

Cognitive Media Processing #4

Nobuaki Minematsu



Title of each lecture



- Theme-1
 - ~~Multimedia information and humans~~
 - ~~Multimedia information and interaction between humans and machines~~
 - ~~Multimedia information used in expressive and emotional processing~~
 - A wonder of sensation - synesthesia -
- Theme-2
 - Speech communication technology - articulatory & acoustic phonetics -
 - Speech communication technology - speech analysis -
 - Speech communication technology - speech recognition -
 - Speech communication technology - speech synthesis -
- Theme-3
 - A new framework for “human-like” speech machine #1
 - A new framework for “human-like” speech machine #2
 - A new framework for “human-like” speech machine #3
 - A new framework for “human-like” speech machine #4

A Wonder of Sensation - Synesthesia -

Nobuaki Minematsu



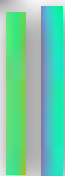
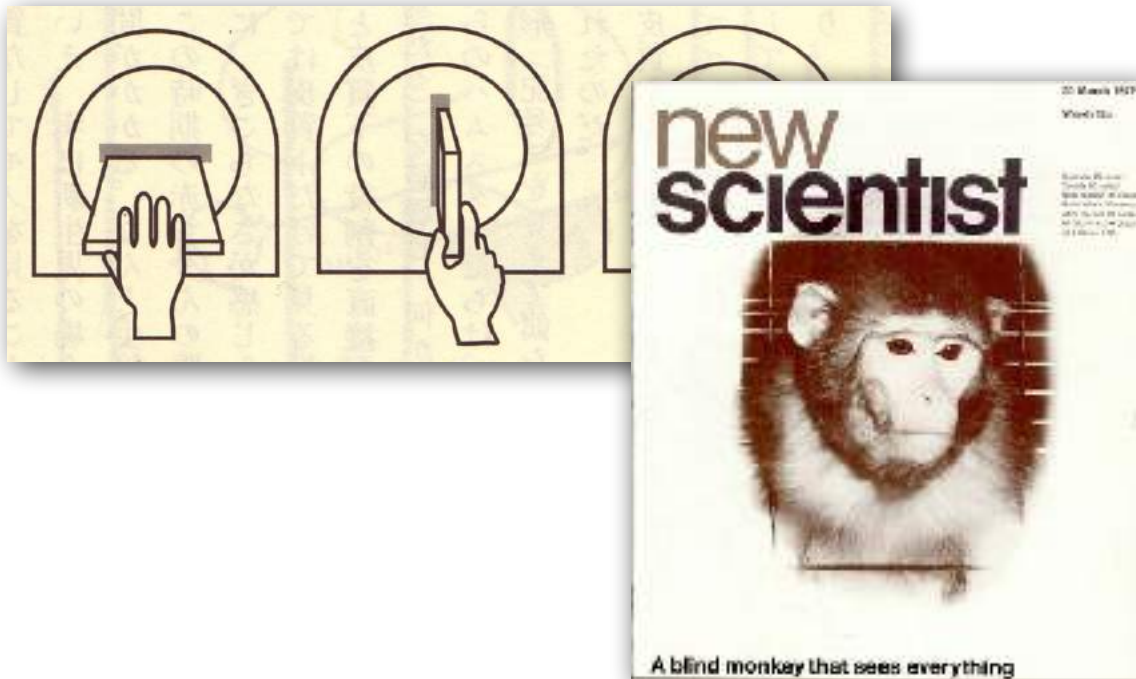
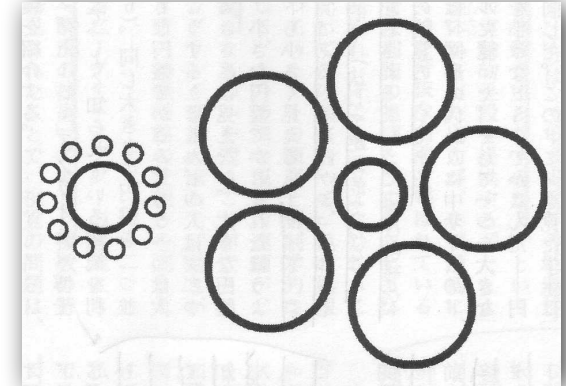
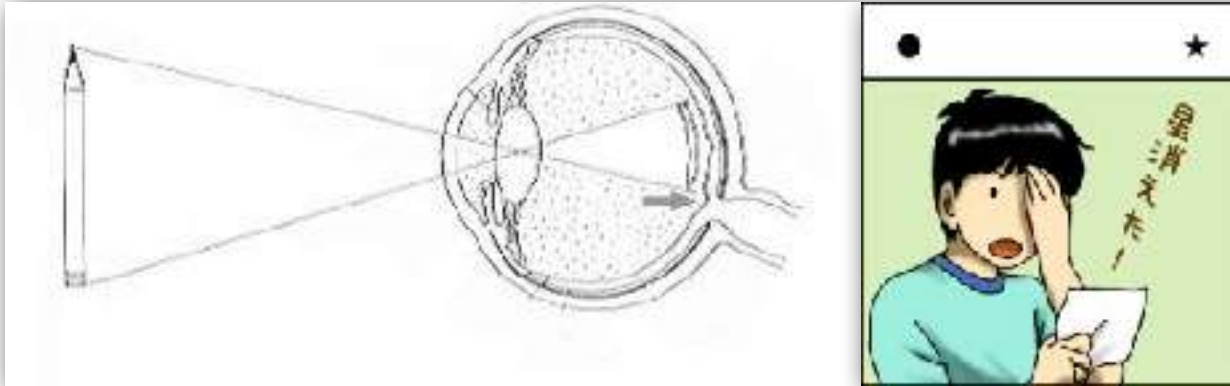
Today's menu

