Un trouble de la perception visuelle: comportement et neuroimagerie fonctionnelle

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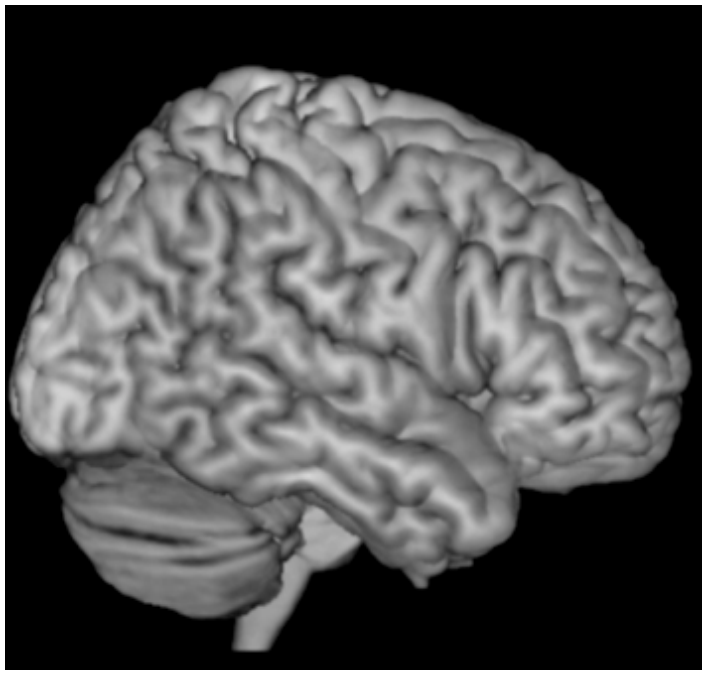
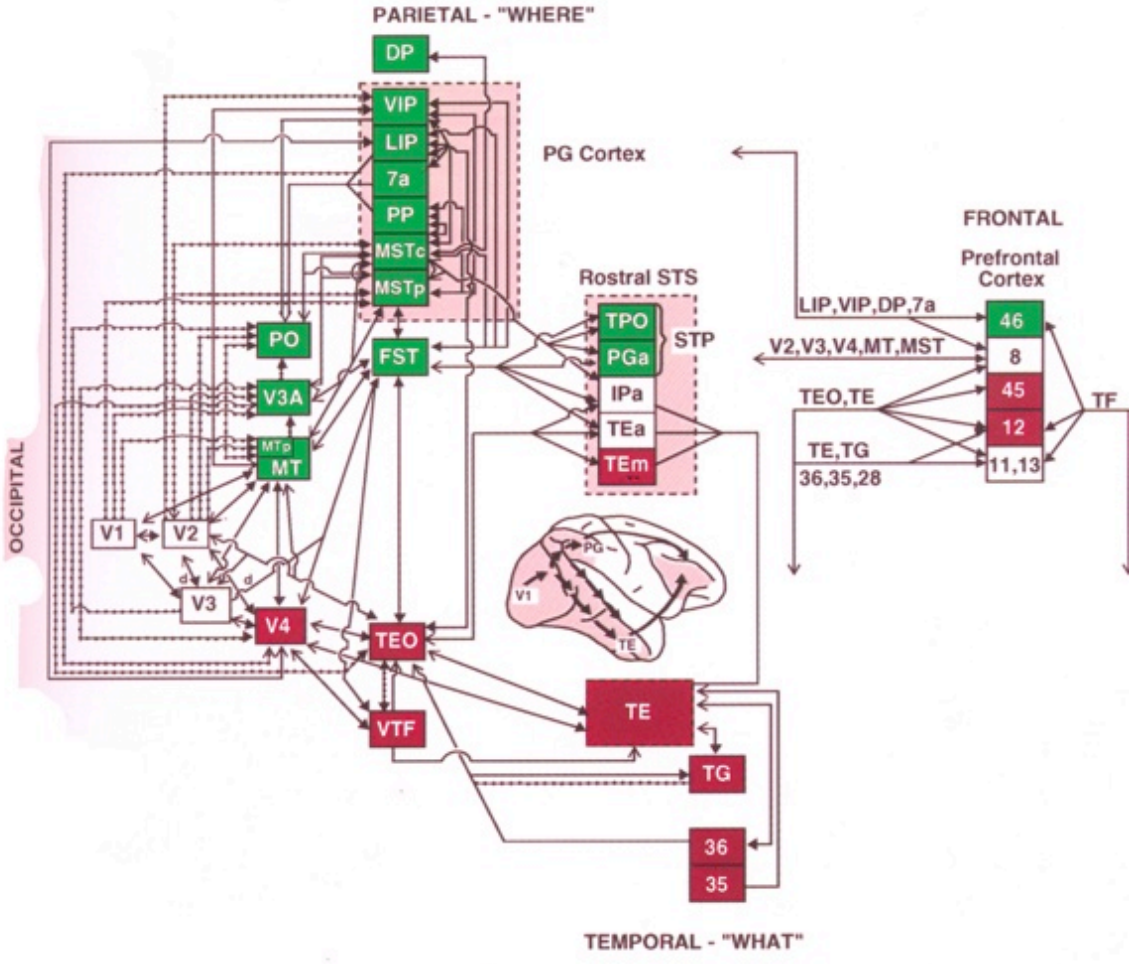
visual areas





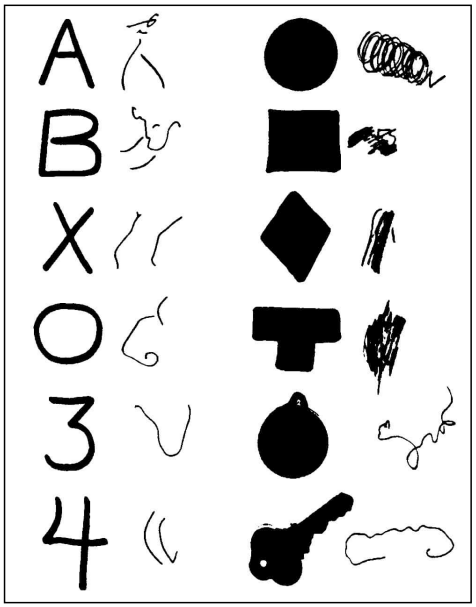
Agnosie aperceptive vs. Agnosie associative

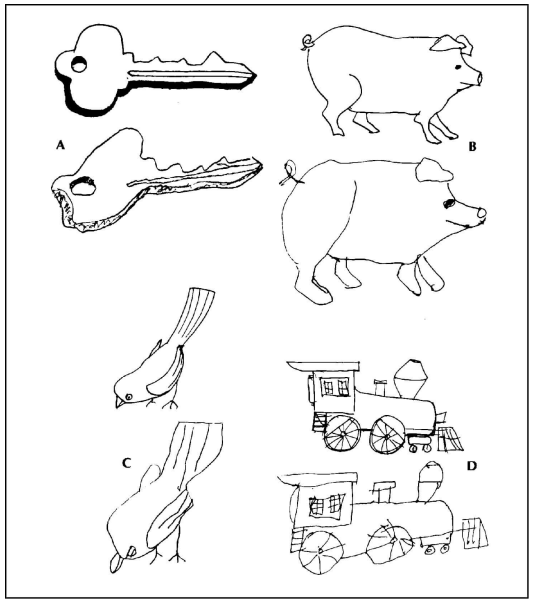
Agnosie visuelle aperceptive (agnosie de la forme)

- Benson & Greenberg (1969): intoxication de CO
- Difficultés sévères de l'identification et de la reproduction formes simples (copie, appariement de lettres…)
- Peut détecter le mouvement
- Perception de la couleur normale
- Identifie objets rapidement en modalité tactile et auditive

