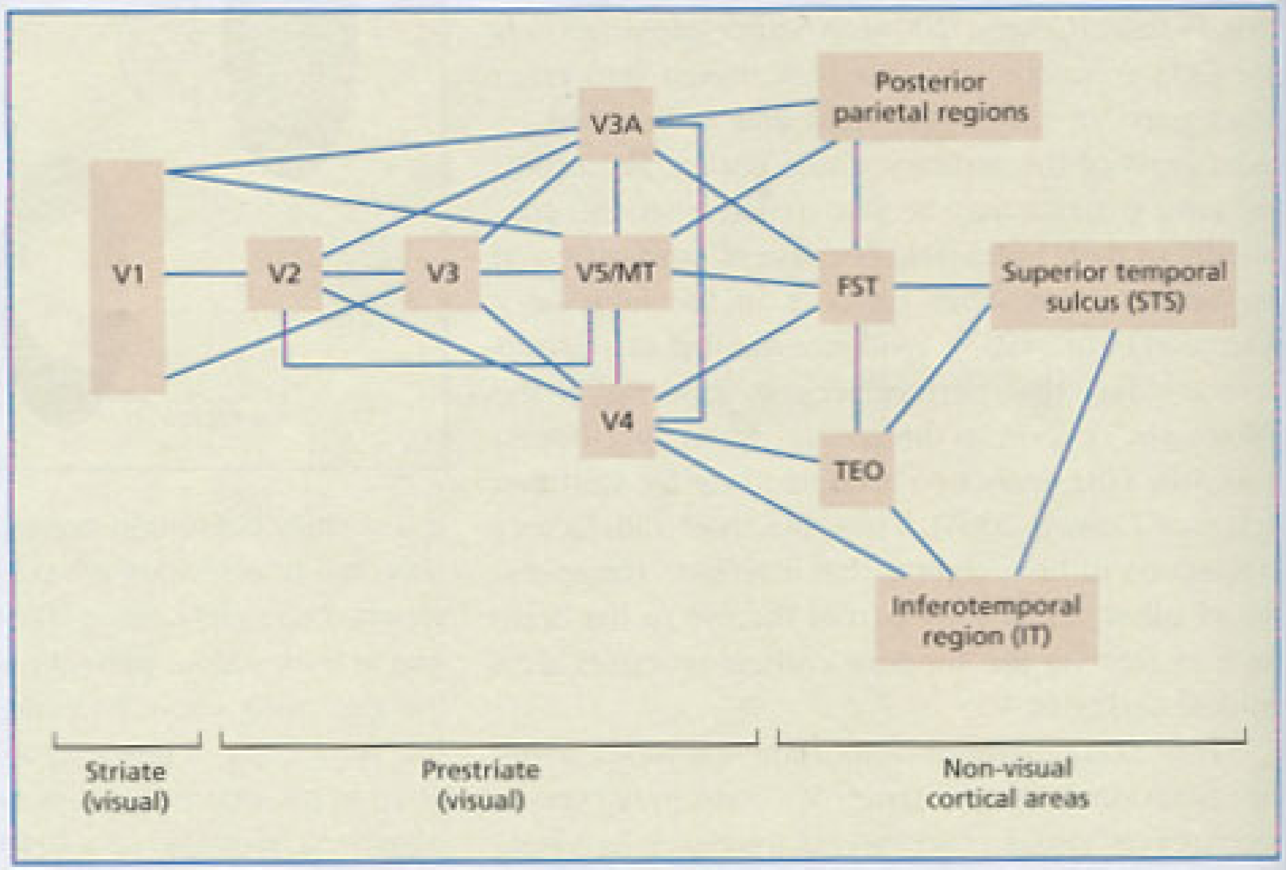


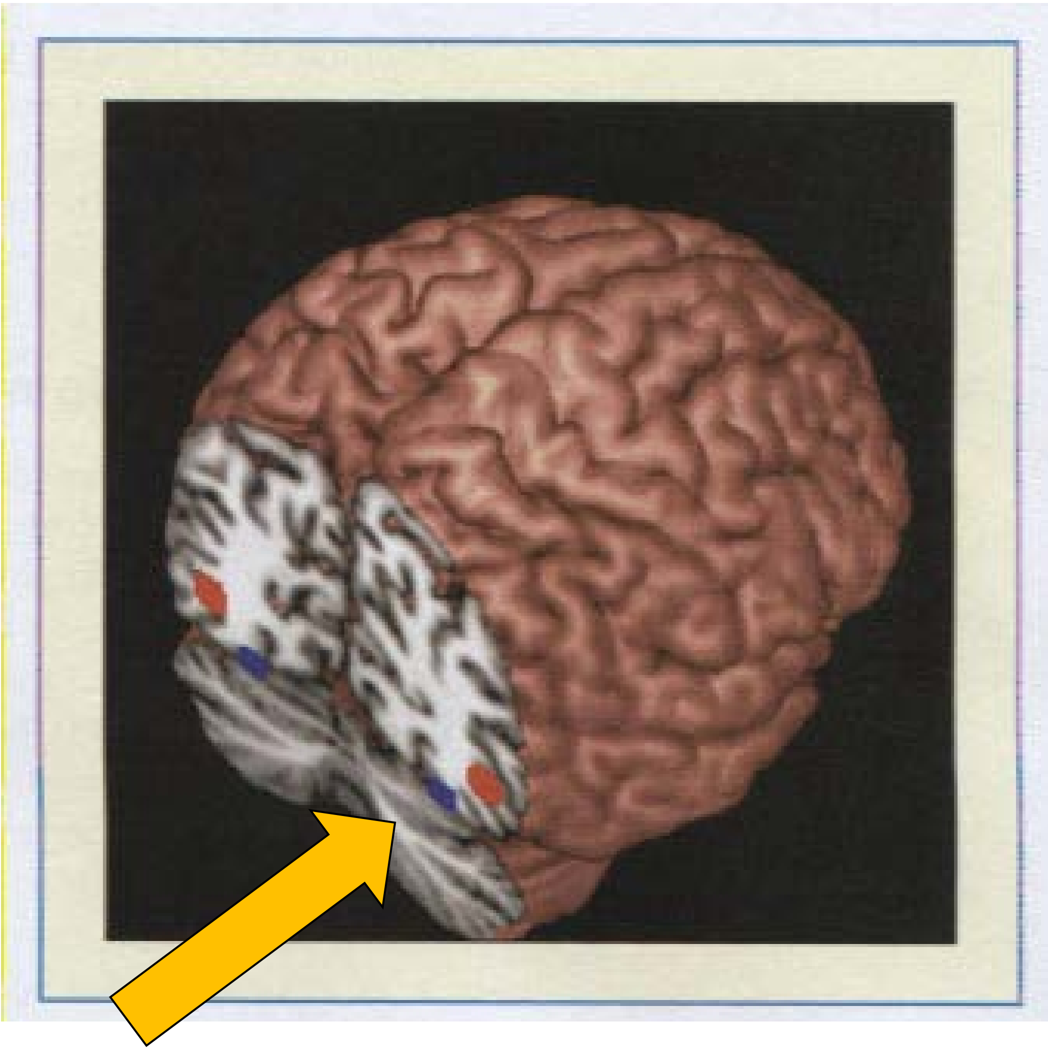
Figure 5.10 Summary of the prominent visual areas and the pattern of connectivity in the macaque. Whereas all cortical processing begins in V1, there are two processing streams that extend either dorsally to the parietal lobe or ventrally to the temporal lobe (see Chapter 6). The stimulus required to produce optimal activation of a cell becomes more complex along the ventral stream. In addition, the size of the receptive fields of these cells increases, ranging from the 0.5-degree span of a V1 cell to the 40-degree span of a cell in area TE. Adapted from art provided courtesy of Steven Luck.

Jenseits von V1: Extrastriatale Regionen

Information from V1 is sent in parallel to a number of other regions in the extrastriate cortex, some of which are specialized for processing particular visual attributes (e.g. V5/MT for movement). These extrastriate regions interface with the temporal cortex (involved in object recognition) and parietal cortex (involved in space and attention).



V4: Das Farbzentrum des Gehirns



Area V5/MT (in red) lies near the outer surface of both hemispheres and is responsible for perception of visual motion. Area V4 (in blue) lies on the under surface of the brain, in each hemisphere, and is responsible for the perception of color. This brain is viewed from the back.

Achromatopsie

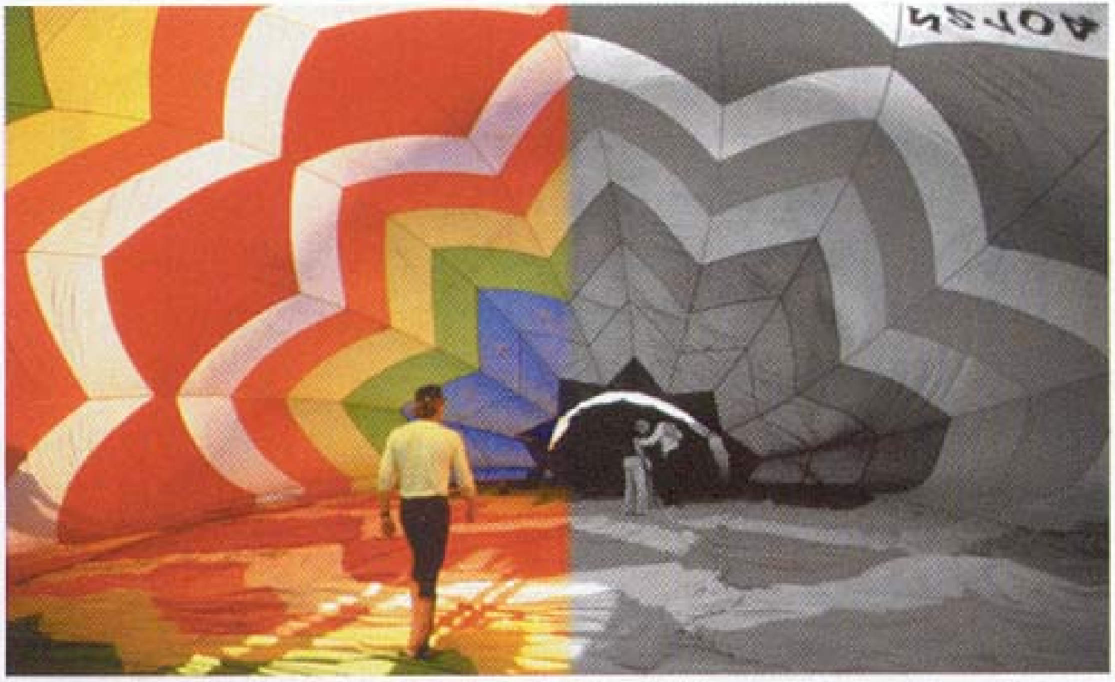
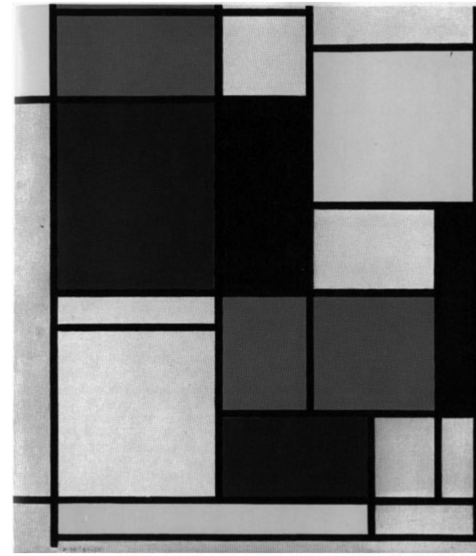


Figure 5.23 In achromatopsia, the world is seen as devoid of color. Because color differences are usually correlated with brightness differences, the objects in a scene might be distinguishable and appear as different shades of gray. This figure shows how the world might appear to a person with hemi-achromatopsia. In most cases, there is some residual color perception, although the person cannot distinguish between subtle color variations.



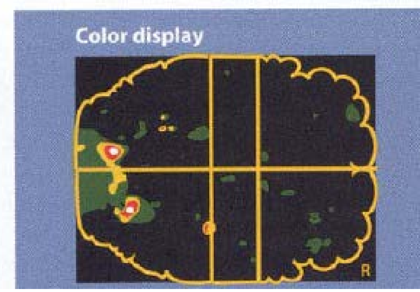
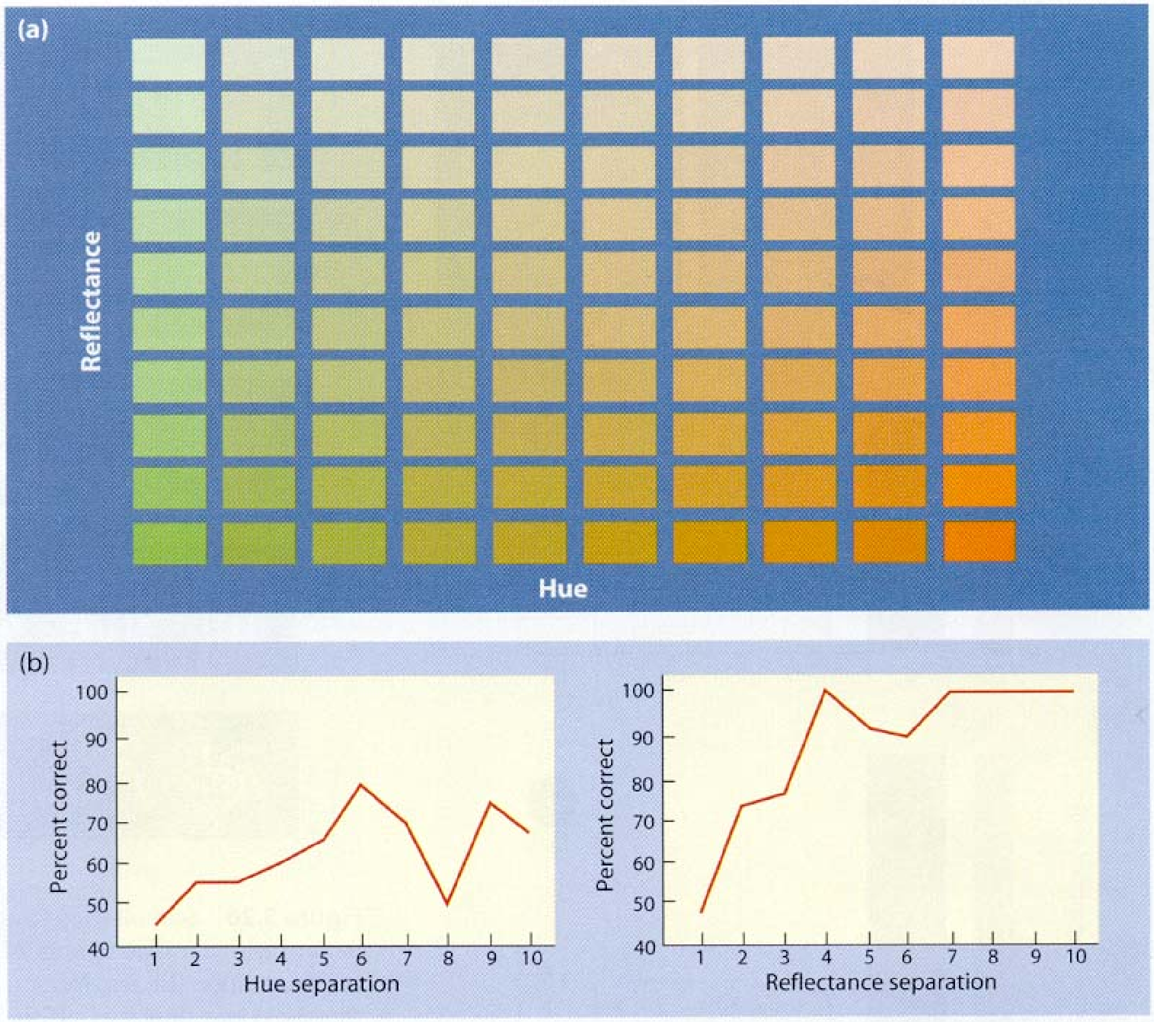


Figure 5.15 Regions of activation when the control conditions were subtracted from the experimental conditions. In the color condition, the prominent activation is medial, in areas corresponding to human V4. In the motion condition, the activation is more lateral, in areas corresponding to human MT. The foci also differ along the dorsal-ventral axis: The slice showing MT is superior to that showing V4. Both stimuli also produced significant activation in primary visual cortex when compared to a control condition in which there was no visual stimulation. Adapted from Zeki (1993).