- Wonders of sensation that I've talked about so far.
 - Unconscious processing
 - Blind spot, blind sight, color illusion, size illusion, etc
- Other wonders of sensation
 - Visual sensation described by a doctor with brain damage.
 - Some peculiar behaviors of autistic individuals
 - A claim on brain info. processing from a brain scientist
- BBC documentary + more
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Wonders of sensation

- Examples of unconscious processing



Emotional processing and the brain

- Emotions in the brain (low road) = rough but very rapid
 - Mostly unconscious and implicit (prelogical)

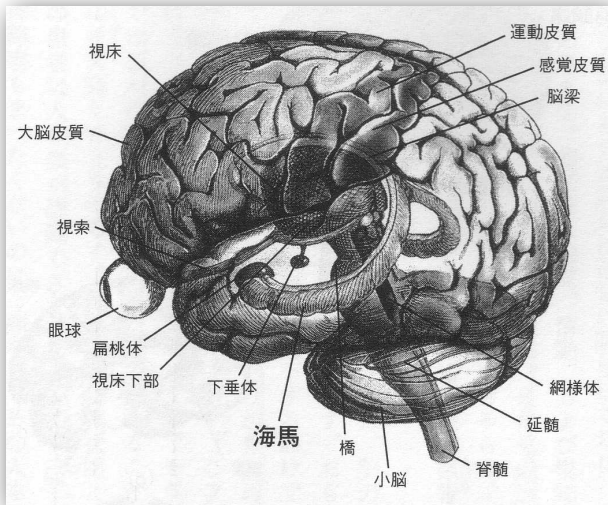


図 3-11 大脳新皮質の下に隠れた下等動物の脳。

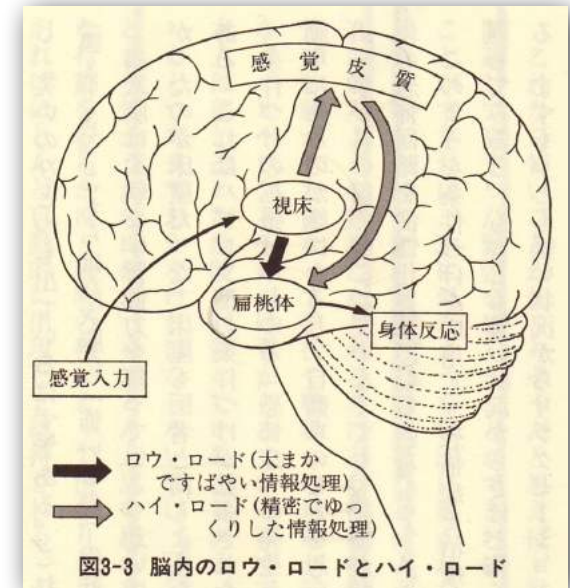
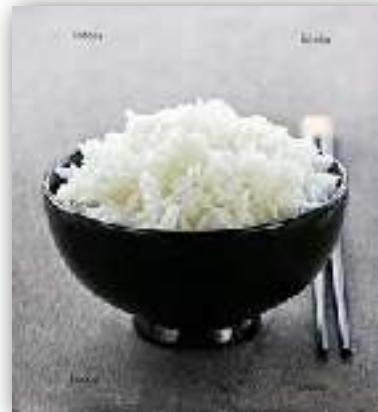
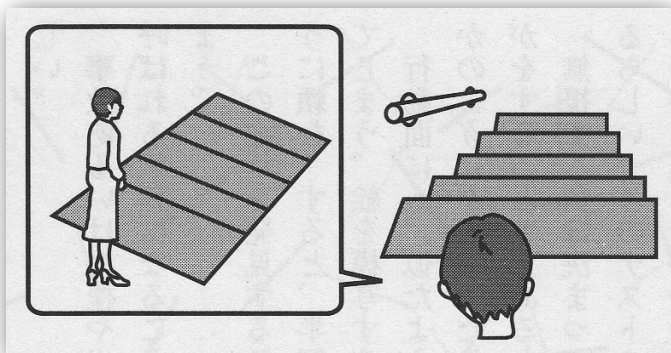


図3-3 脳内のロウ・ロードとハイ・ロード

- Your “conscious” world
 - What you can see, hear, touch, taste and smell “consciously”.
 - Only a part of human information processing
 - Enormous amount of unconscious and background processing.
 - How to make “human-like” information processing machines?
 - Researchers (engineers) have to be aware of our “unconscious” processing.

Some facts caused by brain damages

- “I’m living with a damaged brain.” (Dr. Kikuko Yamada)
 - Higher-level brain dysfunction (高次脳機能障害)
 - A part of the brain does not function well and she can be aware of that.
 - A medical doctor herself describes what she can sense through her damaged brain.
 - Seeing = conversion of a 2D image into a 3D image
 - What happens if the visual region of the brain has some dysfunction.
 - Stairs = just a plane with some linear segments
 - Cannot tell whether the stairs go up or down.
 - Chopsticks partially hidden at the background of a rice bowl.
 - Two separate objects cannot be bound into one object.
 - Shadows cannot give depth perception.
 - No difference between the two images below.



Sensation by autistics

● What are autistics good at and poor at?

● Good at

- remembering very detailed aspects of stimuli.
 - Especially their visual memory is often extraordinary.
- processing constantly repeated patterns.
- concentrating a (given) specific task.

● Poor at

- dealing with something abstract or invisible.
- capturing the relations of things although good at capturing a specific one thing.
 - Good at capturing an element but poor at capturing elements as a whole.
- dealing with temporal development including future planning
- understanding the environments properly.
 - Hidden messages are difficult to detect, ex. facial expressions, metaphors, etc.
- understanding spoken language.
 - In cases of severely damaged autistics, their first language is written language.
- smooth communication with others.
- dealing properly with sensory stimuli.
 - Their sensitivity of sensory stimuli is too good. Can hear the sounds that non-autistics cannot hear.
 - Difficult to select important stimuli / difficult to ignore irrelevant stimuli.