Agnosie visuelle associative

- Rubens & Benson (1971): AVC temporo-occipital (?) gauche, hémianopsie droite
- Copies effectuées très lentement, trait par trait ('slavish')
- Dénomination, catégorisation, appariement catégoriel impossibles
- Reconnaissance par autres modalités intacte





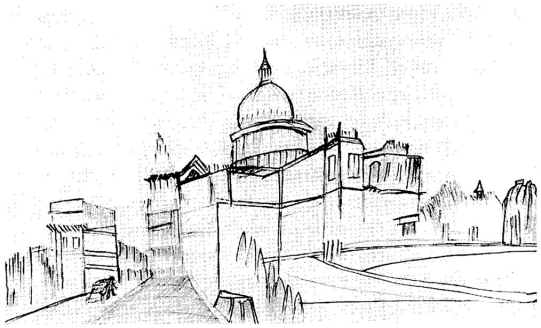
controversies regarding associative visual agnosia

Lissauer (1890) patient with left occipital stroke: right hemianopia, deficient visual identification, but adequate copying (though 'slavish'), can name objects by touch, cannot draw objects from memory; deficit of *association*

Bay (1953) agnosias can be explained by general intellectual decline (also Bender & Feldman, 1972)

Teuber (1968) 'in its purest form a *normal percept* that has somehow been stripped of its meaning'

Farah (2004) associative agnosia is an impairment of fine visual processing, rather than association (Lissauer, 1890; Delvenne et al., 2004)



Grüsser & Landis (1991)

1. Absence of elementary perceptual impairment that could explain the identification failures (e.g. adequate copying)

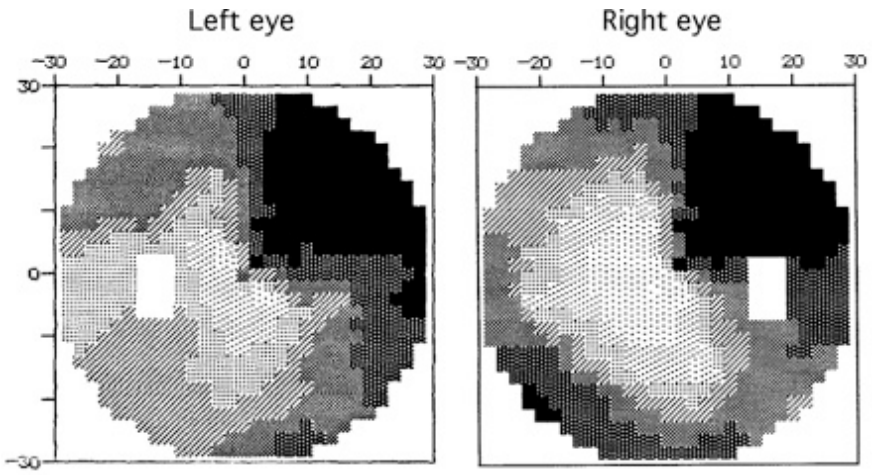
2. Absence of generalized semantic impairment

3. Identification errors are not only observed in naming, but also in semantic tasks such as categorization

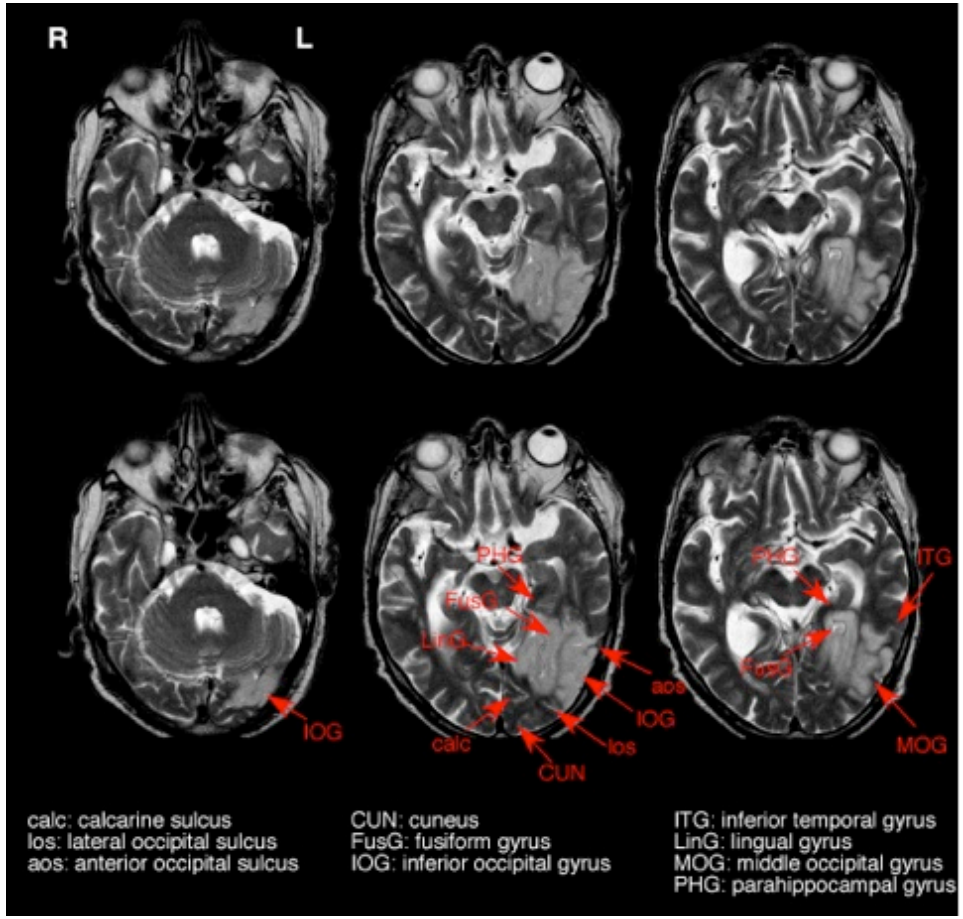
case report: AL

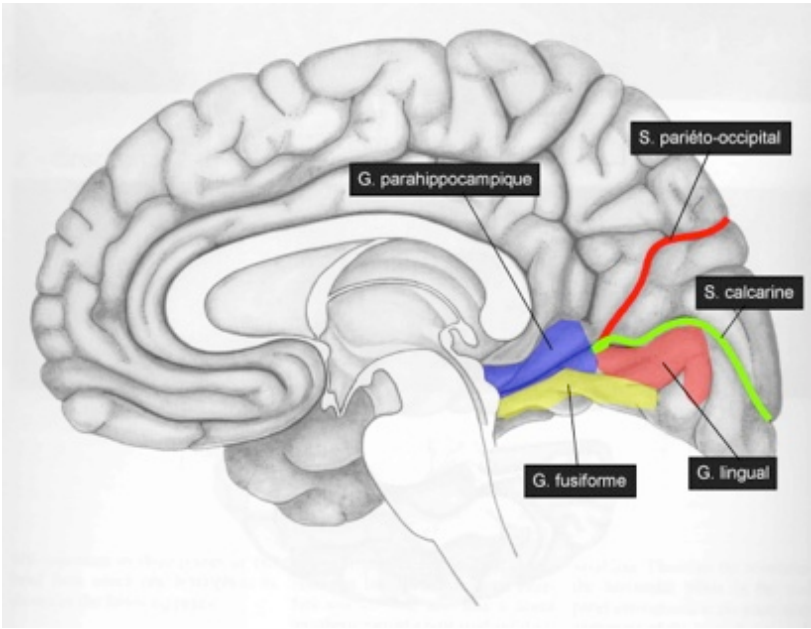
At the age of 72, AL (previously insurance agent) is admitted to the hospital following a left ocipito-temporal stroke, right hemianopia, severe alexia and difficulty to identify objects and people