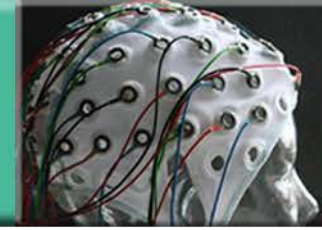
Achromatopsie: Färbung und Reflektanz

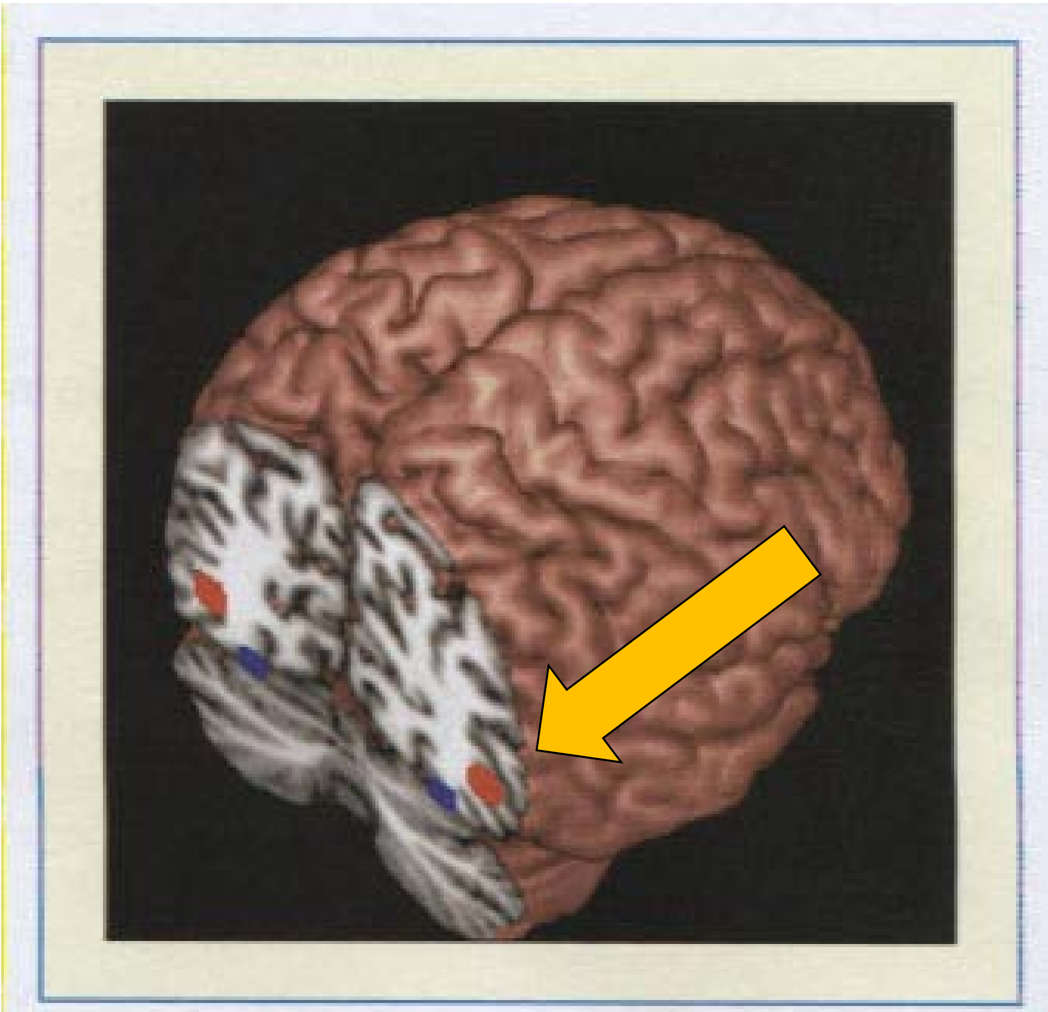
Figure 5.24 **(a)** Psychological scaling techniques can be used with healthy individuals to create stimulus sets in which the similarity of all neighboring pairs is judged as equal. These techniques are used to create norms for the similarity across the different dimensions of a color (hue, saturation, and reflectance, the physical measure that underlies our perception of brightness). **(b)** Pairs of color chips were presented and the achromatopsia patient was asked to judge whether they were the same or different. This patient's ability to make such judgments was severely impaired when the pairs differed in hue, even when the stimuli differed by 10 units. His ability to discriminate brightness, although not normal, was much better. Here, he almost always labeled the stimuli as different when they were separated by at least 4 units. (b) From Heywood et al. (1987).



Patient PT:
Defizit in der Farbwahrnehmung nach Verletzung der P-Bahn

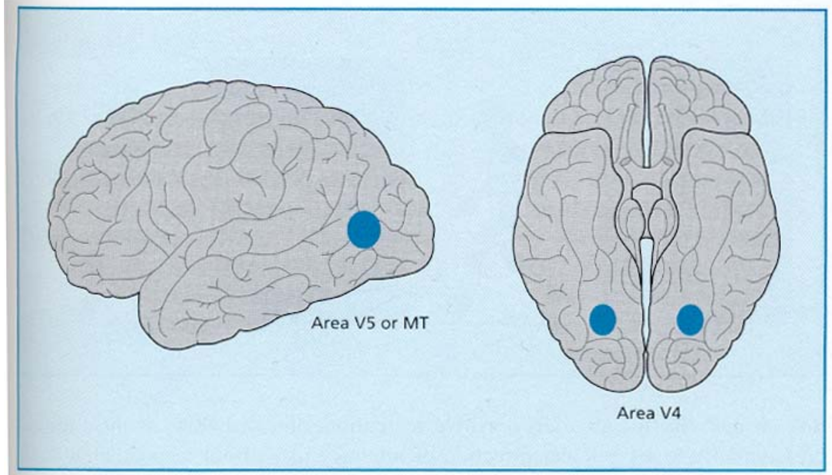
V5/MT: Das Bewegungs-zentrum des Gehirns





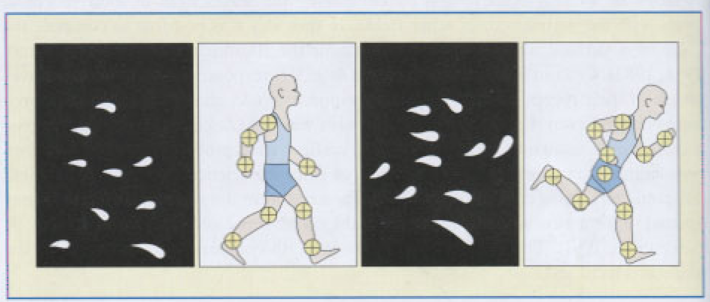
Area V5/MT (in red) lies near the outer surface of both hemispheres and is responsible for perception of visual motion. Area V4 (in blue) lies on the under surface of the brain, in each hemisphere, and is responsible for the perception of color. This brain is viewed from the back.

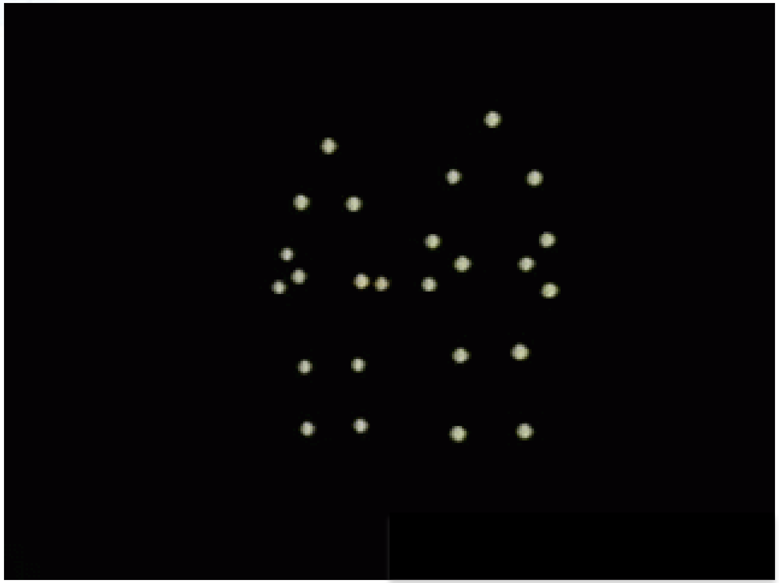
V5/MT: Das Bewegungs-zentrum des Gehirns



Area V5 or MT is responsible for processing visual motion and is located at the occipito-temporal junction bilaterally (left side shown here). Area V4 is responsible for the processing of colour and is located on the under surface of the brain in the fusiform region. Adapted from Allison et al., 1994.

When this array of dots is set in motion, most people can distinguish between biological and non-biological motion.





V5/MT: Das Bewegungs-zentrum des Gehirns

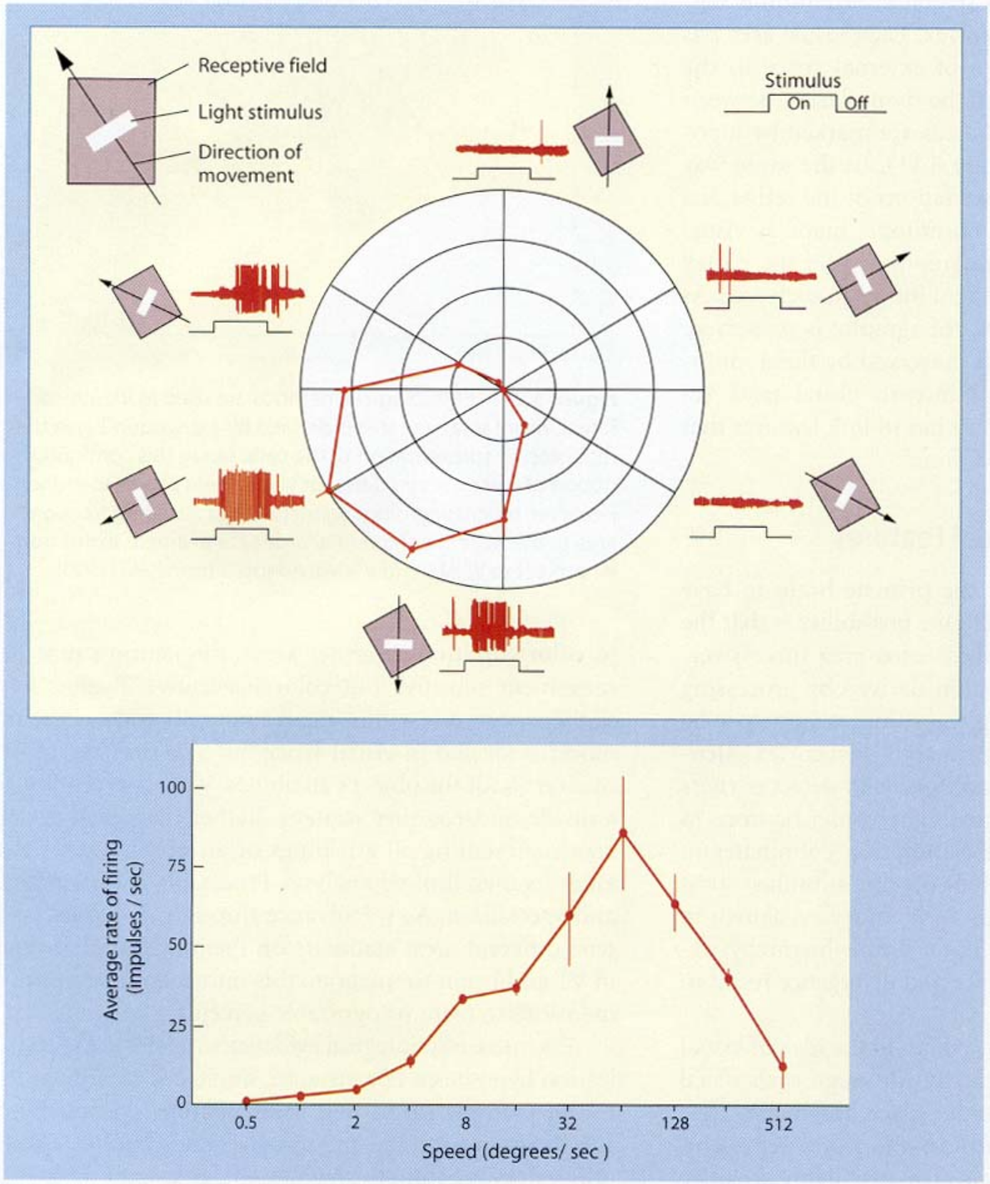


Figure 5.12 Directional and speed tuning of a neuron from area MT. **Top:** A rectangle was moved through the receptive field of this cell in various directions. The red traces beside the stimulus cartoons indicate the response of the cell to these stimuli. In the polar graph, the firing rates are plotted, with the angular direction of each point indicating the stimulus direction and the distance from the center indicating the firing rate as a percentage of the maximum firing rate. The polygon formed by connecting the points indicates that the cell was maximally responsive to stimuli moved down and to the left; the cell responded minimally when the stimulus moved in the opposite direction. **Bottom:** The graph shows speed tuning for a cell in MT. In all conditions, the motion was in the optimal direction. This cell responded most vigorously when the stimulus moved at 64 degrees/sec. Adapted from Maunsell and Van Essen (1983).