自閉症の特徴の強みと弱み

強み→① 具体的なことをよく理解し、記憶する。

- ② 目で見て認知したり記憶する機能的な記録・記憶力が高い。
- ③ 決まったパターンのくり返しに強い。
- ④ 好きなことへの集中力。

弱み→① 抽象的なこと、社会的なことに弱い。

- (一つひとつの情報はキチンと理解しているが、それらの相互関係がつかみにくい。目には見えないこと、経験していないことを想像することが難しい。)
- ② 時間の経過しをたてるのが苦手。
- (出来事の切りかわりがわかりにくい。いつもの流れが変更されると、わからなくなる。)
- ③ 状況を読み取ることに、
- (人の表情、しぐさや雰囲気などが理解しにくく、人の感情がわかりにくい。察られているのに感じがつらかり、察められているのに知らん顔など・・・。)
- ④ 話し言葉への理解、自分からのコミュニケーションが難しい。
- (言葉が出て来ず返すことになるなど。)
- ⑤ 感覚刺激に対して特別な反応をする。
- (音や光刺激に対して過敏だったり鈍感だったりする。活字刺激が一度にたくさん入りすぎてしまう。特定の感覚刺激に苦痛を感じる。)

Sensation by autistics

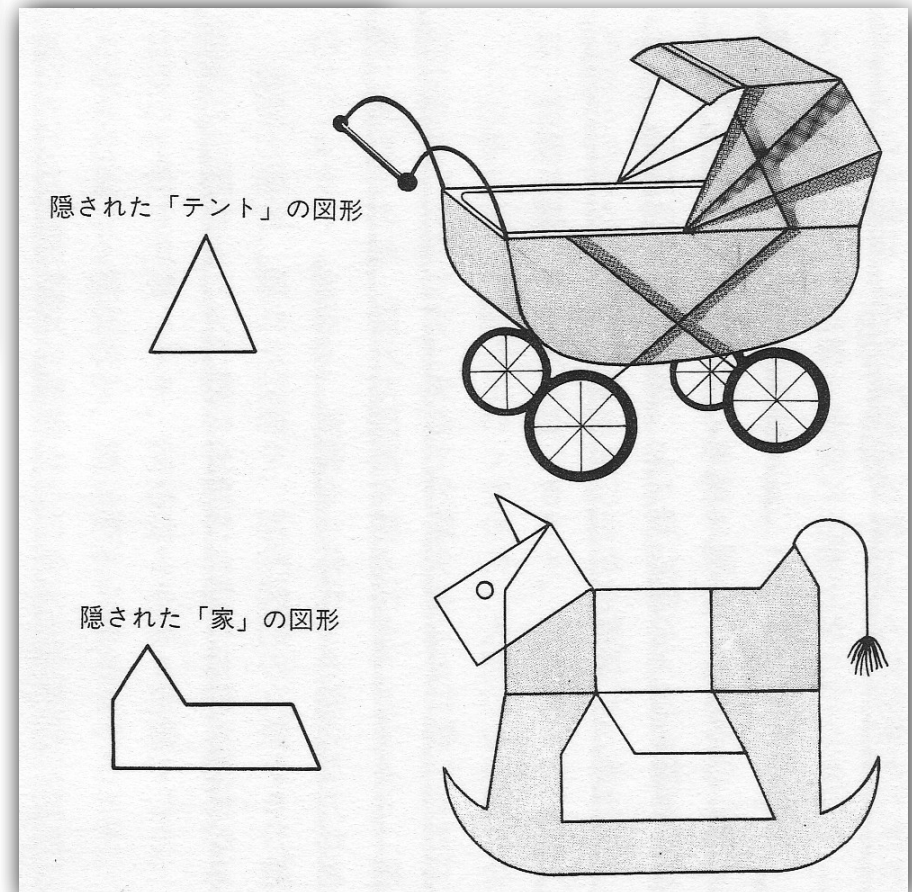
- Which do you perceive at first?

