

Synesthesia: Atypical brain connections inspiring art

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Let's chat a bit about everyone's favorite
neurological condition....

Synesthesia!



Wassily Kandinsky *Black Strokes I*
(1913)

Seeing sounds!

Tasting music!

Feeling
colors!

Hearing odors...?

Definition

- Melding together of senses
- Atypical sensation triggered by a perception
 - Letters have specific colors; Some words have specific tastes
- Involuntary, automatic, constant
- Simple, benign hallucination
- Often present since childhood
- Can be drug-induced (LSD, psilocybin, ecstasy) or acquired after neurological events (stroke, migraine)

What synesthesia is not

- Exceptional memory for associations
- Preferences in associations (cultural or individual)
 - Red is hot
 - Word 'Bouba' sounds round whereas 'Kiki' sounds pointy
- Synesthetic metaphors
 - Figures of speech
 - "loud colors", "dark sounds", "sweet smells »

History

- Early
 - Woolhouse (1710), Sachs (1812)
 - Galton (1880), Suarez de Mendoza (1890), Flournoy (1893)
 - Pierce (1907), Ferrari (1907)

- Recent
 - Cytowic (1993, 2002)
 - Baron-Cohen et al. (1993) –Hyperconnectivity hypothesis
 - Ramachandran et al. (2001, 2005, 2008)
 - Ward (2013) - Review

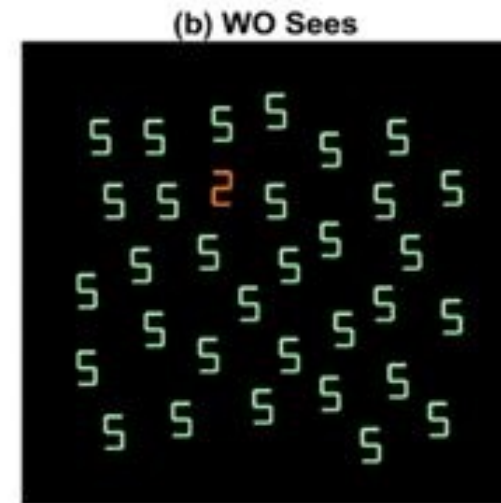
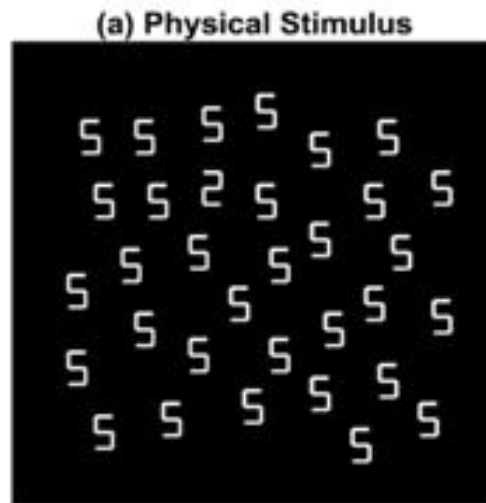
Added colors

- One of the most frequent
- Colored graphemes
 - Letters, numbers, words
 - Real color seen but added color seen on top or in mind's eye
- Colored sounds
 - Music, words or common sound
 - Color appears in mind
- Colored emotions



Synesthesia helps attention & perception

- Digit-color synesthetes see the target digit (2) faster (Palmeri et al., 2001)



Sound-color synesthesia

- <https://www.youtube.com/watch?v=obrBAysVef0>
- Often music or tone sequences
 - Hockney
 - Kandinsky?