Bewegungssehen:
Bewegung (25ms) an- oder abwesend

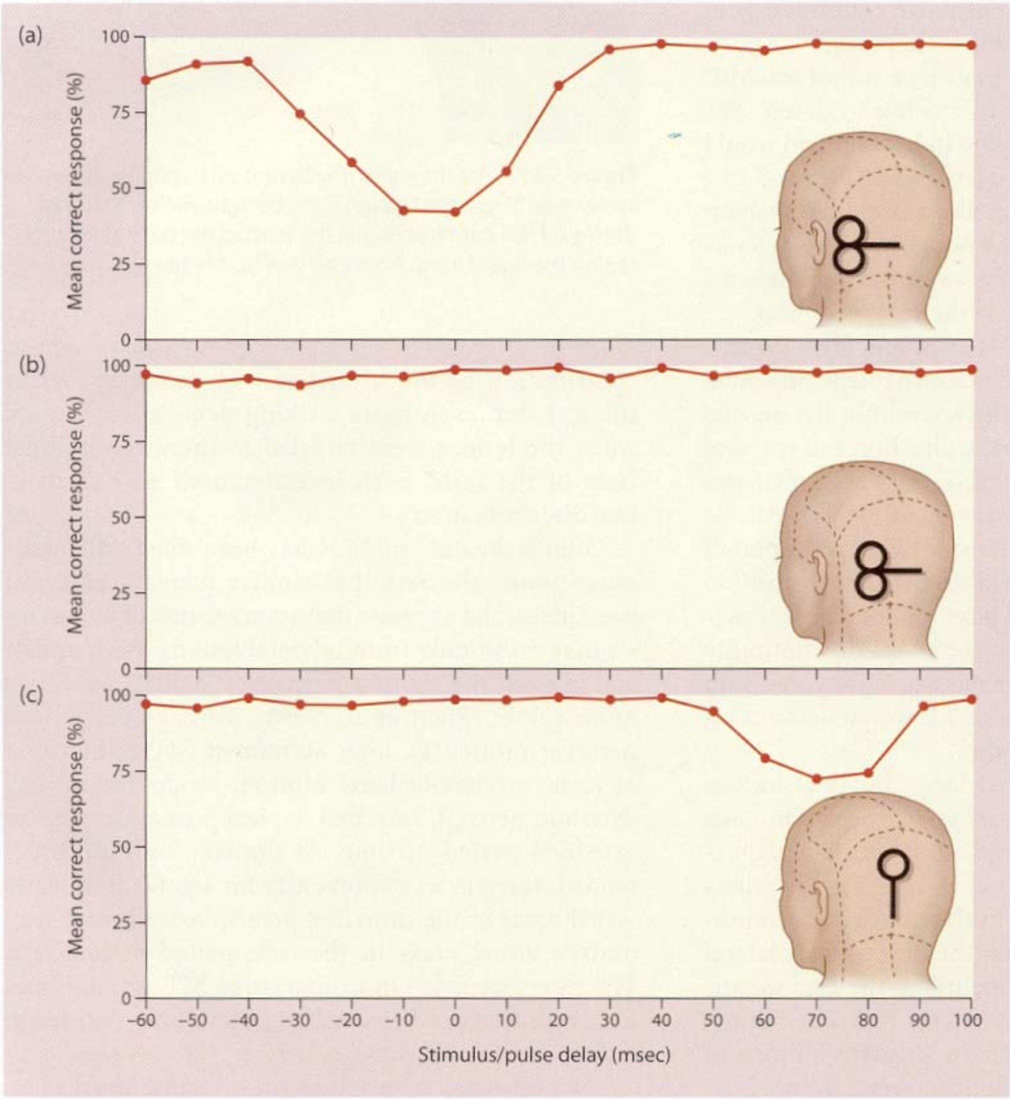
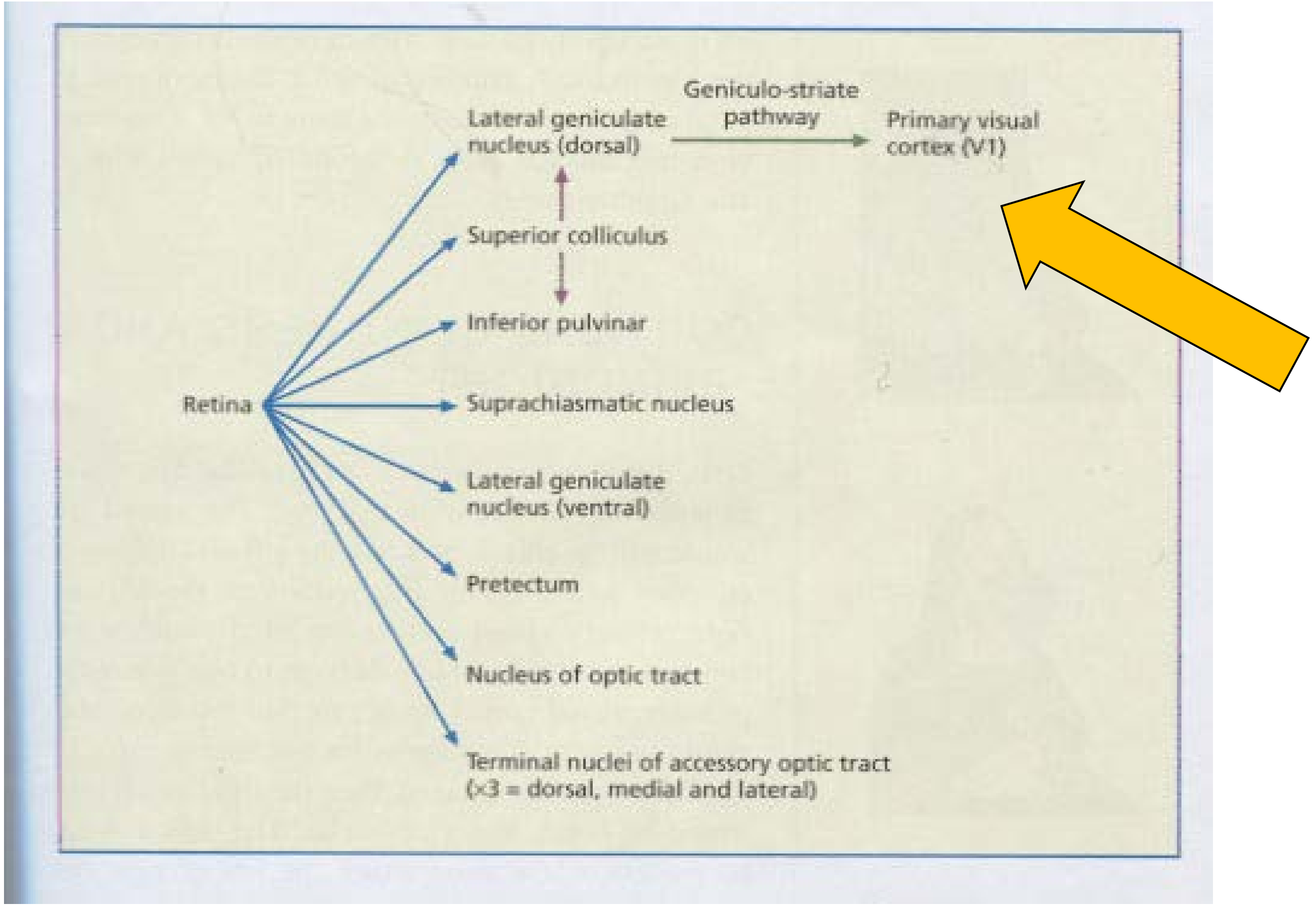


Figure 5.28 Perception of motion during transcranial magnetic stimulation (TMS) over the visual cortex. Results are rates of accuracy in determining the direction of motion as a function of the time between stimulus onset and the TMS pulses applied over area MT **(a),** V1 **(c),** and an extrastriate region between these two **(b).** Adapted from Beckers and Zeki (1995).

Bewegungssehen; Alternative Routen nach V5



L.M.:Akinetopsie

Figure 5.27 For the patient with motion blindness, the world appears as if viewed through a strobe light. Rather than see the liquid rise continuously in the teacup, the patient reports seeing the liquid jump from one level to the next.

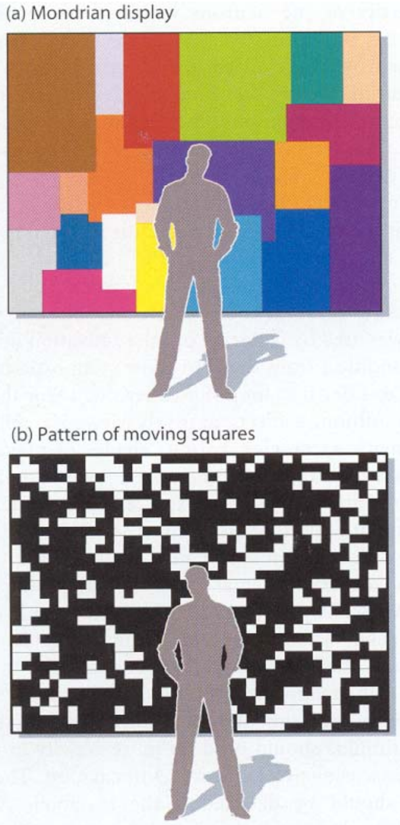


Figure 5.14 Schematic of the stimuli used in a PET experiment to identify regions involved in color and motion perception. **(a)** For the color experiment, the stimuli were composed of an arrangement of rectangles that were either shades of gray (control) or various colors (experimental). **(b)** For the motion experiment, a random pattern of black and white regions was either stationary (control) or moving (experimental). Adapted from Zeki (1993).

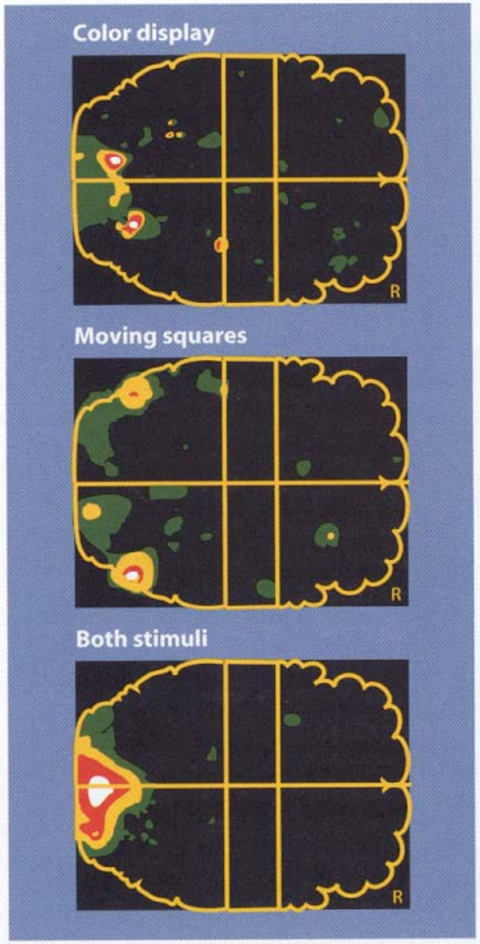
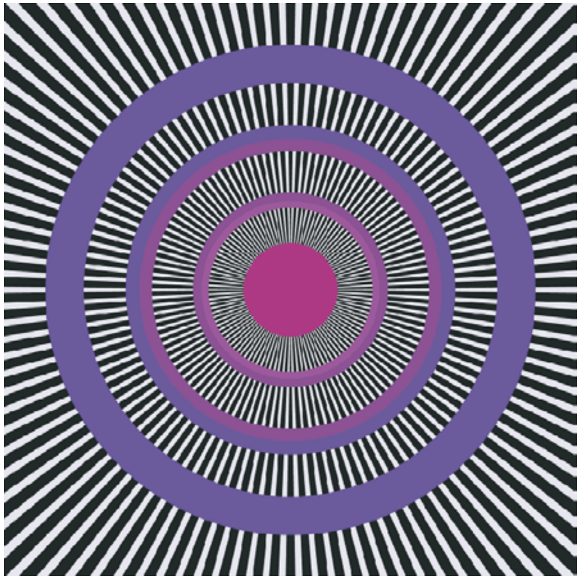
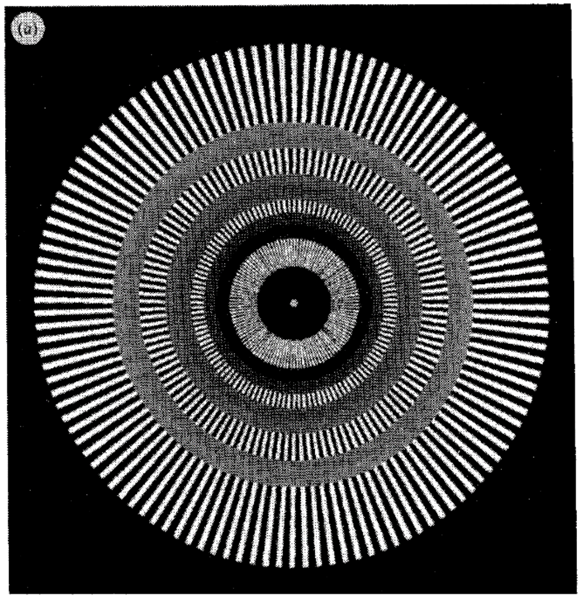
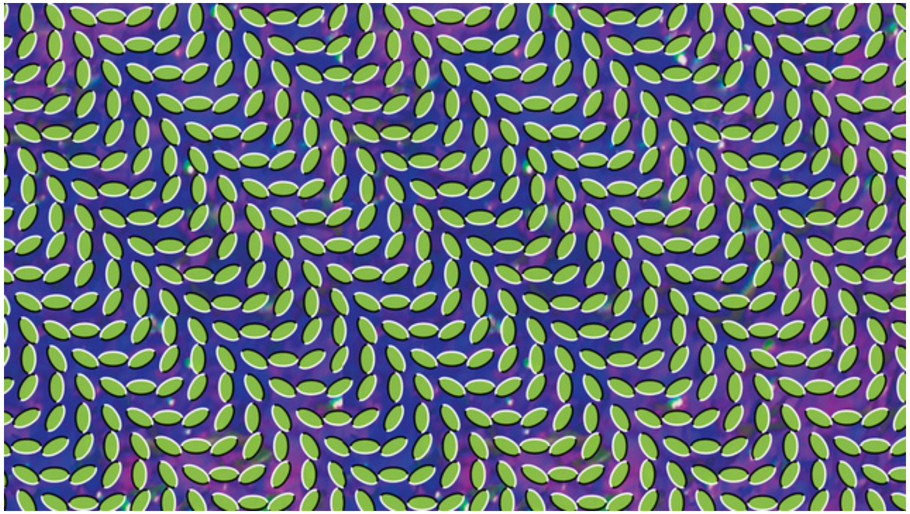


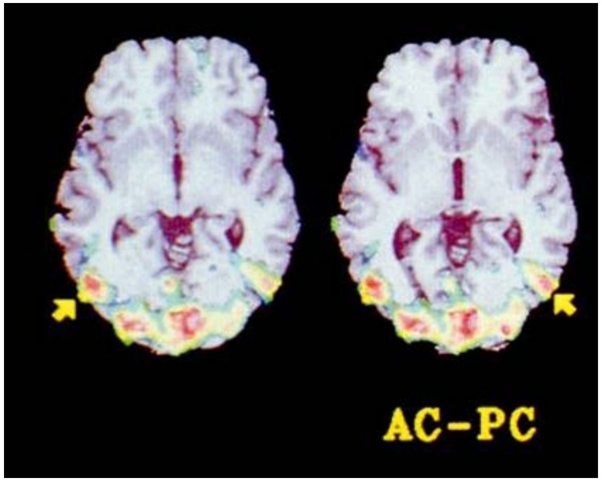
Figure 5.15 Regions of activation when the control conditions were subtracted from the experimental conditions. In the color condition, the prominent activation is medial, in areas corresponding to human V4. In the motion condition, the activation is more lateral, in areas corresponding to human MT. The foci also differ along the dorsal-ventral axis: The slice showing MT is superior to that showing V4. Both stimuli also produced significant activation in primary visual cortex when compared to a control condition in which there was no visual stimulation. Adapted from Zeki (1993).