Details are Attended to Instead of Whole Gestalts

CONSISTENT		INCONSISTENT	
S S S S	H H	S S	S S
S S S S	H H	S S S S	S S
S S S S	H H H H	S S S S	S S
S S S S	H H	S S	S S
S S S S	H H	S S	S S

•Autism faster response time to small letters

- Find this piece in the whole picture.



Face! Face! Face!

- Some experimental facts

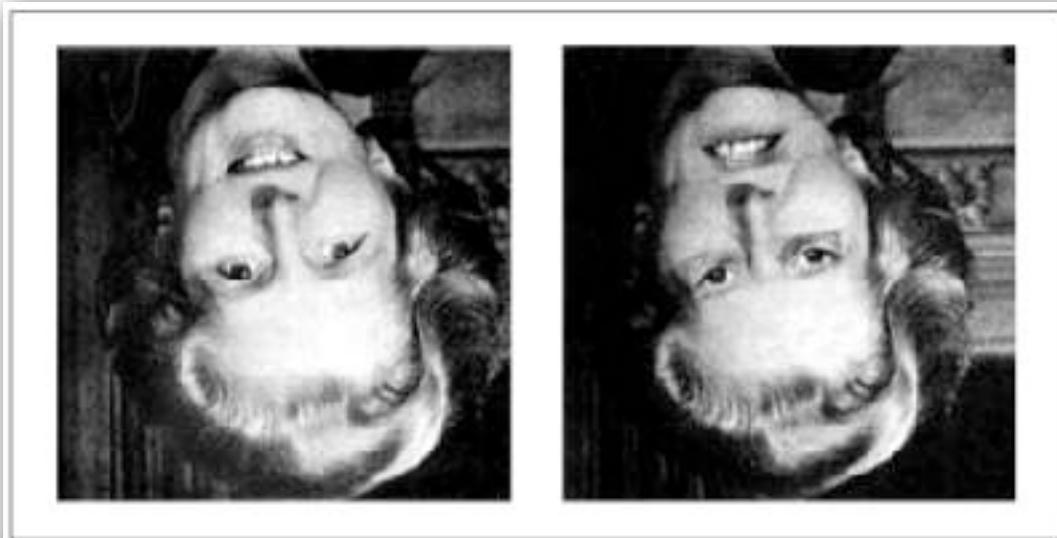


図2 サッチャー暗視 (Thompson, 1980)



図1 顔と見えるか、果物と見えるか

(M. Moscovitch et al. Journal of Cognitive Neuroscience, 9, 1997)
普通はこの絵を見て、顔と果物を同時に見ることができる。しかし、物
体欠如の患者はこれに人の顔は見えても、果物を見ることができなかつ
た。反対に相対失調の患者の場合は、果物ばかりが目立つた。