AL's verbal IQ (117) is superior to his performance IQ (69). AL has a right superior quadrantanopia, pure alexia ('letter-by-letter' reading) and associative visual agnosia



lesion extent





picture naming

Naming line drawings (Snodgrass & Vanderwart, 1980)

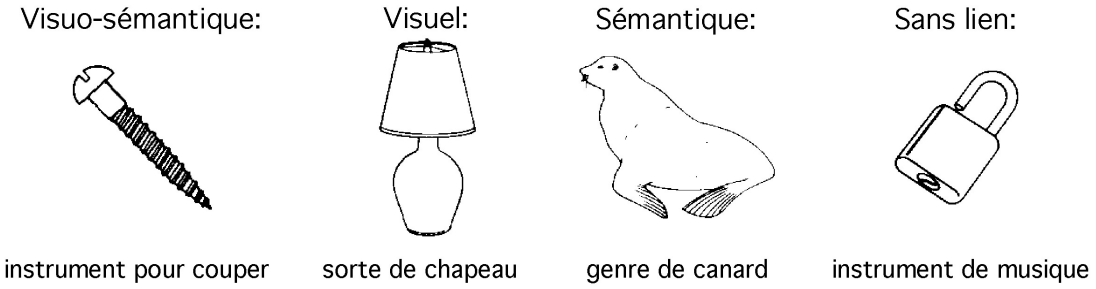
Correct: 121 (47%)
Wrong: 138 (53%)

Familarity: correct: 3.5; wrong: 3.1 ($p < .001$)
Visual complexity: correct: 2.97; wrong: 2.97

When unable to name AL is never able to give a correct verbal description or to gesture the use of an object

Error classification

Visuo-semantic	46 (33%)
Visual	17 (12%)
Semantic	29 (21%)
Unrelated	29 (21%)
'Don't know'	14 (10%)
other	3 (2%)



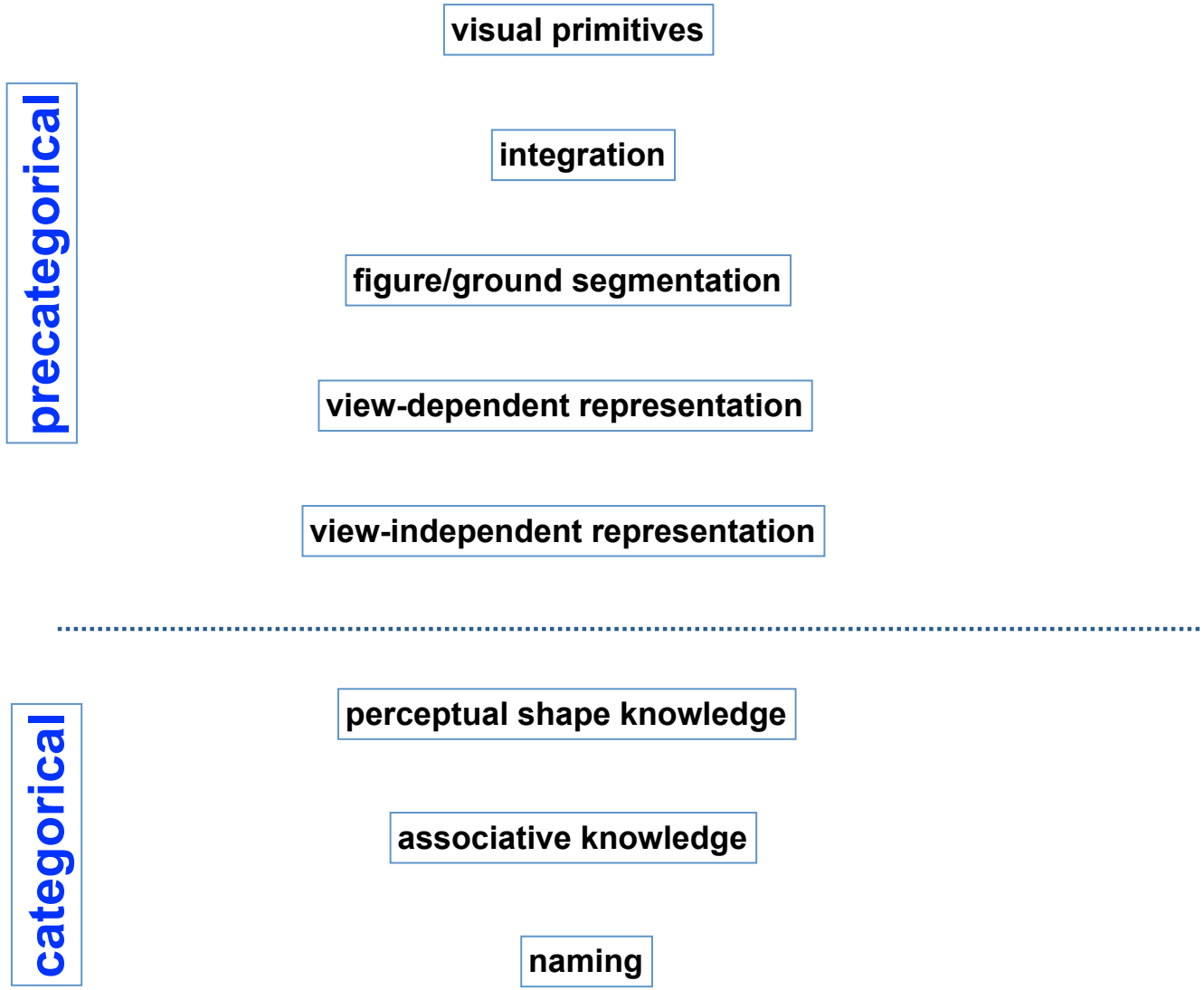
face perception

Perception of internal facial features

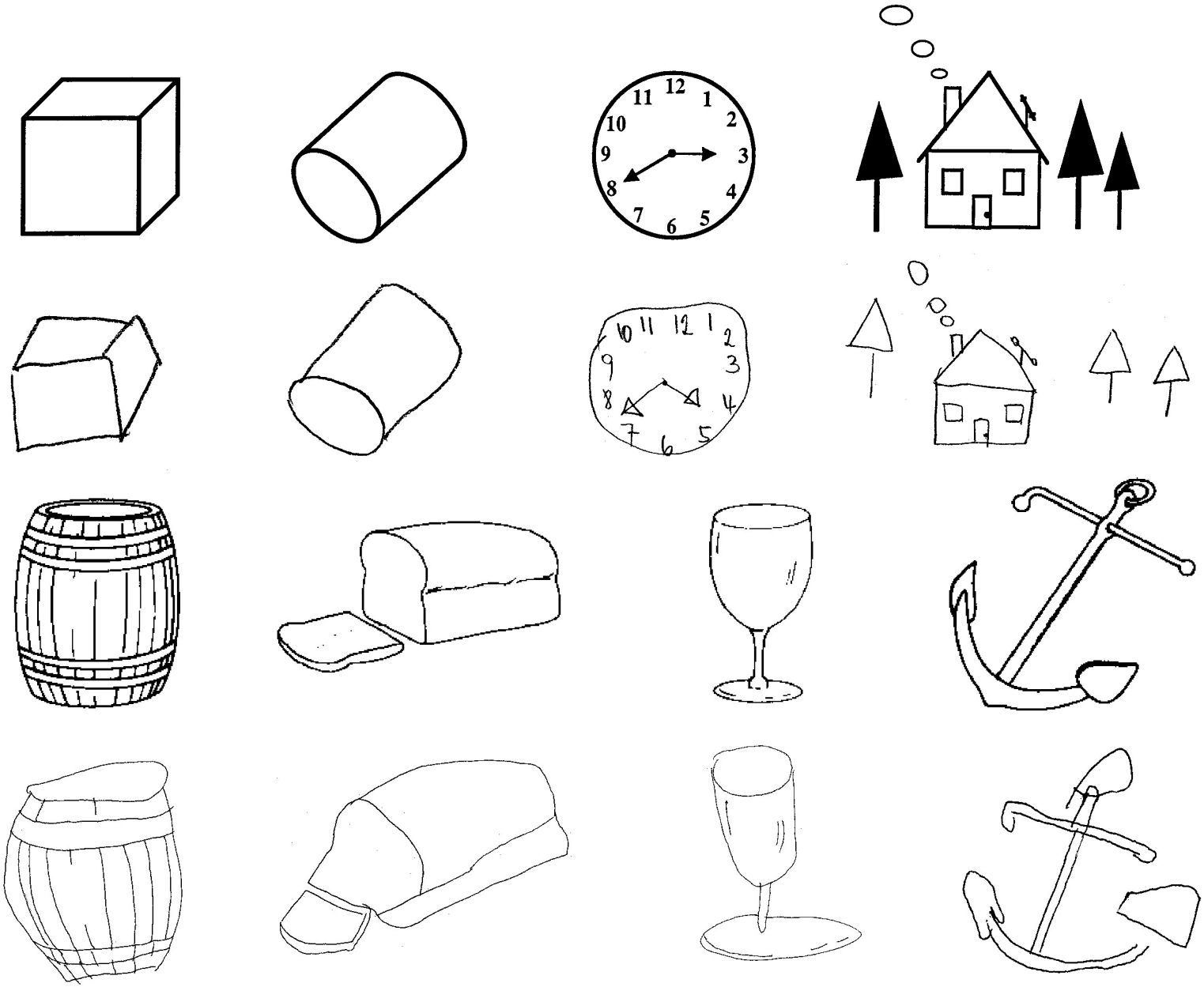
Identification: 9/56 (16%)