Bewegungsillusionen gehen mit MT/V5 Aktivierung einher

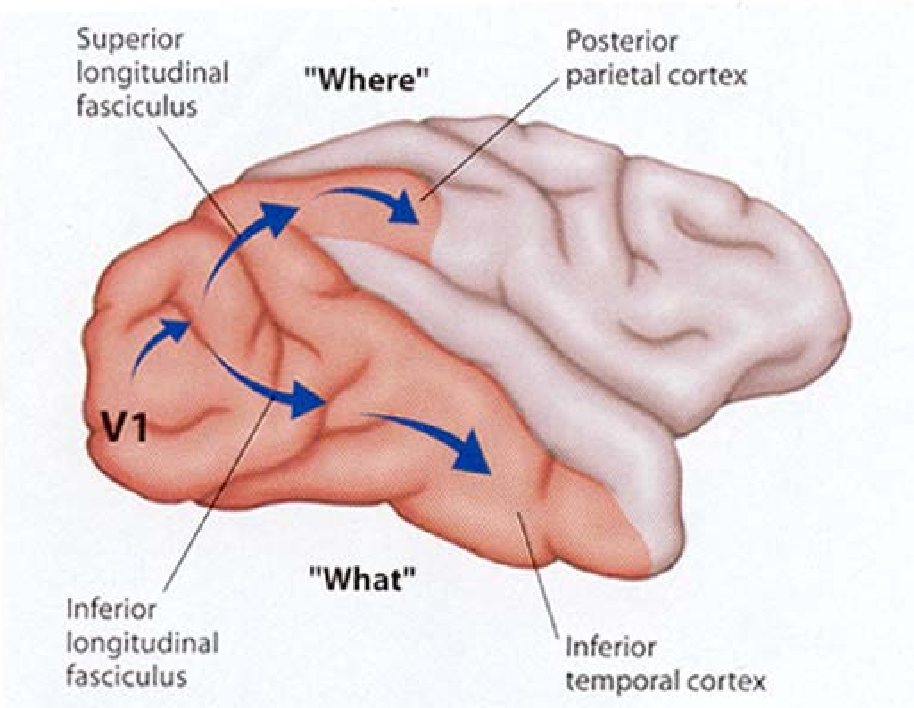


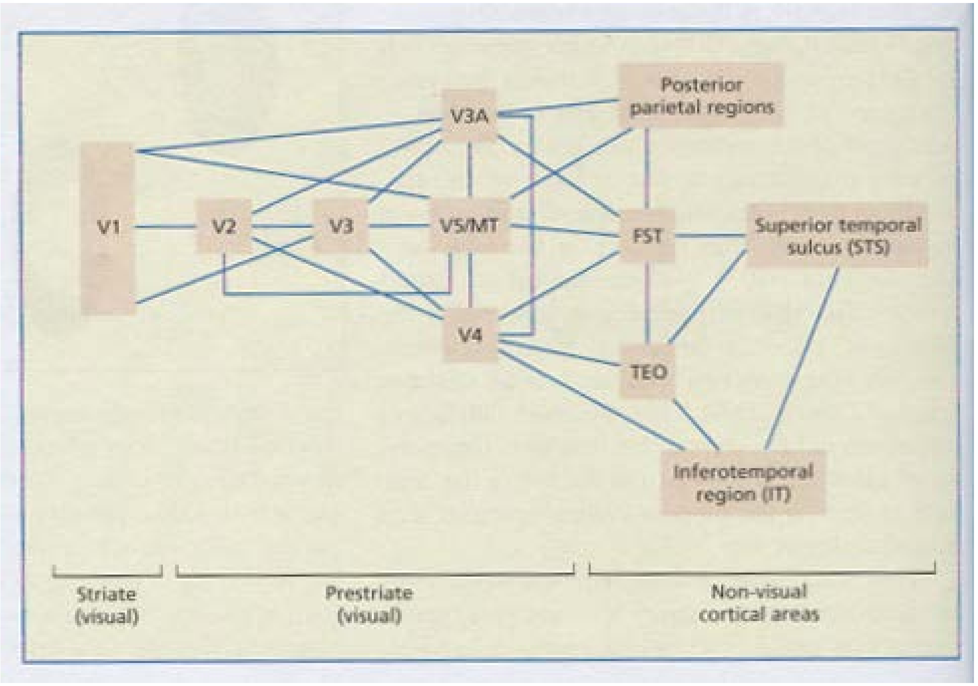


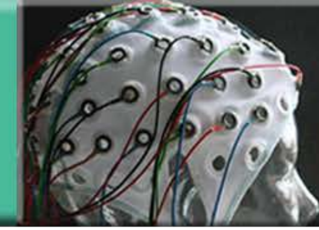




Die Dorsal- und Ventralbahn







Die Dorsal- und Ventralbahn: Läsionseffekte

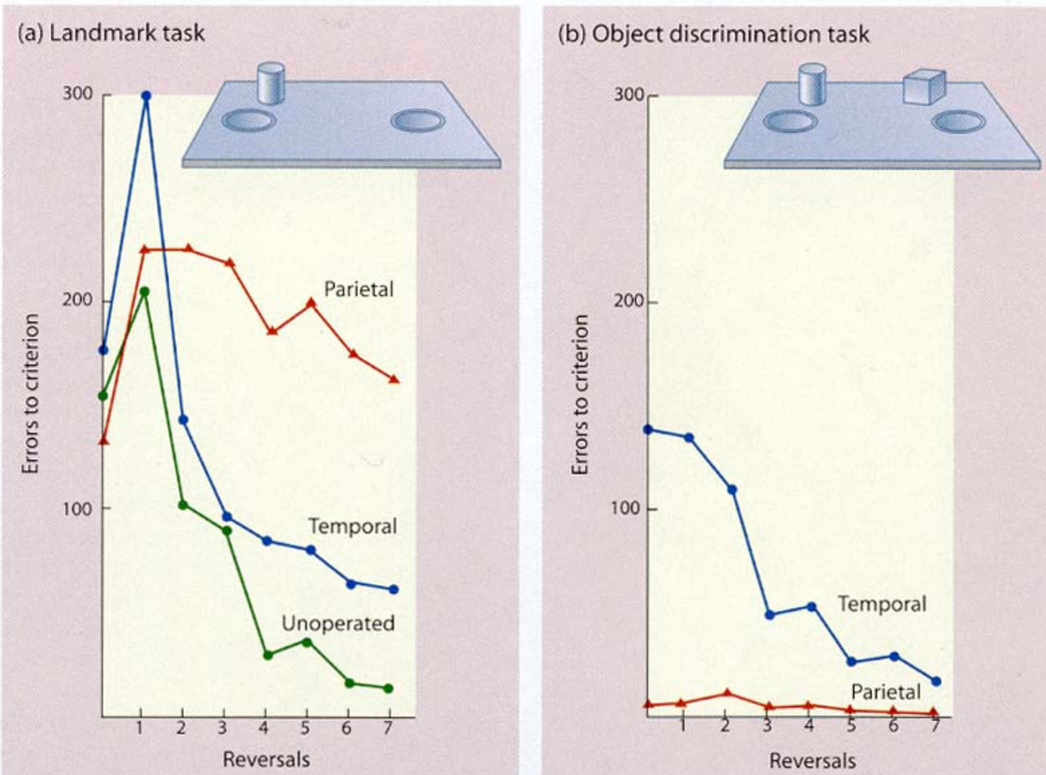


Figure 6.4 Double dissociation in support of the what-where dichotomy. **(a)** In the landmark task, the monkey initially finds a reward in the food well closest to the cylinder. Once this association is learned, the rule is reversed so that now the food is always placed in the well farthest from the cylinder. While all the animals have difficulty following the first few reversals, the control animals as well as those with bilateral temporal lobe lesions show significant improvements with subsequent reversals. Animals with bilateral parietal lobe lesions fail to improve. **(b)** In the object discrimination task, the location of the food is associated with one of the objects. Now the animals with temporal lobe damage show more impairment than those with parietal lobe lesions. Control animals were not tested on the object discrimination task. Adapted from Pohl (1973).

Charakteristika der Dorsalbahn

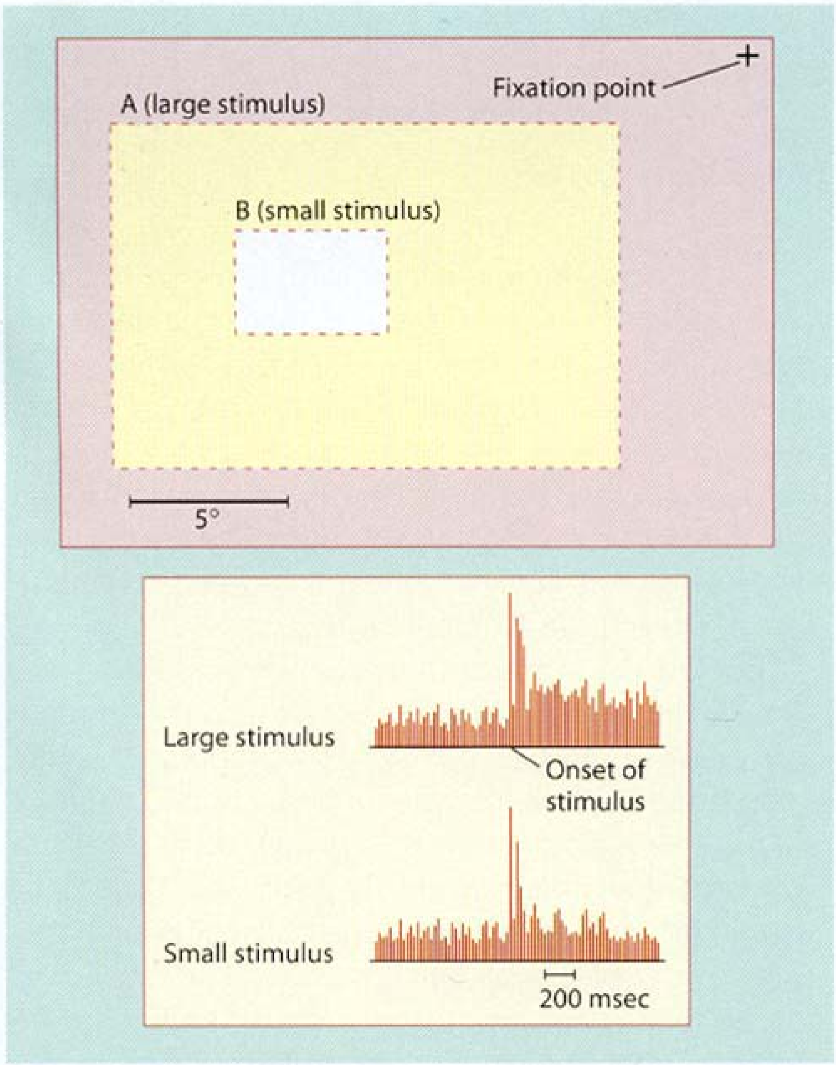


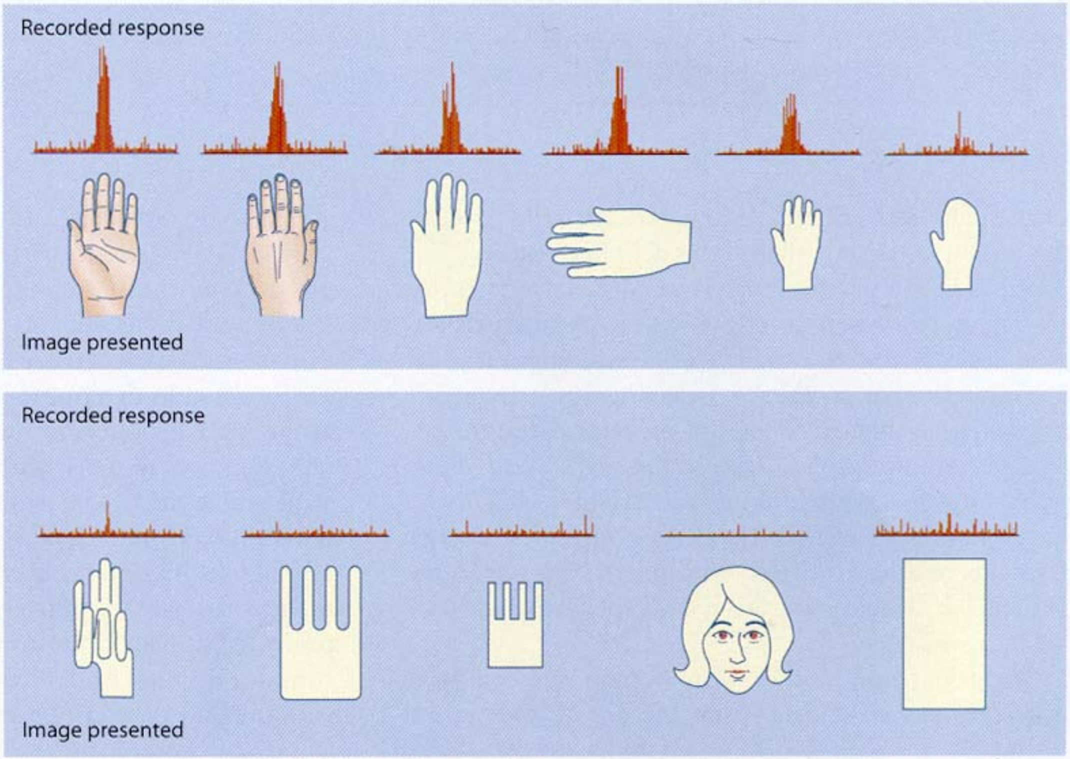
Figure 6.6 Single-cell recordings from a neuron in the posterior parietal cortex of the monkey. The receptive field of the cell was centered in the lower quadrant of the left visual field. While fixating, the animal was presented with either a large or a small stimulus. The cell responds to both stimuli, although the magnitude of activity is correlated with the size of the stimulus.

40 % der Zellen der Dorsalbahn haben rezeptive Felder, die die Fovea mit einschließen.

Alle Zellen der Ventralbahn sind foveal.

Charakteristika der Ventralbahn

Figure 6.7 Single-cell recordings from a neuron in the inferior temporal cortex. These cells rarely respond to simple stimuli such as lines or spots of light. Rather, they respond to more complex objects such as the hand drawings shown in the top row. Note that the cell shows only a weak response to the mitten, indicating that its activity is not associated with the general shape of a hand. This cell does not respond to the comblike objects that contain the series of parallel lines as in the hand stimuli. Adapted from Desimone et al. (1984).



- Alle Zellen haben rezeptive Felder, die die Fovea mit einschließen.

- 59% der Zellen reagieren merkmalsspezifisch.