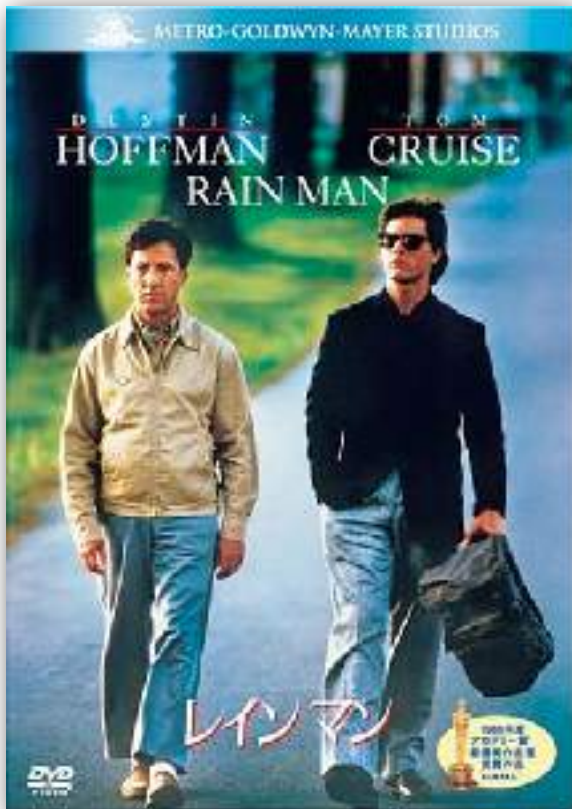
Sensation by autistics

- Stephen Wiltshire as “human camera”
 - Extraordinary memory of visual stimuli, especially buildings in a landscape.
 - But poor at spoken language, environmental changes, etc.



Sensation by autistics

- Kim Peak as “walking library”
 - A model of “Rain Man” in the movie entitled as “Rain Man”
 - He has an extraordinary memory of numbers.
 - He can remember all the sentences in the books that he read.
 - But he is poor at reading between lines, detecting hidden messages.



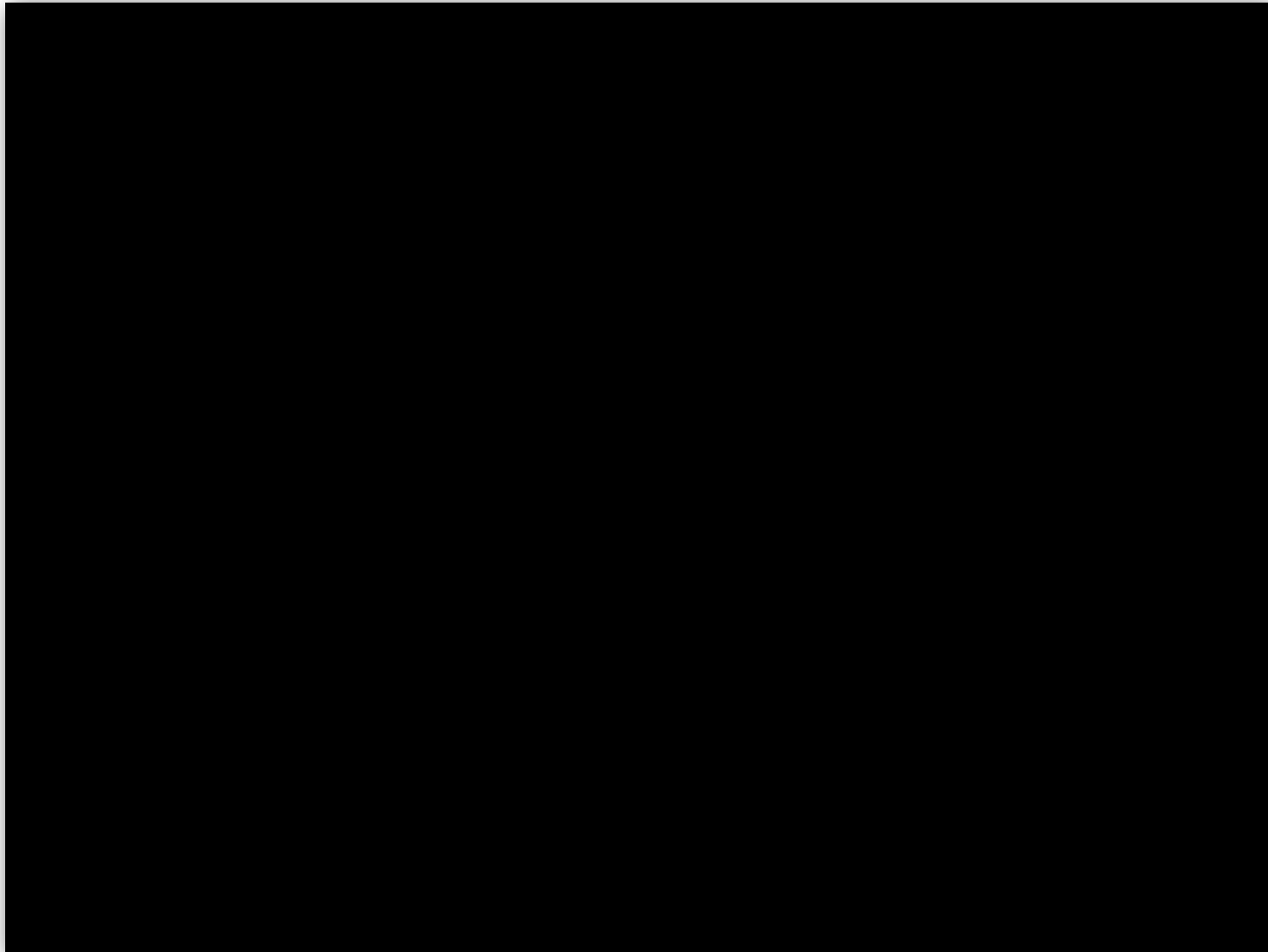
Similarity?