	Score	Cut-off
Bruyer & Schweich		
Facial decision	24	21
Face parts	9	8
Indep. of expression	20	20
Indep. of pose	4	8**
Gender identification	19	18
Age identification	29	28
Facial expression	12	11
Face familiarity	38	38

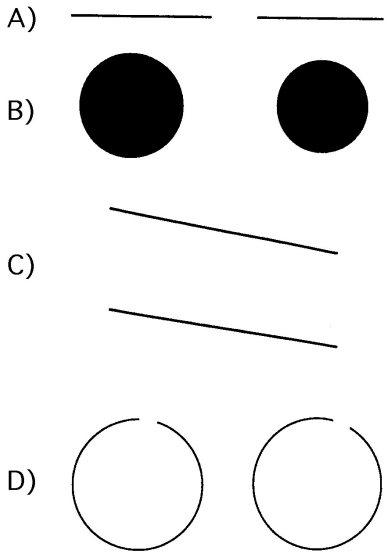
different stages of shape perception

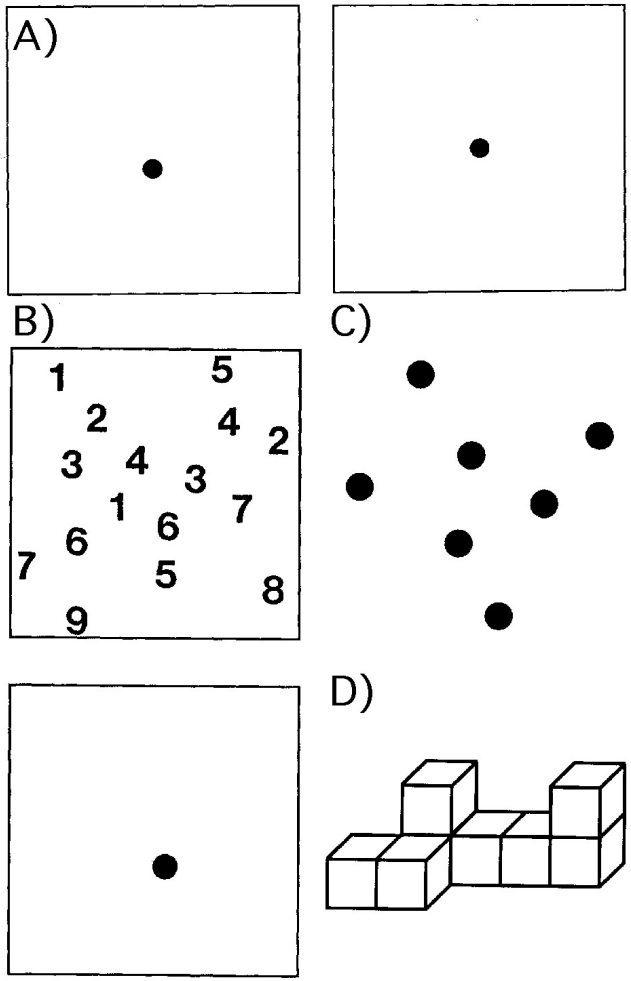


copying simple forms



processing visual primitives and spatial perception



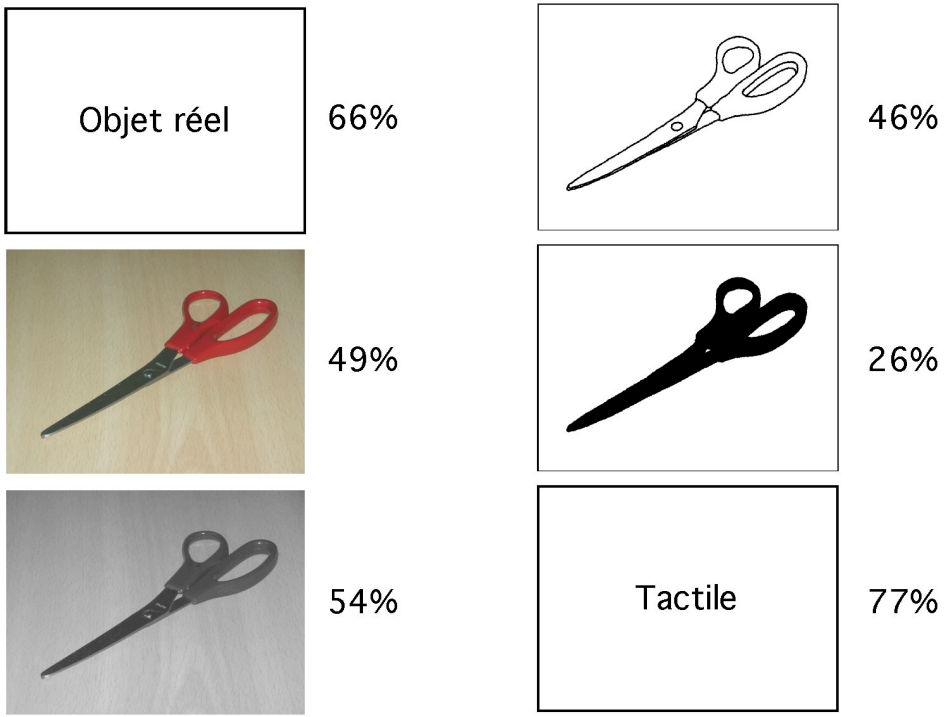


	Score	z	%
BORB			
A) Length match task	27	0.06	52
B) Size match task	24	-1.4	8
C) Orientation match task	25	0.08	53
D) Position of gap match task	34	-0.3	39
VOSP			
Dot counting	10	0.5	69
Position discrimination	20	0.44	67
Number location	8	-1.3	10
Cube analysis	8	-1	16

is the deficit purely visual?