Die Dorsal- und Ventralbahn

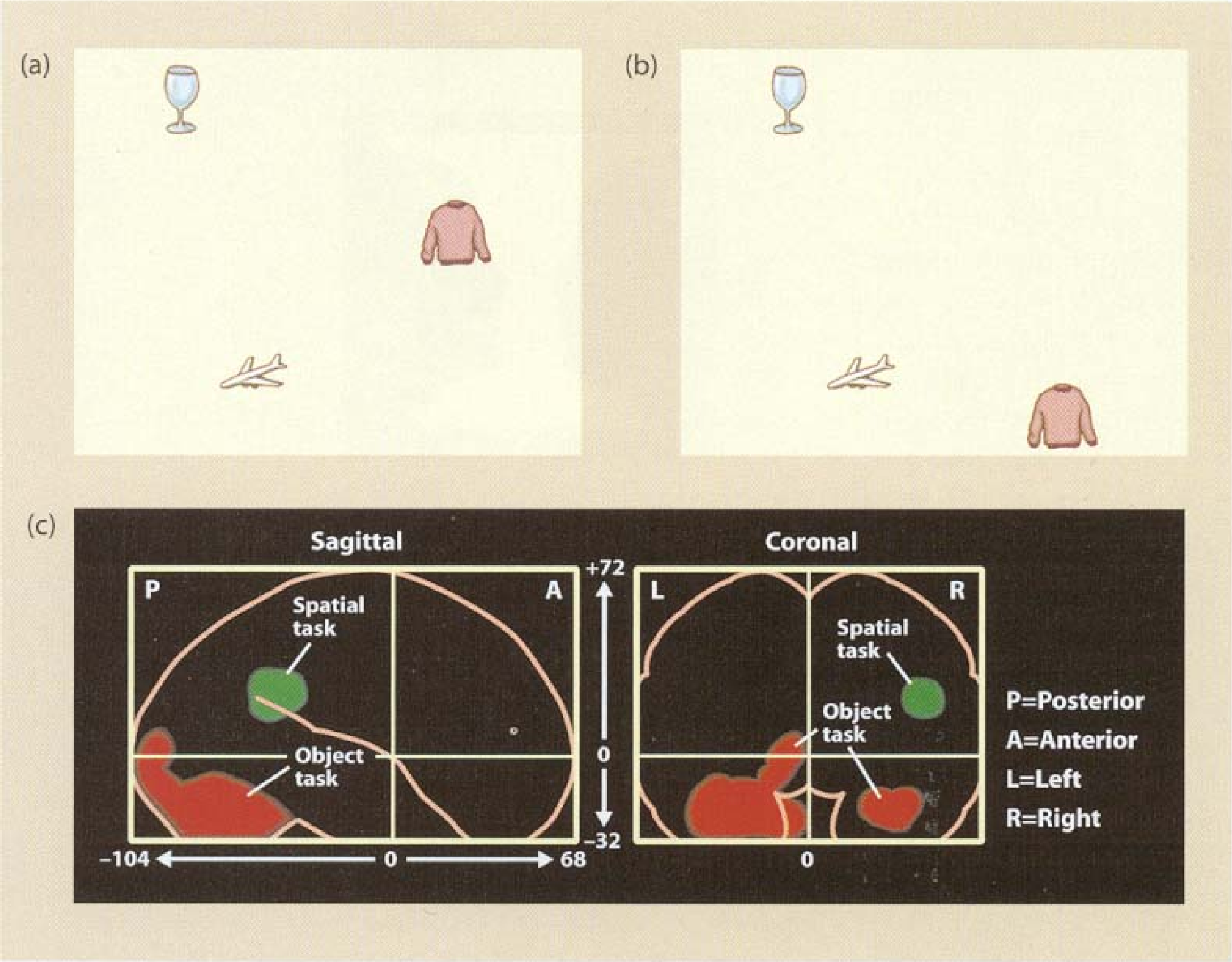


Figure 6.8 Same-different matching task used to contrast spatial and object discrimination. **(a)** Sample stimulus. **(b)** Test stimulus in which a same response would be required in the object task and a different response would be required in the spatial task. **(c)** Sagittal section showing activation centers for the object task (red) and spatial task (green). While both activations are superimposed on the same slice, activation during the spatial task was restricted to the right hemisphere whereas activation during the object task was bilateral. Adapted from Kohler et al. (1995).

Komponenten der Objekterkennung:
Keine zusätzliche Aktivierung für vertraute Objekte in der Ventralbahn

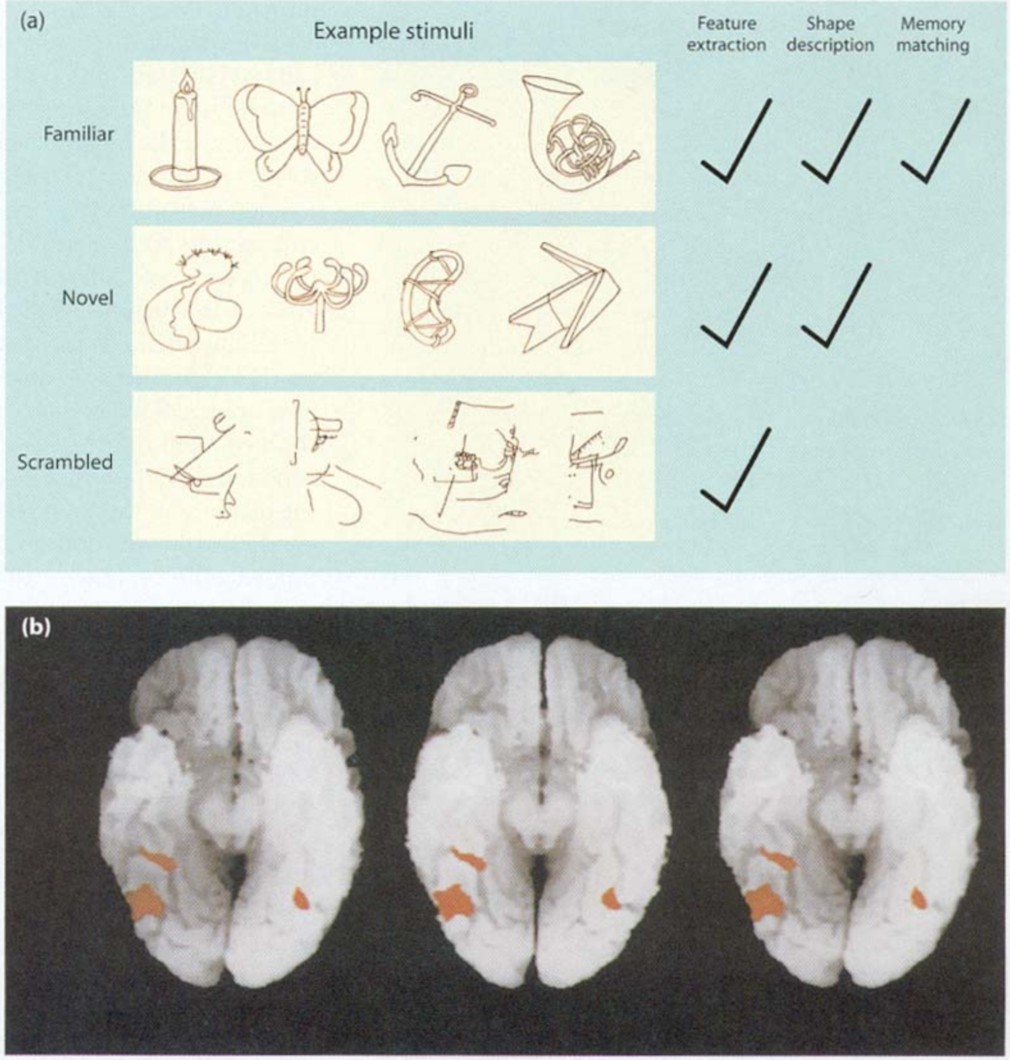
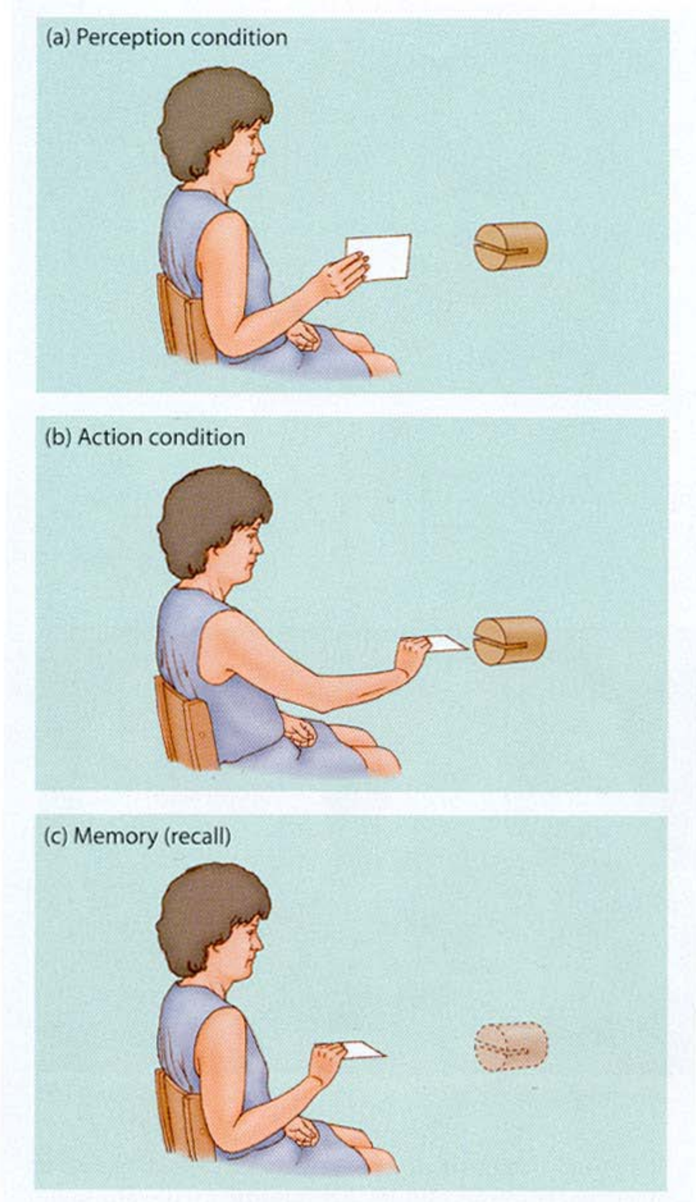


Figure 6.9 Component analysis of object recognition. **(a)** Stimuli for the three conditions and the list of required mental operations. Novel objects are hypothesized to engage processes involved in perception even when verbal labels do not exist. **(b)** Activation for both novel and familiar objects was bilateral along the ventral surface of the occipitotemporal cortex. From Kanwisher et al. (1997).

„Where“ vs „how“ ? Die Patientin D.F.
(Läsion der Ventralbahn)



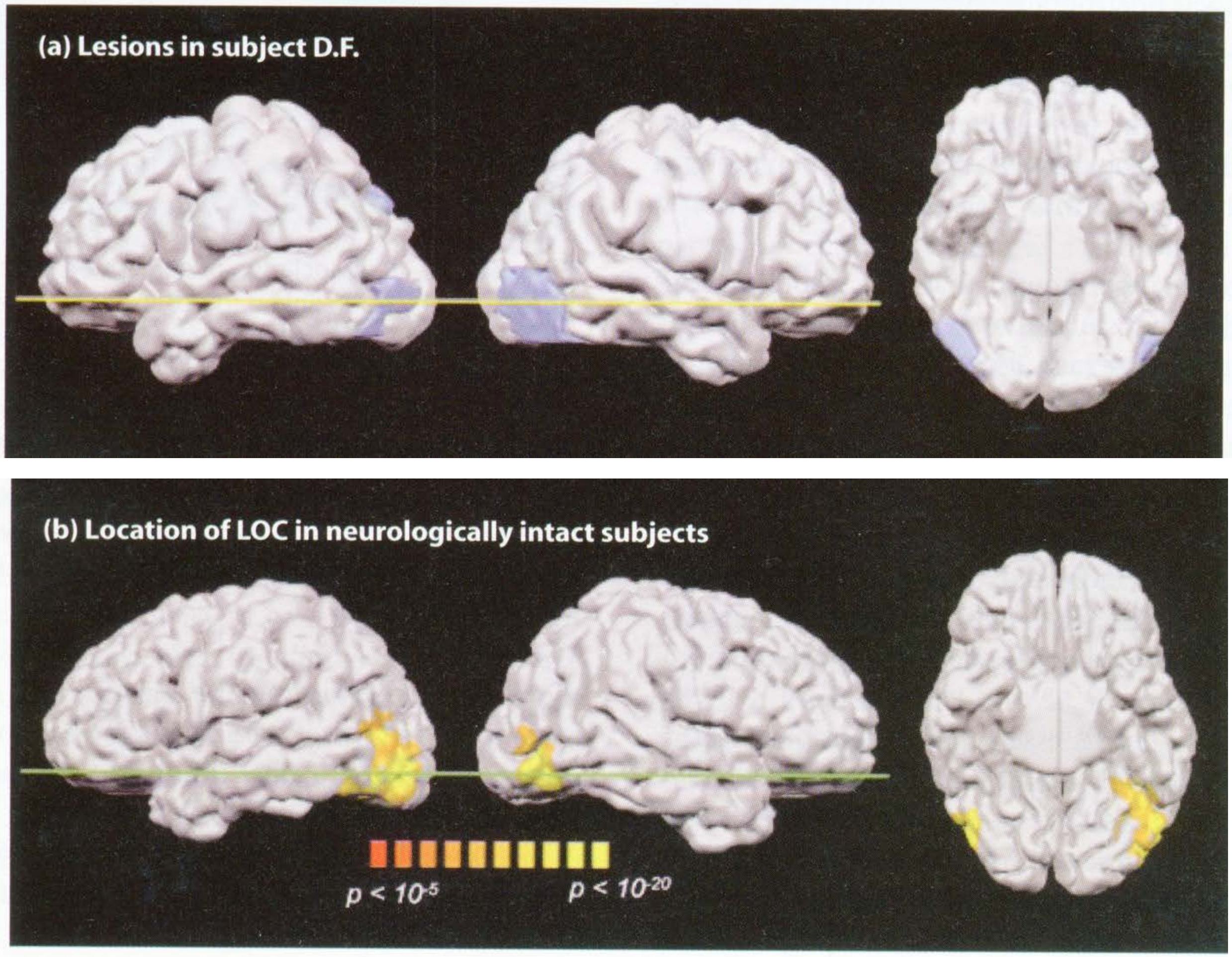
f

√

√

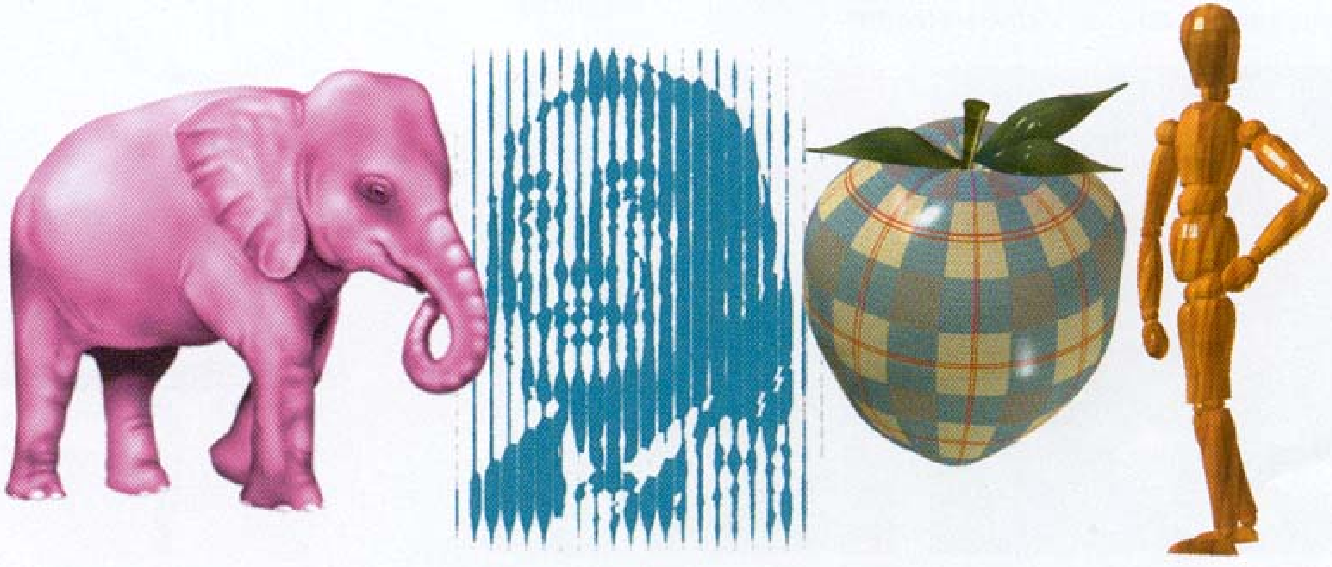
„Where“ vs „how“ ? Die Patientin D.F.
(Läsion der Ventralbahn)

Figure 6.11 Ventral-stream lesions in D.F shown in comparison with the expected location of the lateral occipita complex (LOC) in healthy participants. **(a)** Reconstruction of D.F's brain lesion is shown n pale blue. Latera views of the left and right hemispheres are shown, as is a ventral view of the underside of the brain. **(b)** The highlighted regions (yellow) indicate activation in the lateral occipital cortex of neurologically healthy individuals when they are recognizing objects.