- Good at memorizing facts
 - Poor at generalizing those facts and extracting hidden information in the facts.



A report from CBS news

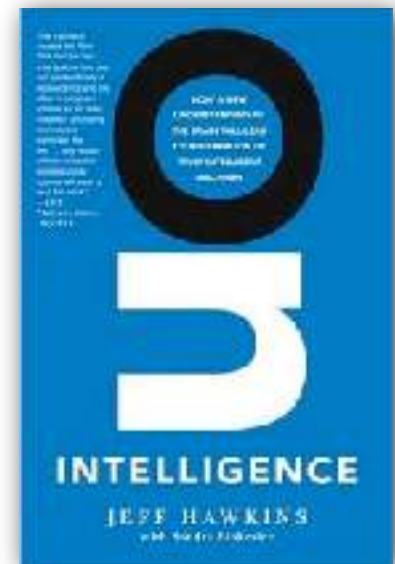
- The Tool Man



A claim from a brain scientist

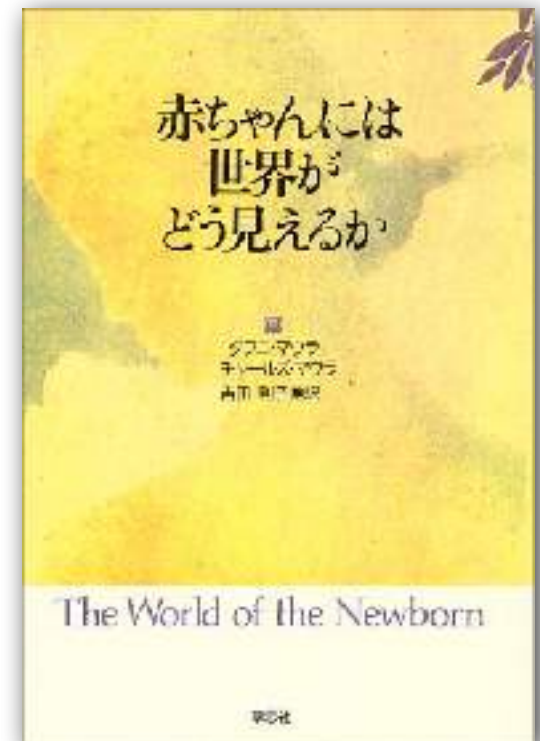


- Rewiring in the brain
 - Visual information can be linked to the tongue.
 - “Taste” region of the brain can be rewired to “vision” region of the brain.
 - “Audition” region of the brain can be rewired to “vision” region of the brain.
- The essence/core of info. processing is the same among regions?
 - Visual cortex, auditory cortex, motor cortex, etc
 - The function of brain regions seems to be different from each other.
 - Organizing principle for cerebral function (V. Mountcastle, 1978)
 - 大脳皮質の構成原理
 - The function of each region seem rather independent but the unit of the cerebral cortex (大脳皮質), which is called “column”, has a very similar anatomical structure in any region.
 - Implies that a universal information algorithm exists in the cerebral cortex, irrespective of physical differences in sensory stimuli??