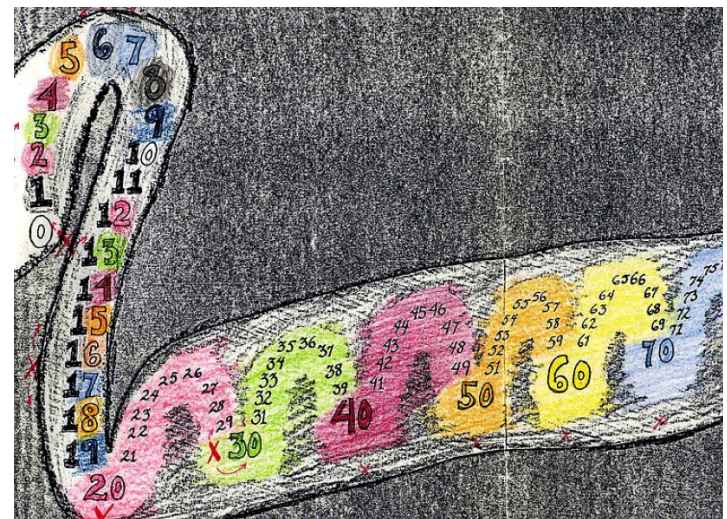
Word-Reading synesthesia

- Ticker tape phenomenon
- See words written when spoken to



Sequence-space synesthesia

- Numbers, days or months have a spatial form
- Can facilitate time management or mental manipulation
- Some have incredible memory for dates



Vision-touch synesthesia

- Feel touch when they see someone being touched
- Some have extreme pain empathy
 - Avoid violent movies