Picture naming vs. Naming to description

Picture naming	Description (e.g. 'piece of furniture used to sleep on' - bed)	
121 (47%)	256 (95%)	($\chi 2$ = 146, p < .00001)



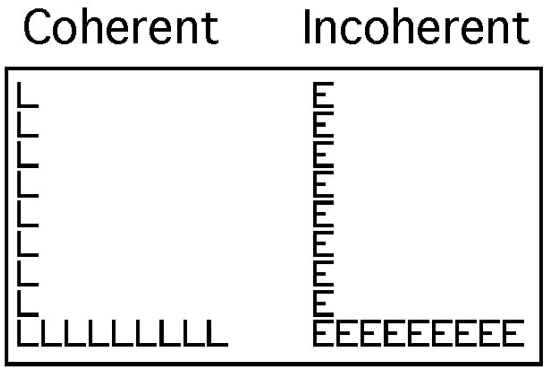
Naming 35 real-word objects

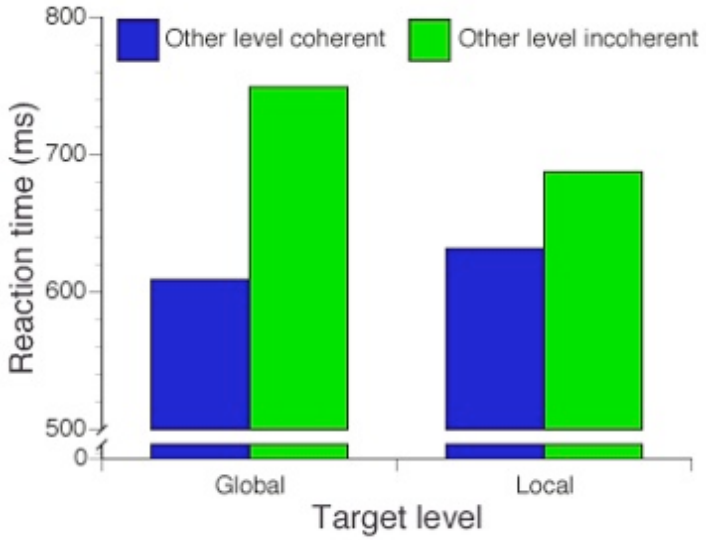
Decline of performance with less information in the picture

Tactile identification better than visual identification (p < .05) except for real object

local/global shape integration

Hierarchical stimuli: how do local shape elements influence global shape processing and vice versa?



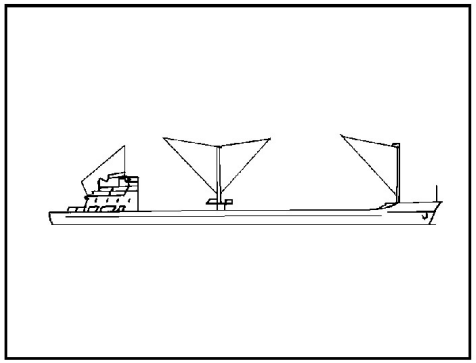


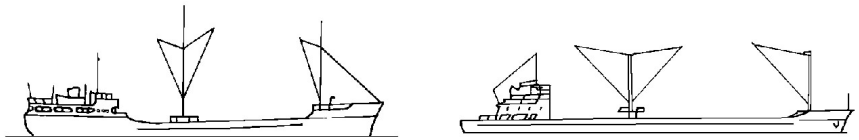
Influence local - global: 140 ms ($p < .001$)

Influence global -local: 56 ms ($p < .05$)

view-dependent (local shape) processing

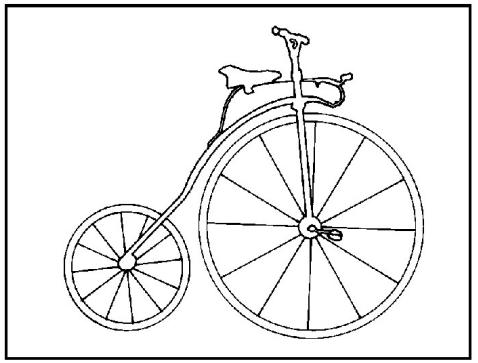
Même orientation

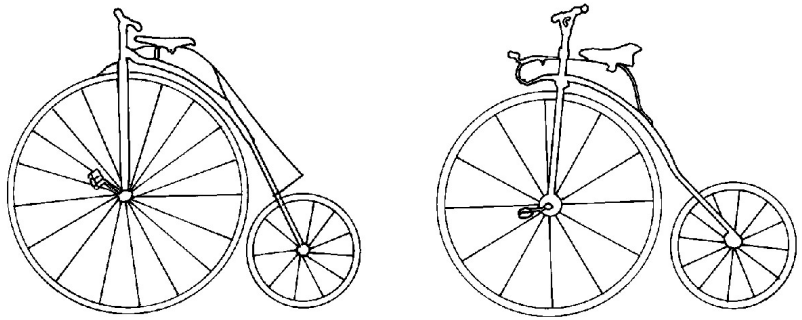




24/24 (100%)

Différente orientation





23/24 (96%)

high-level (3D) view-independent processing

Structural representations of objects across different view-points: preserved in matching tasks

Dénomination

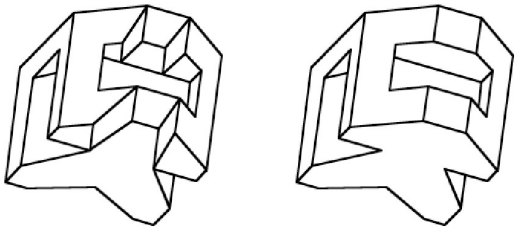
Canonique: 26/40 (65%)
Non-canonique: 6/40 (15%)

Appariement

38/40 (95%)

Detection of violations in 3D-structure: preserved

78/80 (97.5%)



first conclusions

Elementary visual and spatial functions
- visual primitives (angles, intersections, curvatures)
- size, length, position, orientation
- spatial processing (counting, spatial localisation)

Local/global shape integration
- figure copying
- hierarchical shapes

View-dependent processing
- figure copying
- analysing local differences in shape

View-independent processing
- matching across view-points
- detection of 3D structure violations

- deficit is modality-specific

- deficit cannot be explained by general cognitive/intellectual decline

- deficit cannot be explained by impaired precategorical processing

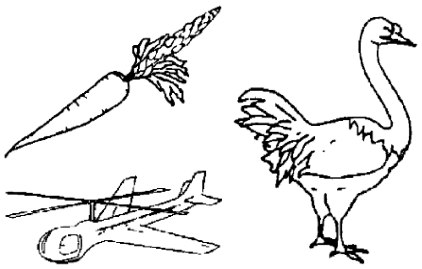
Associative visual agnosia (Grüsser & Landis, 1991)

1. *Absence of elementary perceptual impairment that could explain the identification failures (e.g. adequate copying)*
2. *Absence of generalized semantic impairment*
3. *Identification errors are not only observed in naming, but also in semantic tasks such as categorization*

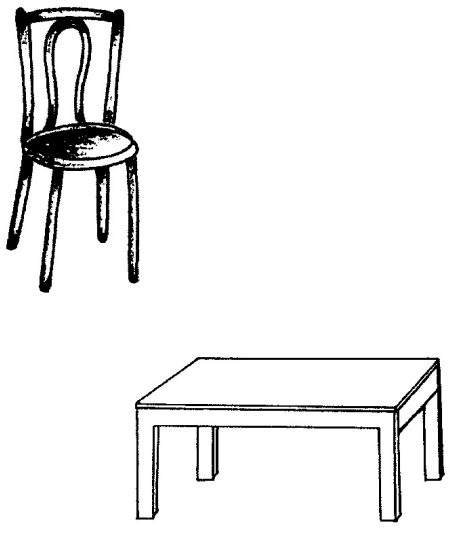
visual matching and categorisation

	Score	z	%
BORB			
Object decision	87	-4.9	< 1
Item match	24	-2.7	< 1
Association match	17	-4.4	< 1
Barbarotto et al. (2002)	75%	-	< 5
LEXIS			
Désignation	64	-15	< 1
Appariement sémantique 1	108	-20	< 1
Appariement sémantique 2	118	-7.9	<1