Objekterkennung: Primat der Form

Figure 6.11 Despite the irregularities in how these objects are depicted, we have little problem in recognizing them. We may never have seen pink elephants or plaid apples, but our object recognition system can still discern the essential features.



Variabilität der Objektwahrnehmung
Das Generalitäts- / Spezifitätsproblem

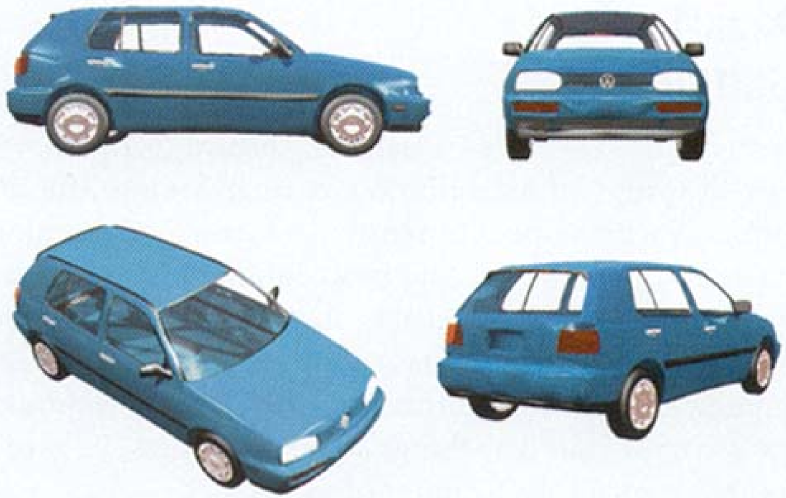
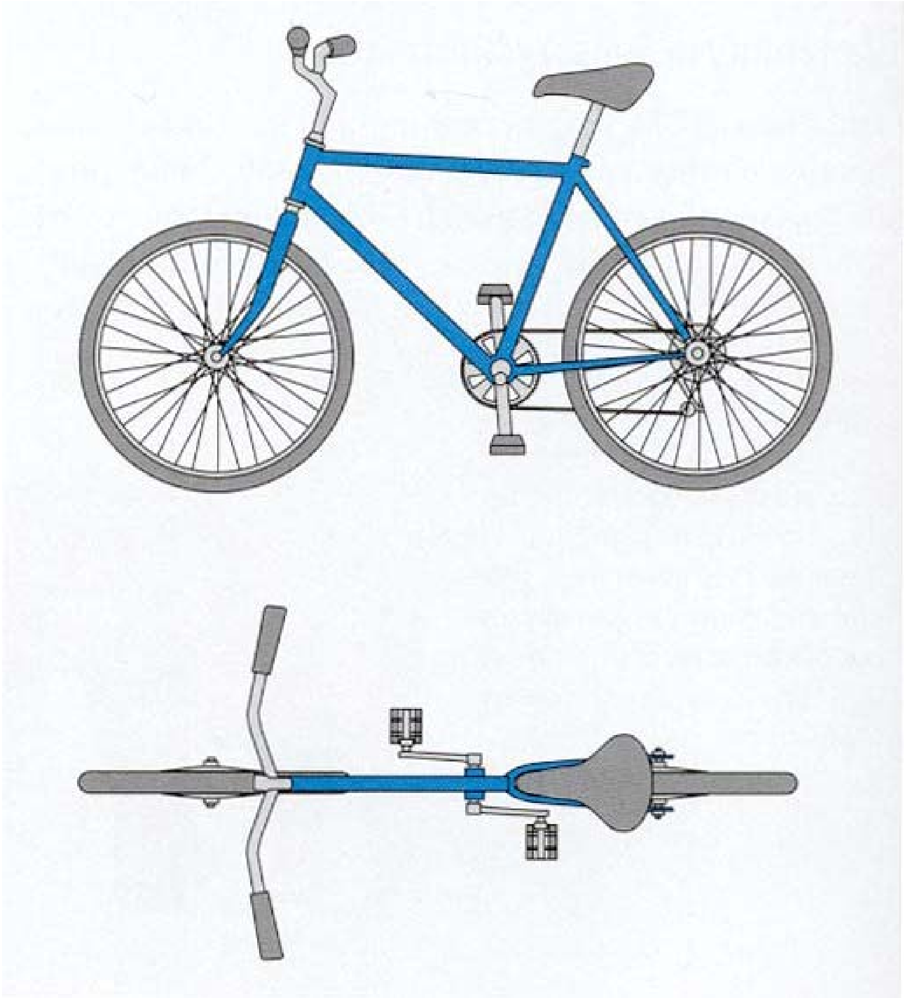


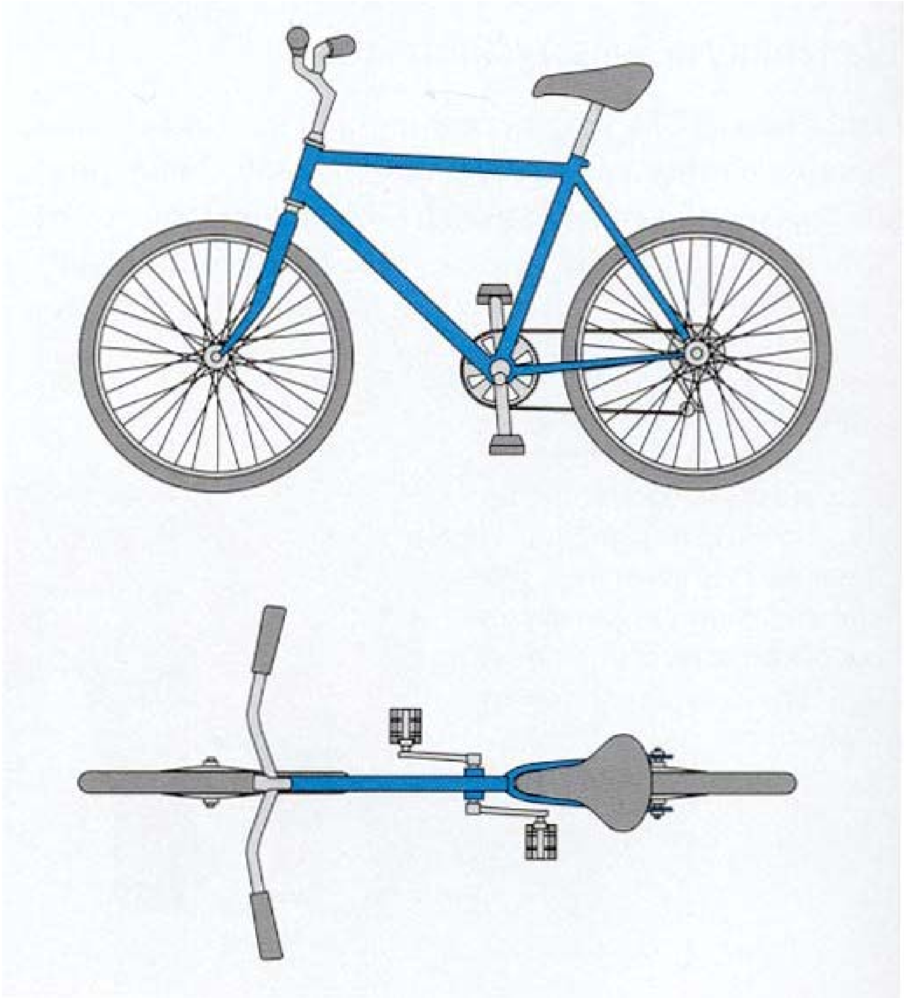
Figure 6.12 The image on the retina is vastly different for these four drawings of a car. Despite this sensory variability, our phenomenology is that we rapidly recognize that the drawings are of the same car.

Figure 6.13 Object constancy must be achieved in spite of the many sources of variation in the sensory input, including shadows **(left)** and occlusion **(right)**.

Blickabhängige Theorien der Objekterkennung



Blickunabhängige Theorien der Objekterkennung



Der „Repetition-Suppression“ Effekt bestätigt blickabhängige und –unabhängige Modelle

Blickunabhängige Theorien

Blickabhängige Theorien

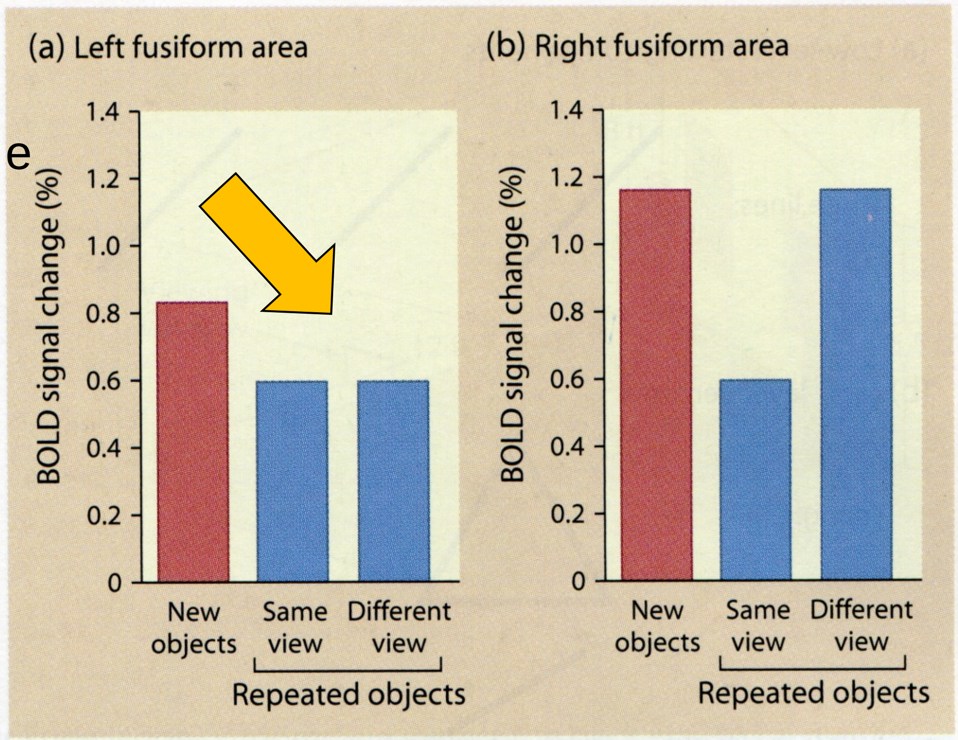
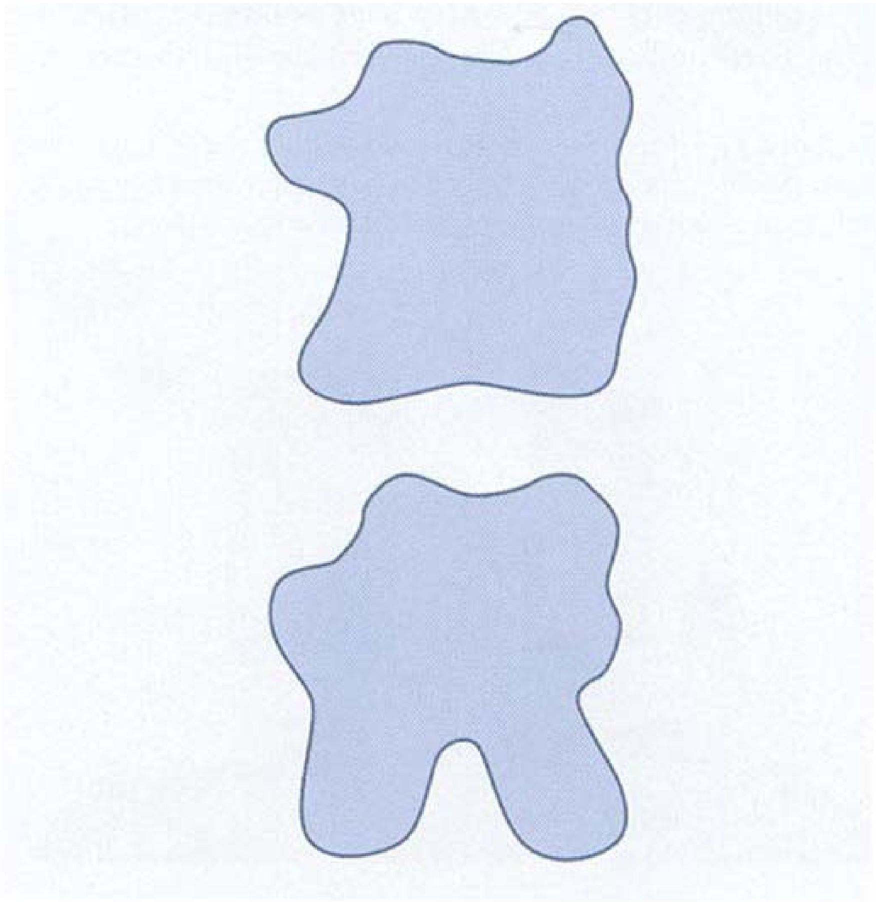


Figure 6.16 Repetition suppression effect. **(a)** A repetition suppression effect is observed in left ventral occipital cortex regardless of whether an object is shown from the same or a different viewpoint, consistent with a view-invariant representation. **(b)** In contrast, activation in right ventral occipital cortex decreased relative to activity during the presentation of novel stimuli only when the second object was presented in the original viewpoint, consistent with a view-dependent representation.

Formenkodierung



Formenkodierung: Regularitäten und invariante Eigenschaften

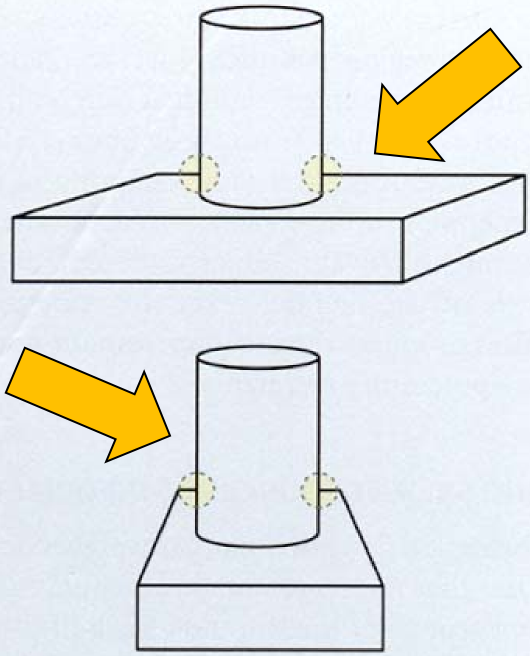


Figure 6.16 Certain perceptual cues are invariant across vantage points. The parallel edges of the rectangle will remain parallel when viewed from any position (given slight distortions due to depth). In contrast, the border between two objects is likely to depend on the viewpoint. In the top drawing, T-junctions are formed by the long edge of the rectangle and the sides of the cylinder. These junctions shift to the short edge of the rectangle when the objects are viewed from the end as in the lower drawing.