A wonder of sensation

- A 45-min documentary film on synesthesia made by BBC
 - Perceiving colors by seeing or hearing numbers
- Every baby is like that.
 - “The world of the newborn” (D. Maurer and C. Maurer, 1989)



“Seeing colors in sounds”

- “音に色が見える世界” (J. Iwasaki)

んわらやまはなたさかあ
 ゐりみひにちしきい
 るゆむふぬつすくう
 ゑれめへねてせけえ
 をろよもほのとそこお

ンワラヤマハナタサカア
 ンワラヤマハナタサカア
 ンワラヤマハナタサカア
 ンワラヤマハナタサカア
 ンワラヤマハナタサカア

図3 著者には平仮名・片仮名がこのような共感覚色に見える。

人付体信借偽優
 寸本言昔為憂
 門閣閤音欠欧欲
 各伐音音区谷

図8 著者が同じ部首の各漢字に見ている共感覚色。

黒灰紫青紺緑
 黄橙茶赤桃白

図7 著者が色彩を表す漢字に見ている共感覚色。

立 立 音 音 意
 日 日 心 心
 心 心

図9 「立」、「日」、「心」を近づけて「意」を作るときに、著者が見ている共感覚色。



“Seeing colors in sounds”

- “音に色が見える世界” (J. Iwasaki)



図16 著者がラテン文字に見ている共感覚色。

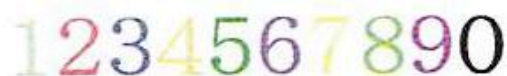


図17 著者が数字・数概念に見ている共感覚色。

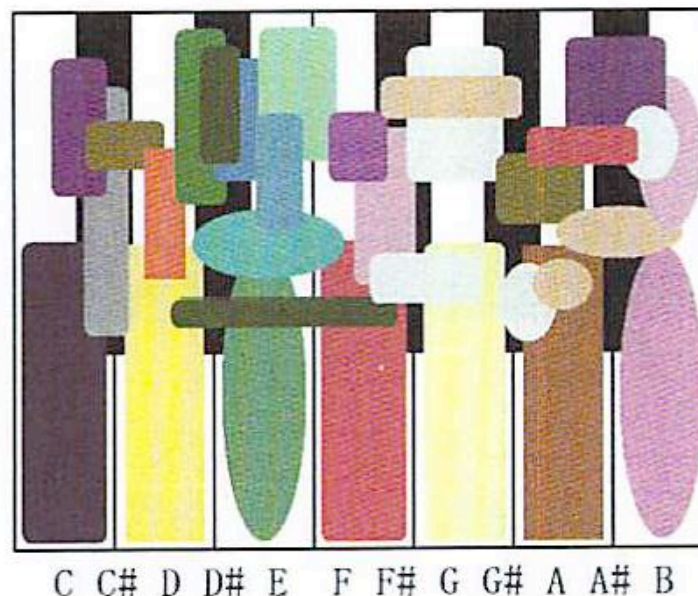


図18

著者が音階に見ている共感覚色。上部の込み入った様々な色は、雅楽や民族音楽に見ることが多い。

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Assignment

- Assignment
 - Read a research paper which is related to the first four lectures of this class, summarize it, and give your own comments to the paper.
 - All the materials used in the lectures can be available at:
 - <http://www.gavo.t.u-tokyo.ac.jp/~mine/japanese/media2017/class.html>
 - Ramachandran's article on synesthesia is also found there.
- Length
 - A few pages of A4 size.
- Submission
 - Your report should be sent to mine@gavo.t.u-tokyo.ac.jp in the form of PDF.
 - The filename must be [studentID]_yourname.pdf
 - 36-302439_nobuaki-minematsu.pdf
 - ID_givenname-familyname.pdf
 - The paper that you read should be attached.
- Deadline = 23:59:59 on Nov. 14



Recommended books