Chimaeras

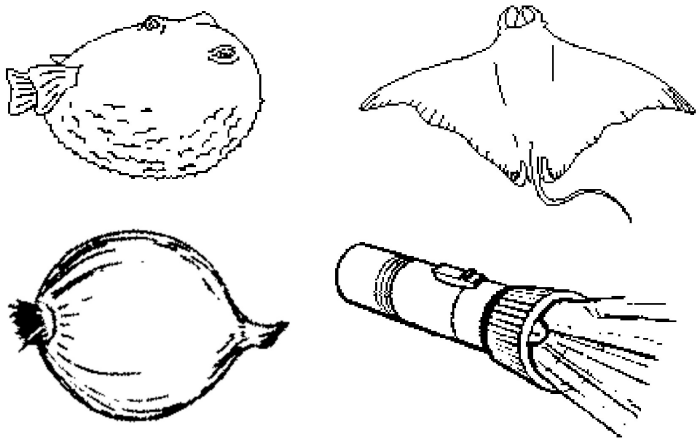


Barbarotto et al. (2002)



	Score
Pyramids and Palm Trees	
visual	37/52
verbal	51/52

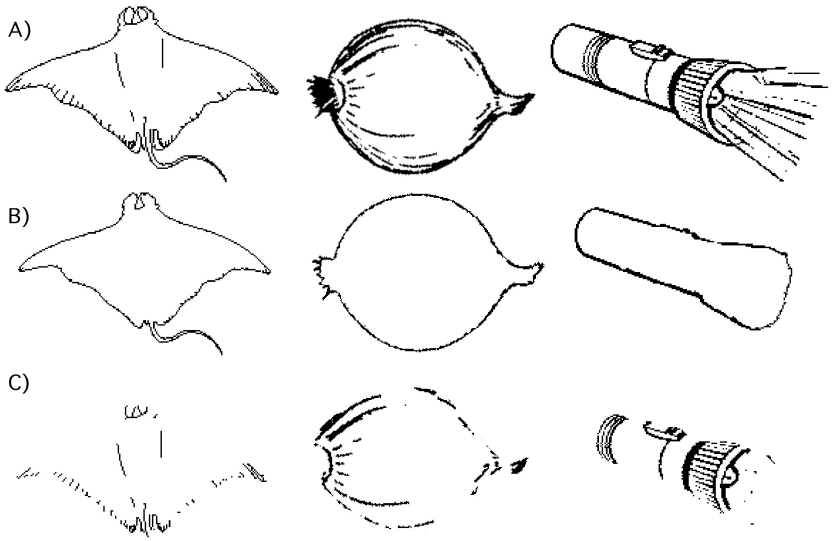
visual and semantic matching



Target (blowfish), semantic distracter (manta ray), visual distracter (onion), neutral distracter (flashlight)

Instruction	Correct	Visual error	Semantic error	Neutral error
'Point to the blowfish'	88%	0%	10%	2%
'Point to the two pictures that have the same form'	93%	-	2%	5%
'Point to the two pictures that are part of the same category'	13%	70%	-	17%
'Tell me which of these four words belong to the same category'	83%	7%	-	10%

visual and semantic matching in the absence of the target

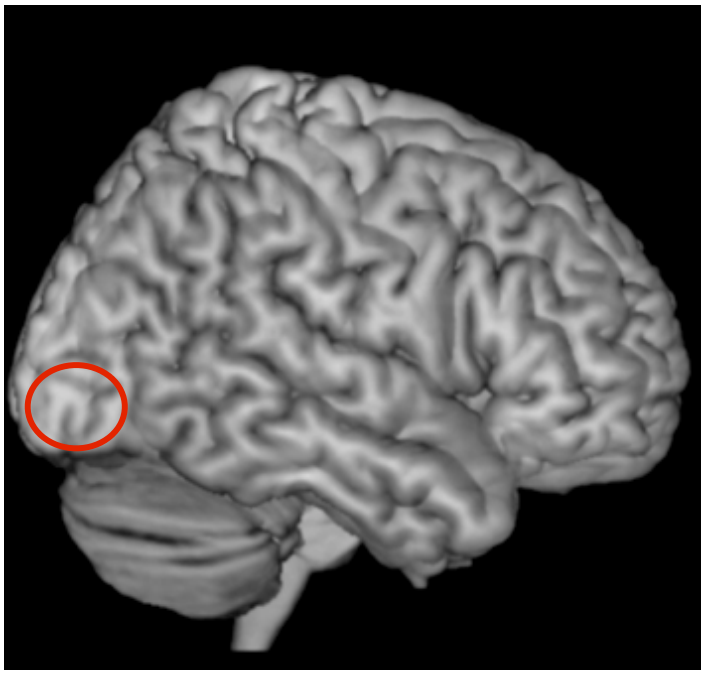


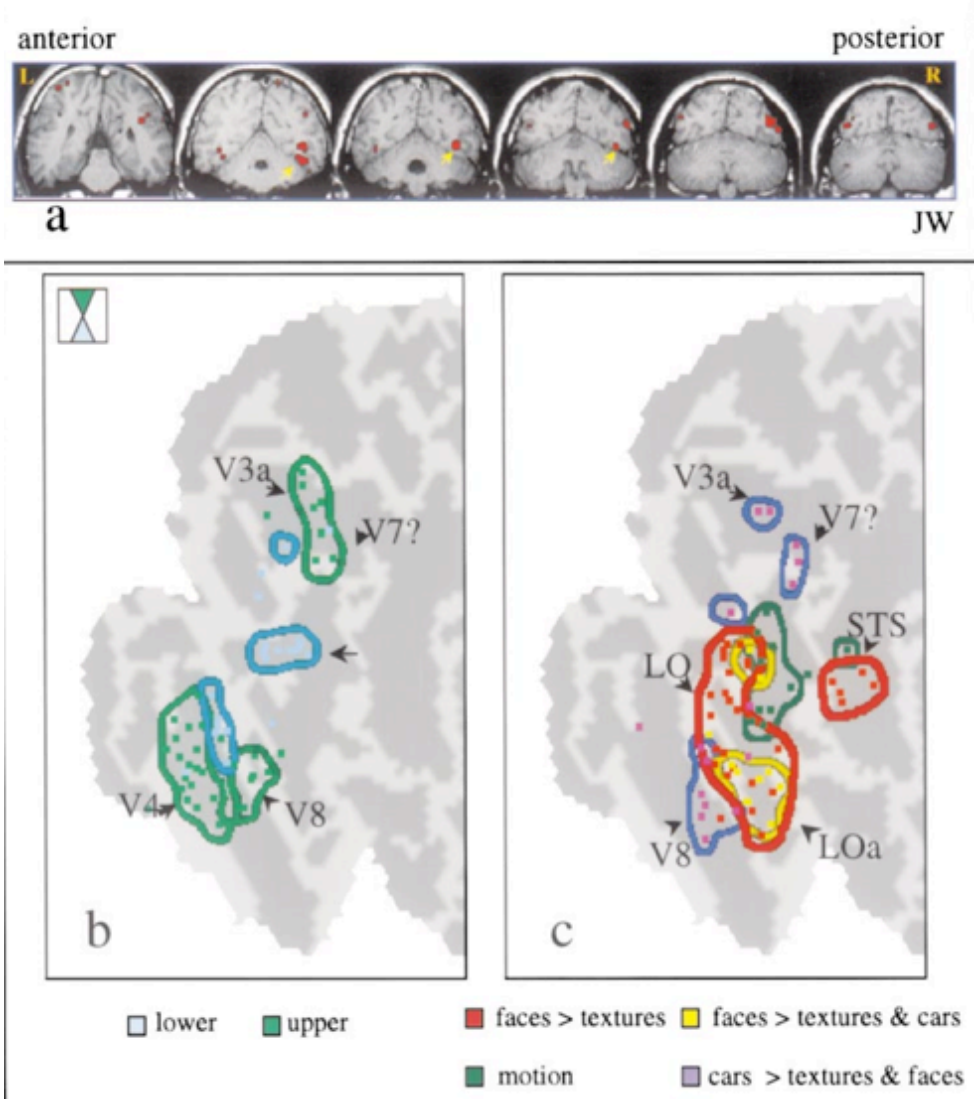
Instruction

‘Point to the blowfish, if it is shown here’