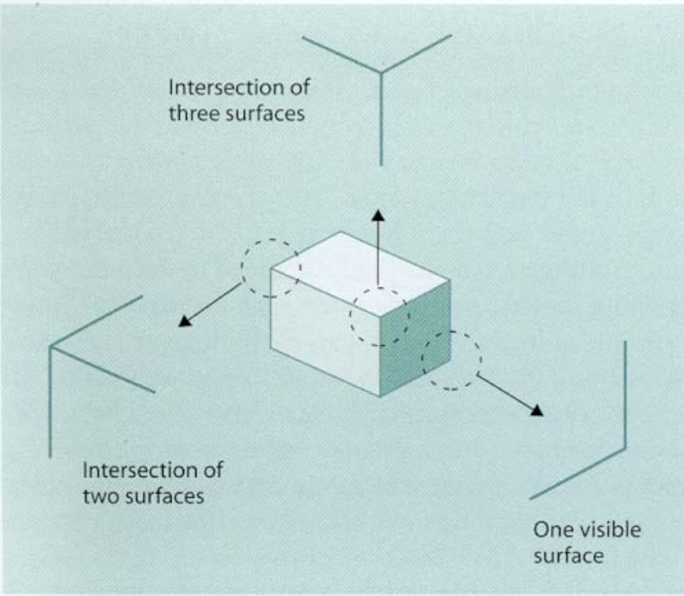


Figure 6.18 Invariant cues to surface perception. The intersection of three visible surfaces creates a Y-junction. An arrow and shaft indicate the intersection of two visible surfaces whereas an arrow alone indicates the corner of one visible surface.

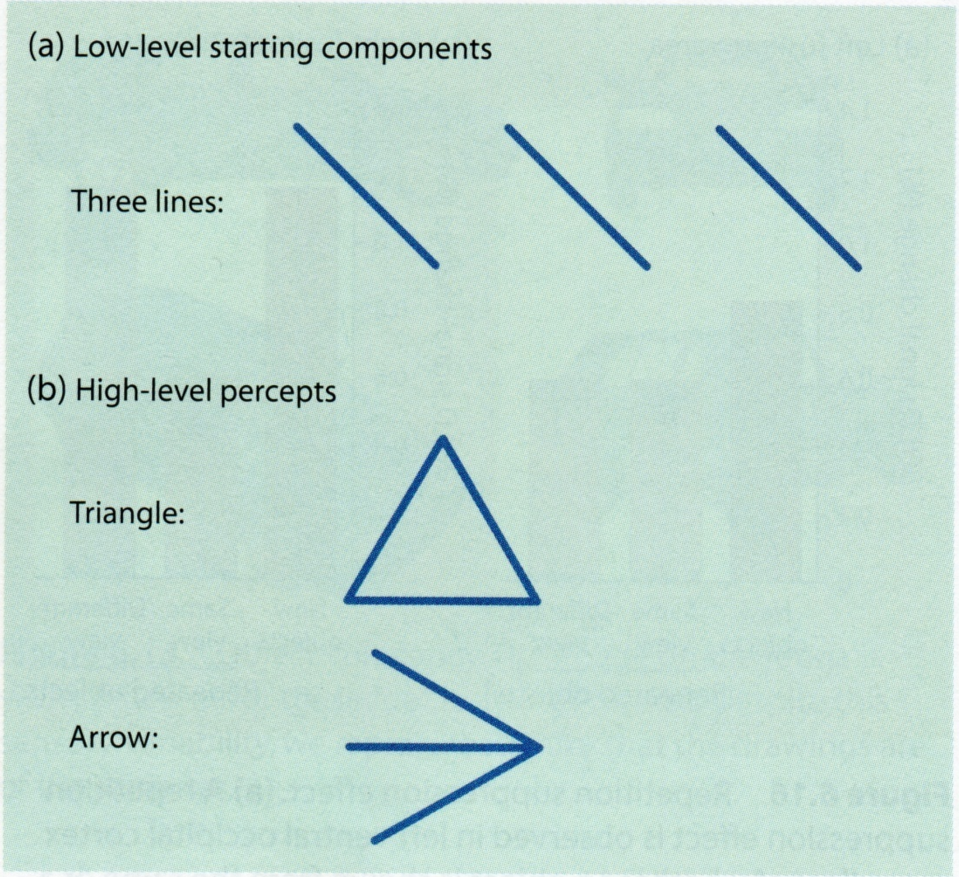
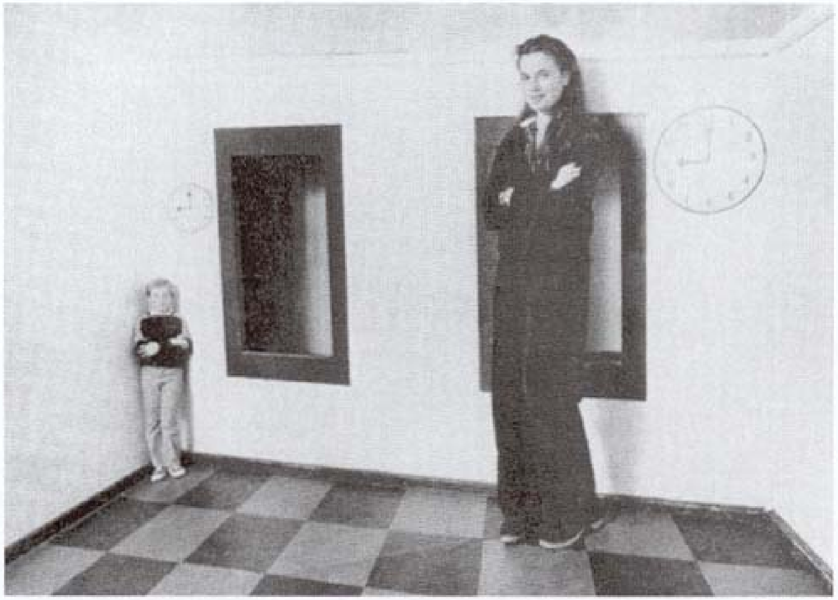
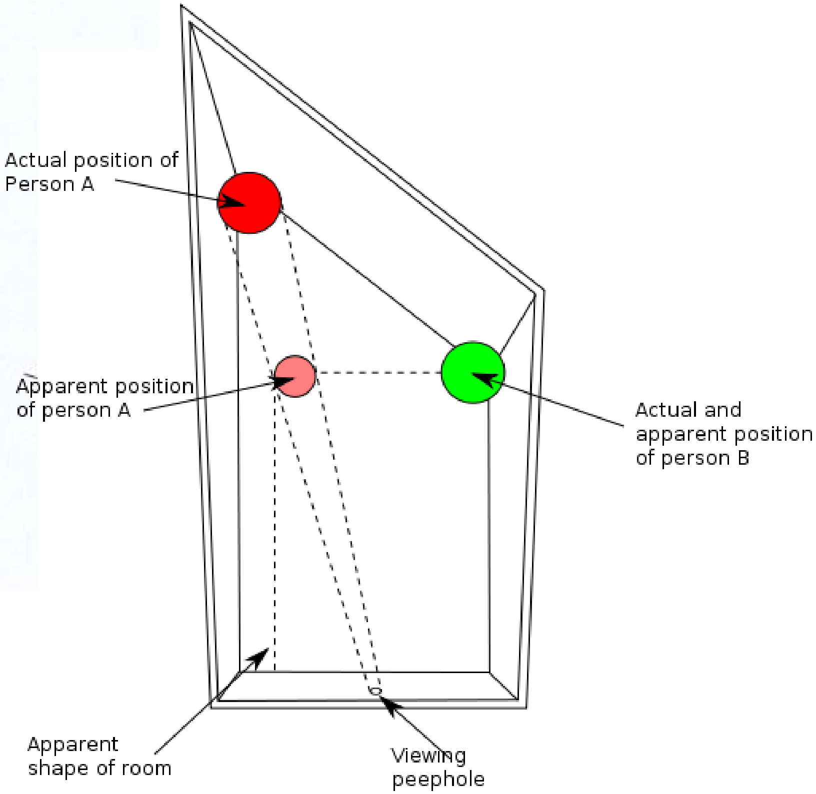


Figure 6.17 The same basic components (three lines) can form different items (e.g., a triangle or an arrow) depending on their arrangement. Although the low-level components **(a)** are the same, the high-level percepts **(b)** are distinct.

Formenkodierung: Parallelität

Figure 6.17 The illusory Ames room exploits the fact that, given our knowledge of rooms, we expect the back wall to be parallel with the front wall and the ceiling to be at a constant height. Our perceptual system assumes the two people are at the same distance, and ends up interpreting the closer one as a giant.





Die Geon Theorie
Geometric Icons = perceptual alphabet

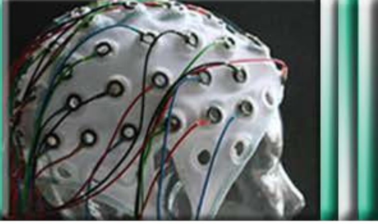
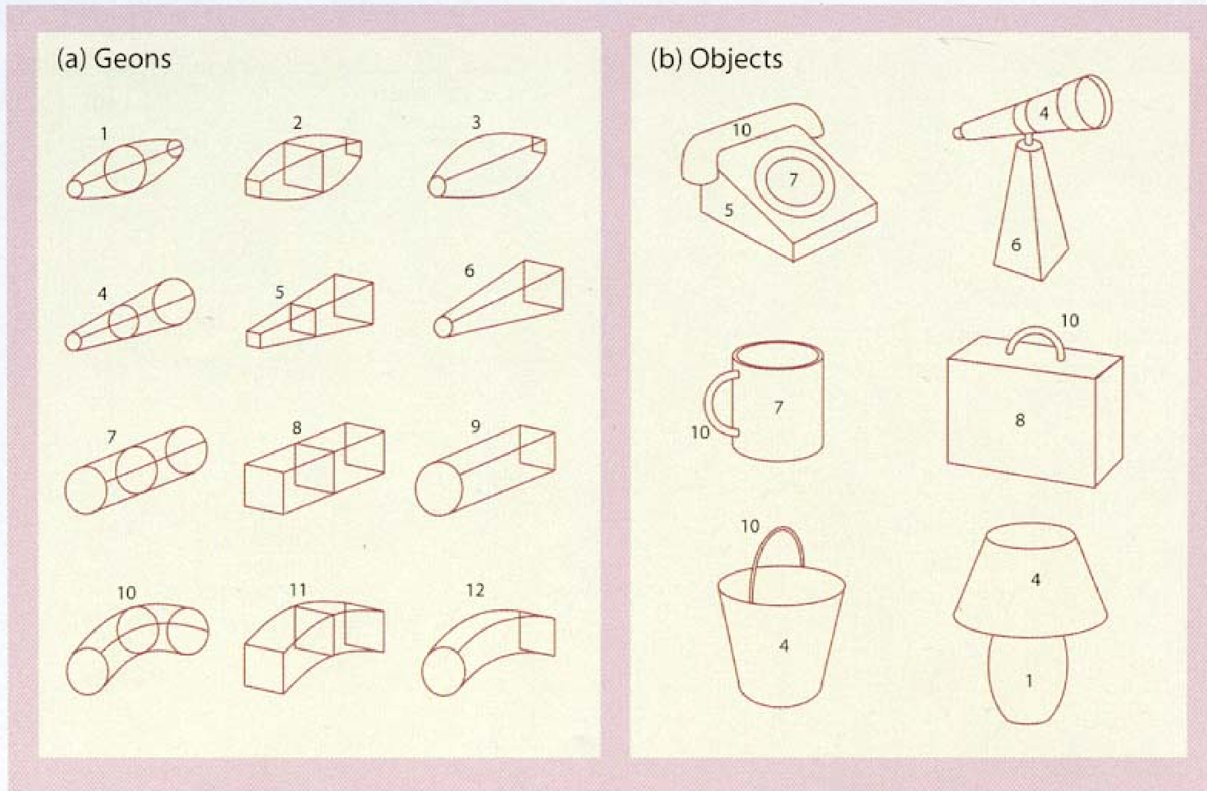


Figure 6.19 The geon theory posits that object recognition is based on identifying the defining geons, or geometrical "ions," that constitute an object. **(a)** Twelve geon shapes, defined by the shape of the cross section (circular, straight, or varying) and parallelism (long or short axes either parallel or not parallel). **(b)** A set of common objects with their component geons marked. The numbers indicate the geons in the left panel. Adapted from Biedermann (1990).



Hierarchische Kodierung
Hierarchical Coding Hypothesis

Die Großmutterzelle

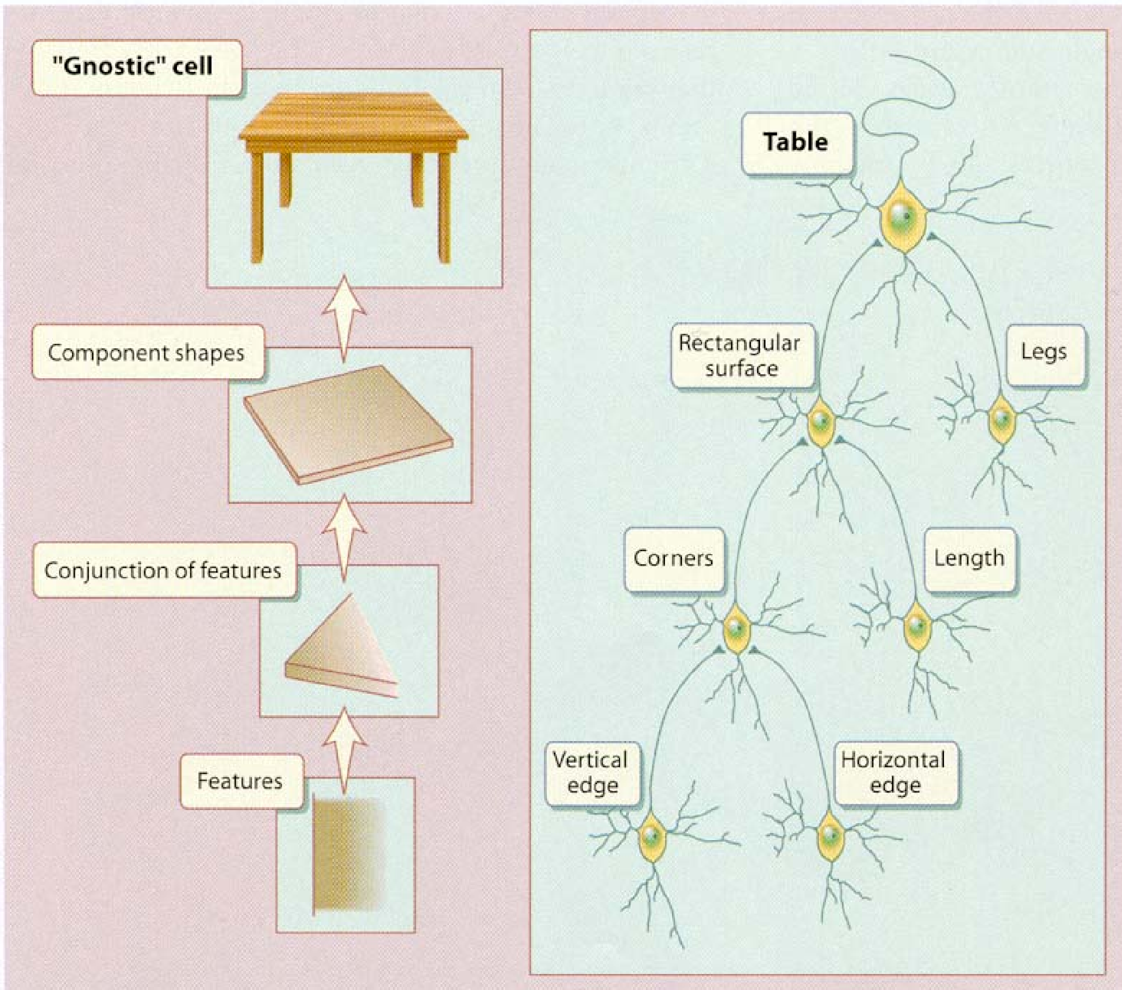


Figure 6.20 Hierarchical coding hypothesis in which elementary features are combined to create gnostic units that recognize complex objects. At the lowest level of the hierarchy are edge detectors, units that operate similar to the simple cells discussed in Chapter 5. These feature units combine to form corner detectors, which in turn are combined to create cells that respond to even more complex stimuli such as surfaces. The left side of the figure shows the hypothesized computational stages for hierarchical coding; the right side is a neural implementation based on the idea of grandmother cells.