	Correct	Visual error	Semantic error	Neutral error
External/internal features	45%	45%	9%	1%
External features	36%	49%	10%	5%
Internal features	60%	31%	8%	1%

form processing in the lateral occipital cortex

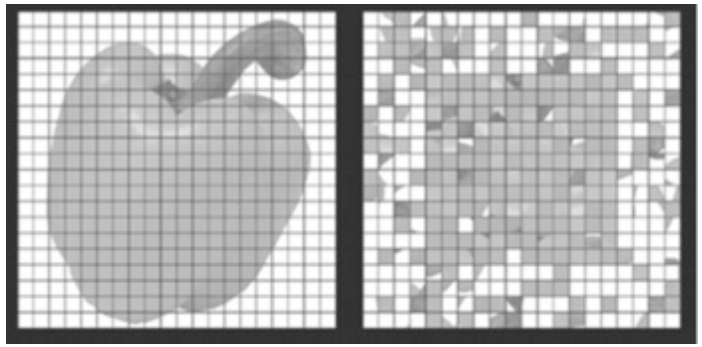


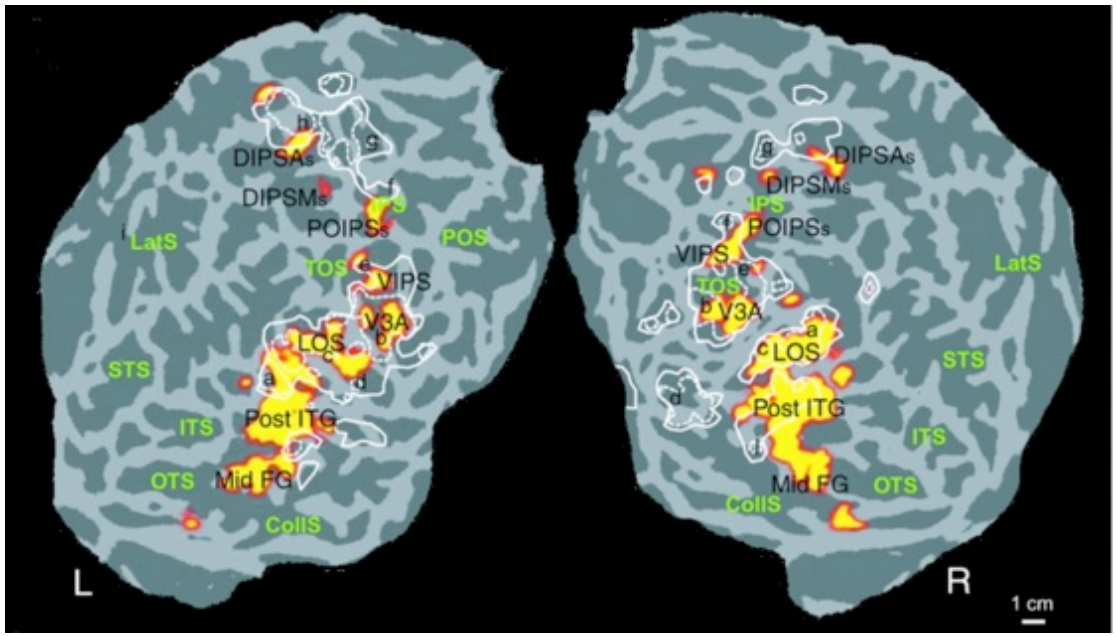


Grill-Spector et al. (1999)

form processing in the lateral occipital complex (ctnd.)

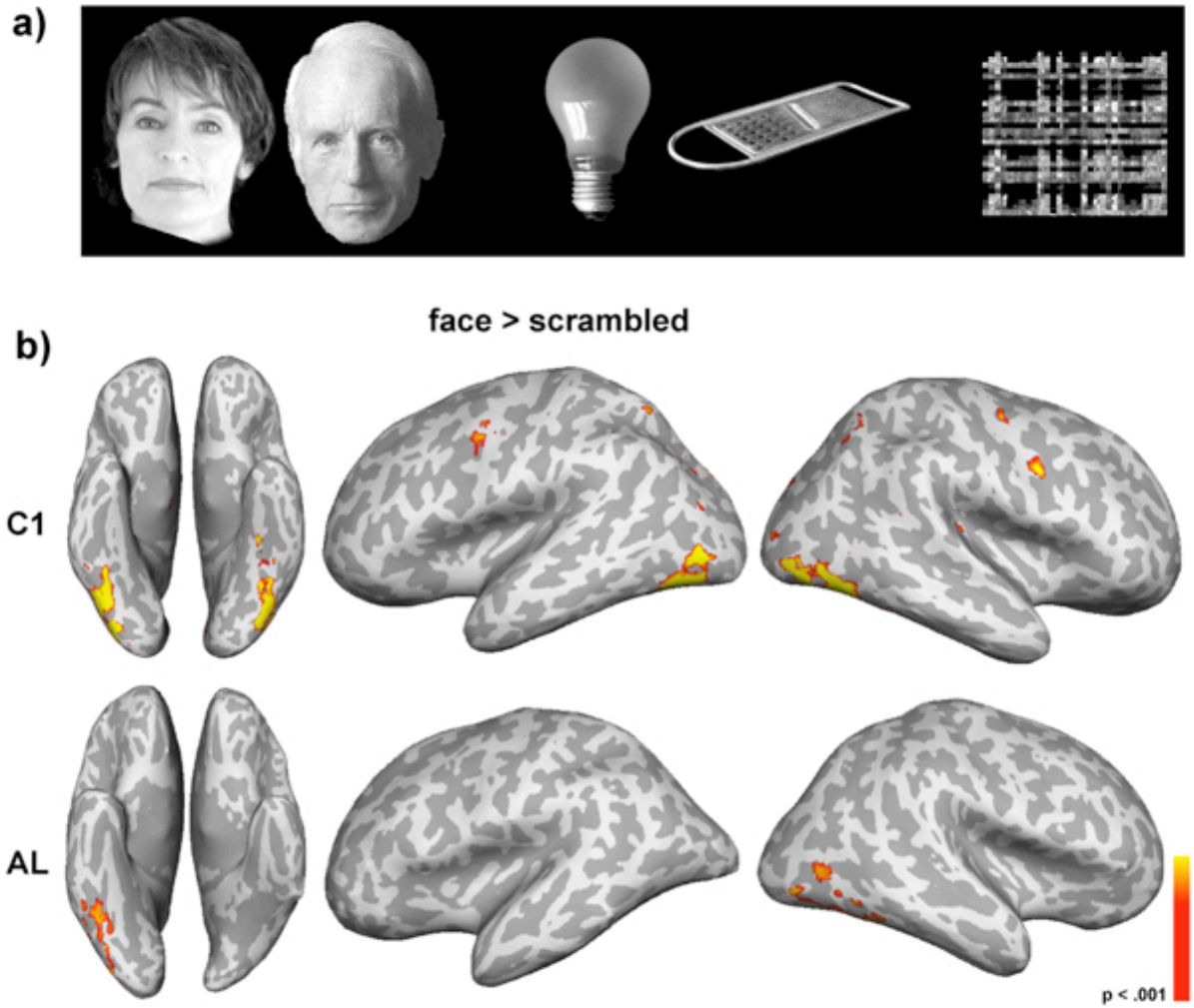
Whole objects activate the lateral occipital complex when compared to scrambled objects



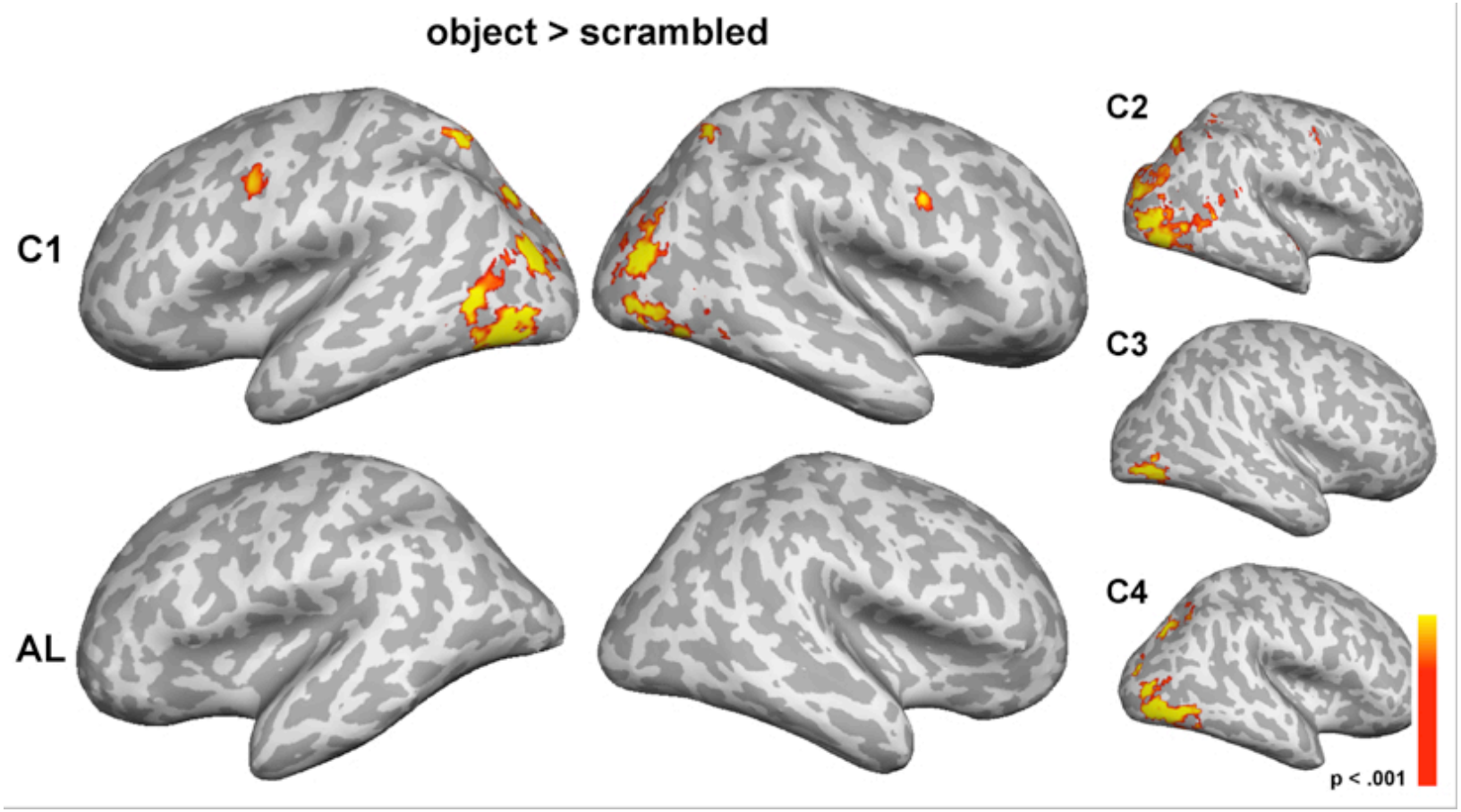


Denys et al. (2004)

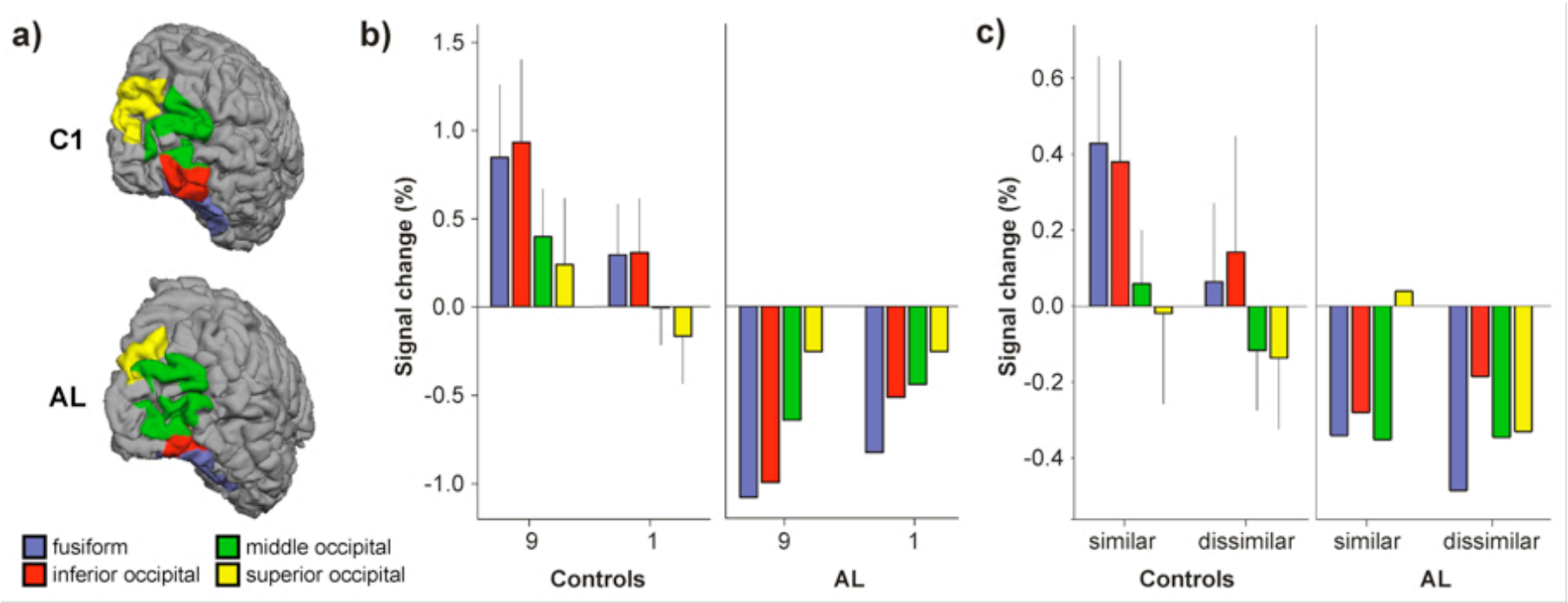
fMR: face > scrambled



fMR: object > scrambled



fMRI: repetition effect



conclusions

AL has visual associative agnosia

- *His impairment of visual perception cannot be explained by impaired elementary visual processing or preconceptual processing*
- *He is impaired in visual naming as well as in semantic (categorization) tasks*
- *He has preserved intelligence and no generalized semantic impairment*

Origin of identification errors

- *AL confuses visually similar distracters with the target (eg a ball with an orange)*
- *He bases his decision mainly on external shape features (eg 'a circular form') and does not sufficiently account for internal shape information*

Neural origin of visual associative agnosia in AL

His failures are related to impaired response of the right lateral occipital complex (LOC), which is functional (response to faces, buildings), but appears not to correctly encode shape information