Hierarchische Kodierung
Hierarchical Coding Hypothesis

Zwei Probleme mit der Großmutterzelle

- Hohe Anfälligkeit einer Einzelzellkodierung
  „*Stribt die Großmutter wenn die Zelle stribt?*

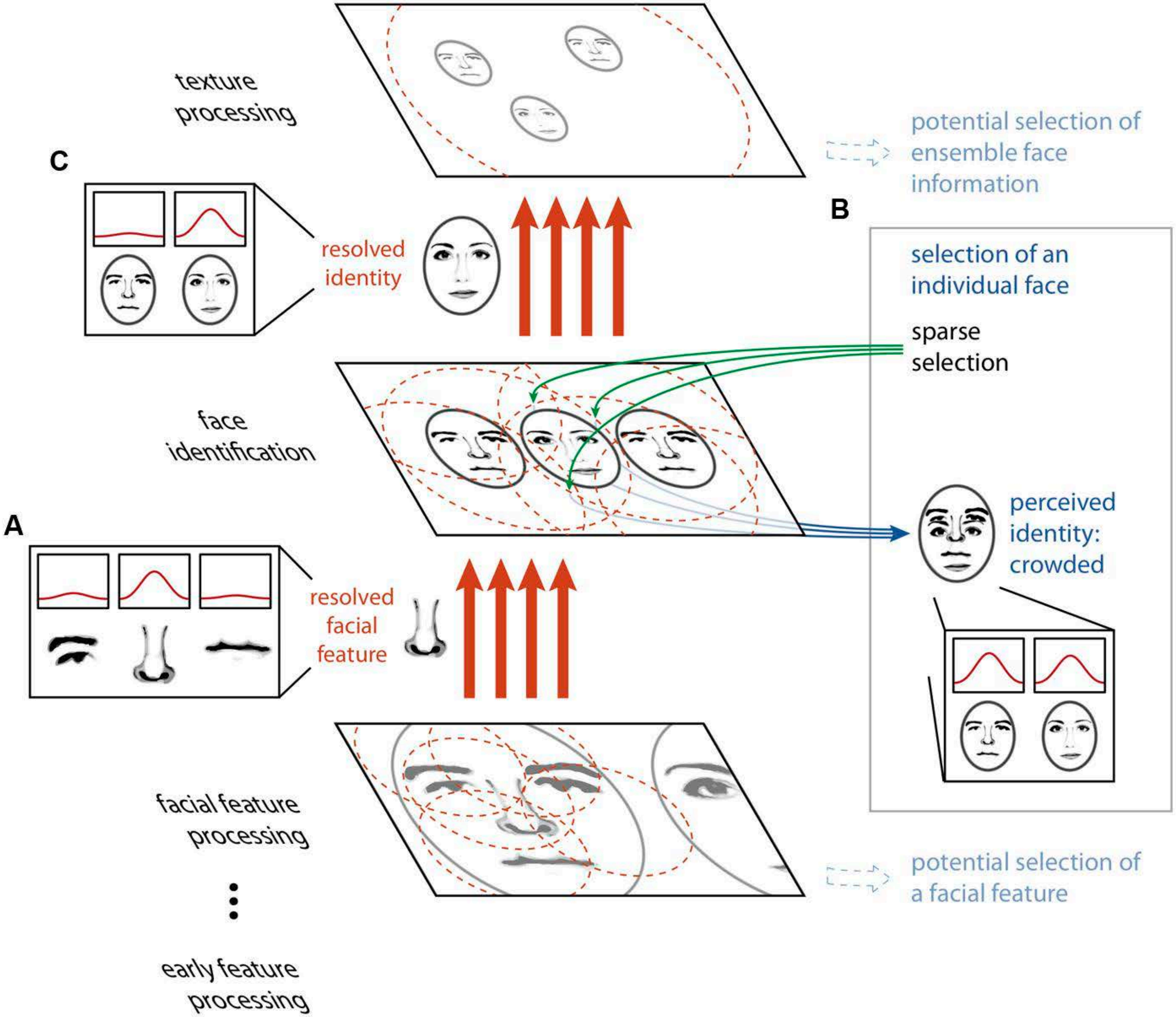
- Wie werden neue Objekte erkannt?

Ensemble Coding Hypothesis

Simultane Aktivierung komplexer Merkmalsdetektoren

Figure 6.21 Ensemble coding hypothesis in which an object is defined by the simultaneous activation of a set of defining properties. "Granny" is recognized here by the co-occurrence of her glasses, facial shape, hair color, and so on.

Ensemble Coding Hypothesis



Invariante visuelle Repräsentationen: Jennifer Aniston Zellen im Hippocampus

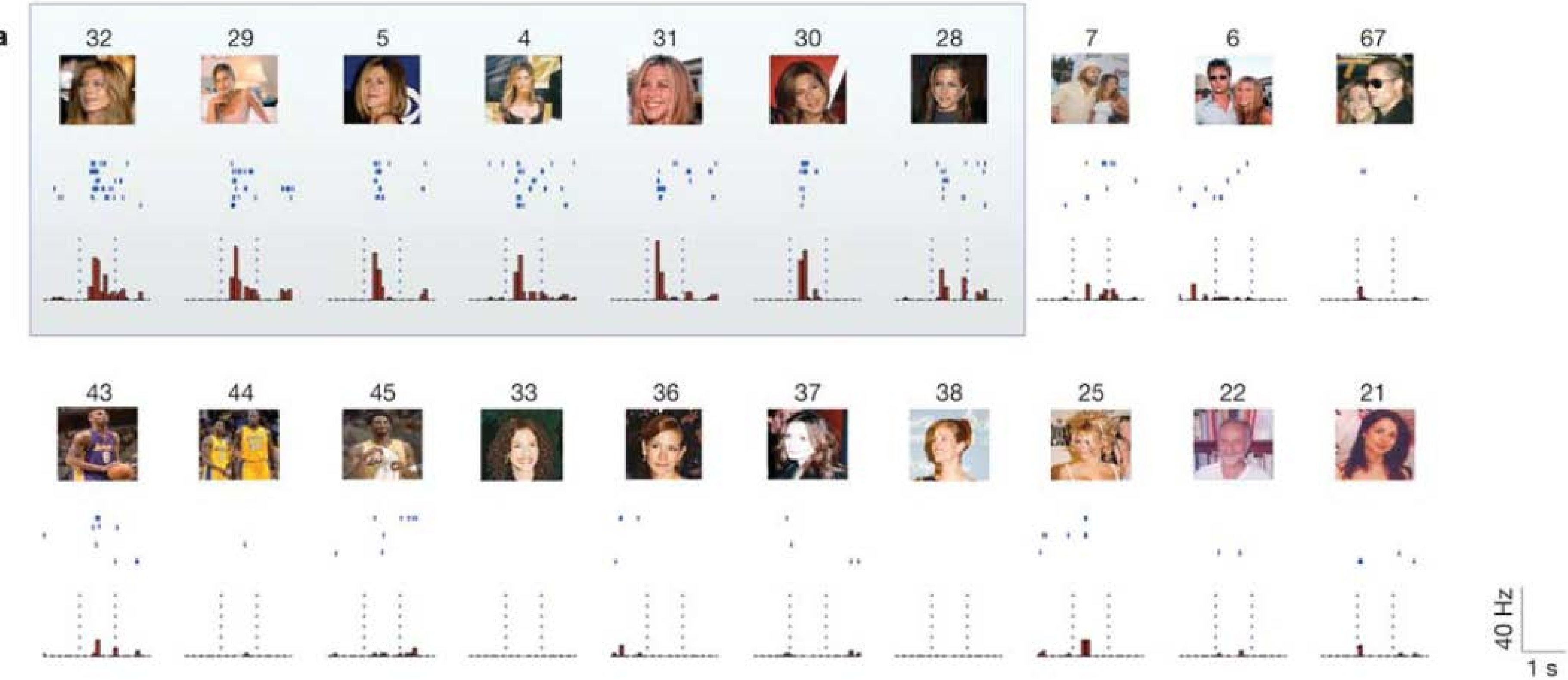


Figure 1 | A single unit in the left posterior hippocampus activated exclusively by different views of the actress Jennifer Aniston. **a**, Responses to 30 of the 87 images are shown. There were no statistically significant responses to the other 57 pictures. For each picture, the corresponding raster plots (the order of trial number is from top to bottom) and post-stimulus time histograms are given. Vertical dashed lines indicate image onset and offset (1 s apart). Note that owing to insurmountable copyright problems, all original images were replaced in this and all subsequent figures by very similar ones (same subject, animal or building, similar pose, similar colour, line drawing, and so on). **b**, The median

Quiroga, R. Q., Reddy, L., Kreiman, G., Koch, C., & Fried, I. (2005). Invariant visual representation by single neurons in the human brain. Nature, 435(7045), 1102–7.

Halle Berry Zellen im Hippocampus

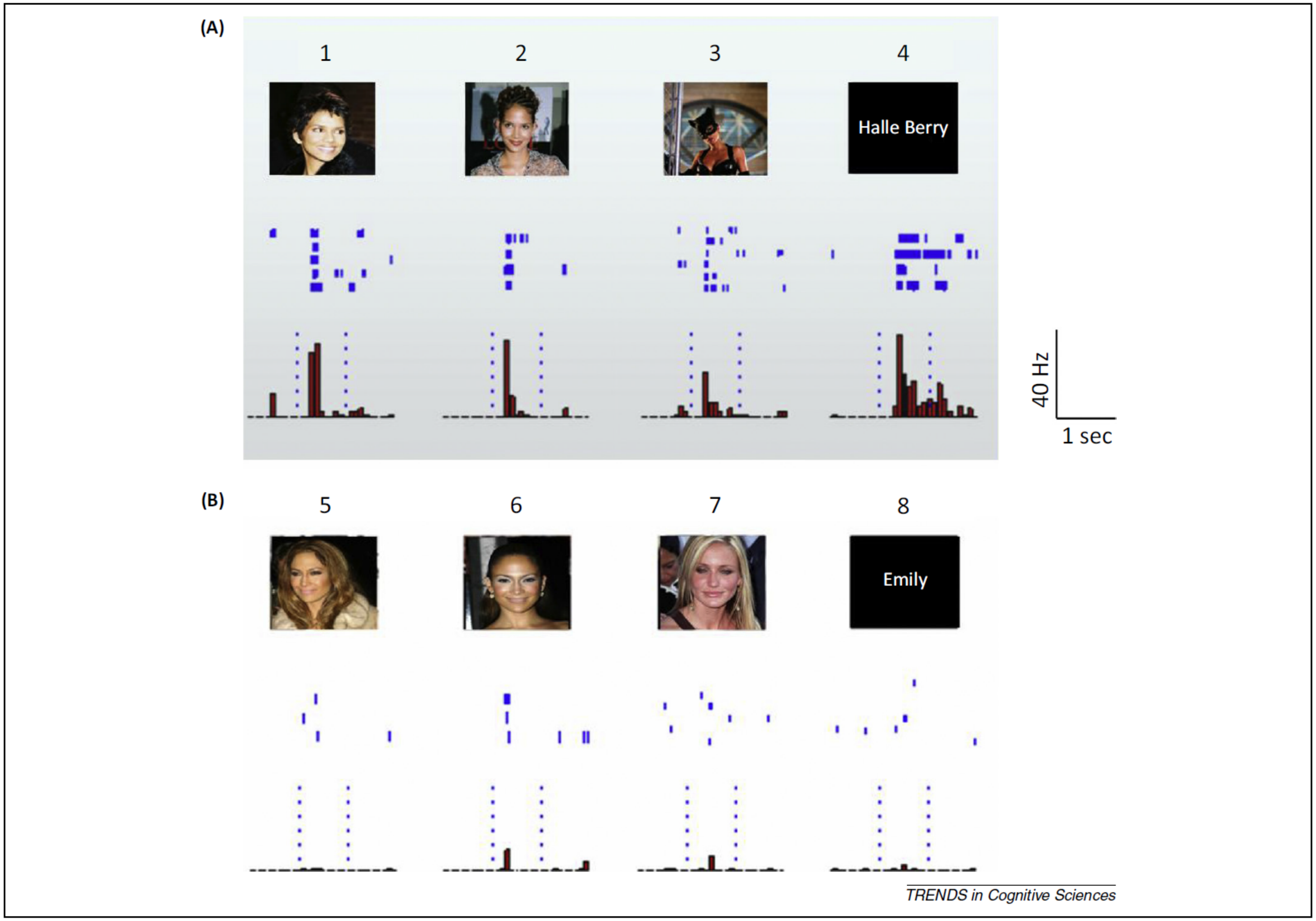


Figure 1. Single-unit recording. A single unit in the right anterior hippocampus that **(A)** responds to pictures of the actress 'Halle Berry' (1–3) and her written name (4). Three images of Halle Berry and the spiking responses to the images are shown. For each image, the corresponding raster plots and post-stimulus time histograms are given. Vertical broken lines indicate image onset and offset (1 s apart). Strikingly, this cell responds to photographs of Halle Berry, to her dressed as Catwoman, and to the letter string 'Halle Berry', but not **(B)** to photographs of other women (5–7) or another name (8). Adapted, with permission, from [26].

Invariante visuelle Repräsentationen im Hc vs. Ensemble Enkodierung im visuellen Cortex

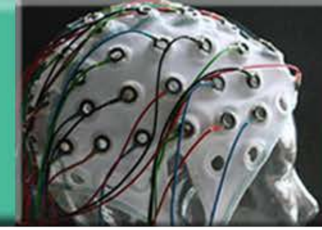


Figure 6.21 Ensemble coding hypothesis in which an object is defined by the simultaneous activation of a set of defining properties. "Granny" is recognized here by the co-occurrence of her glasses, facial shape, hair color, and so on.

- Hippocampus needs access to abstract concepts for LTM formation and explicit remembering

- Some cells not entirely exclusive
- Only used 100 pictures
- Observed selectivity very quickly
- Simultaneous activation of a large number of cells.
- Multidimensional representation of information


Danke für Ihre
Aufmerksamkeit!