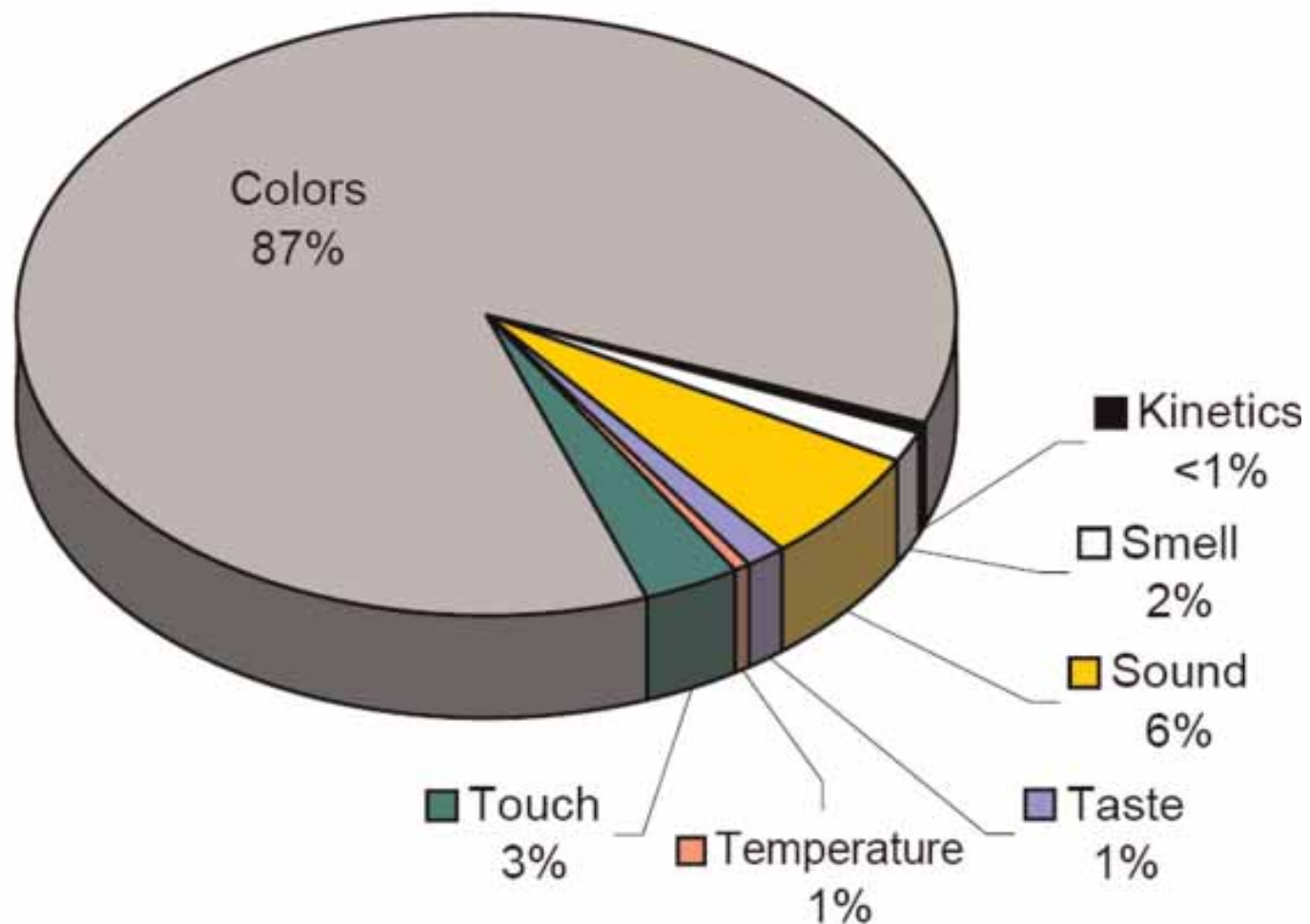


Tastes

- Auditory words have tastes
 - Atis – raisins since friend age 5 ate raisins
 - Tastes may also evoke words
- Voices have tastes
 - Madonna – Munchkins
- Music has tastes
 - Interval-taste
 - Small third-salty
- Tastes can have shapes
 - « The man who tasted shapes »
(Cytowic, 1993)

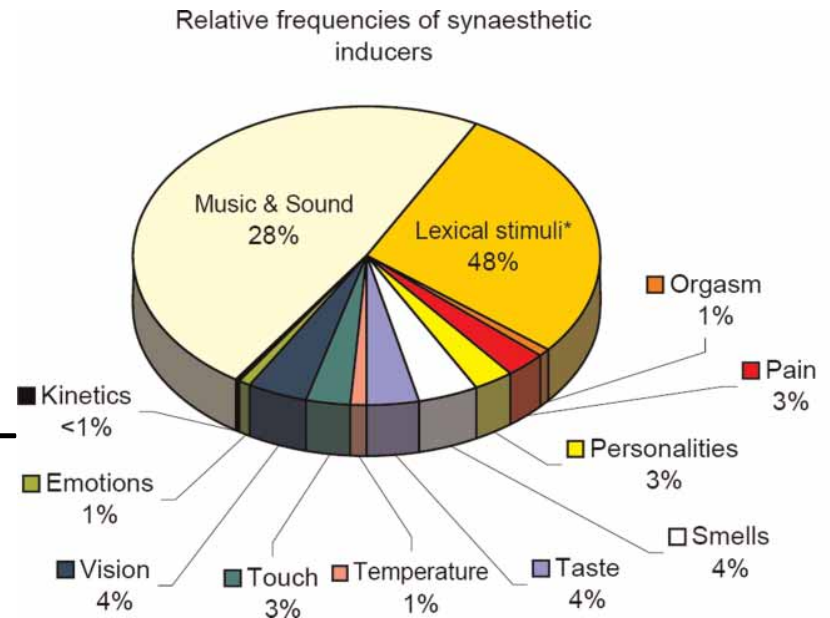


Types of concurrent sensations



Types of inducers

- Words, letters, numbers (48%)
 - Visual or auditory
 - Language development?
- Sounds, music (28%)
- Odors, tastes, touch, pain (3-4% each)
- Emotions (about 1%)



Characteristics

- Often several types experienced by one person
- Generally have to pay attention to inducer to produce the effect
- Women more than men (not sure)
- Prevalence unclear 1 - 4%
- Often familial - Genetics or epigenetics

Developmental synesthesia

- Generally present before 10 yrs
 - Normal phase in children?
 - Link with proliferation of connections before age 2?
- Specific events can create associations
 - Movie ‘Honey I shrunk the kids’ (1989) created a synesthesia between ‘Cherie’ and taste of granules (Richer et al., 2011)
 - Fast permanent learning
- Associations can change
 - Stress, fatigue, inattention alter intensity
 - Concurrent sensations sometimes change or disappear

Drug-induced synesthesia

- LSD, mescaline, psilocybin, ecstasy
 - Enhancers of serotonin
 - Often produce synesthesia
- Cannabis (Baudelaire, Gautier ...)
 - Fewer synesthesias

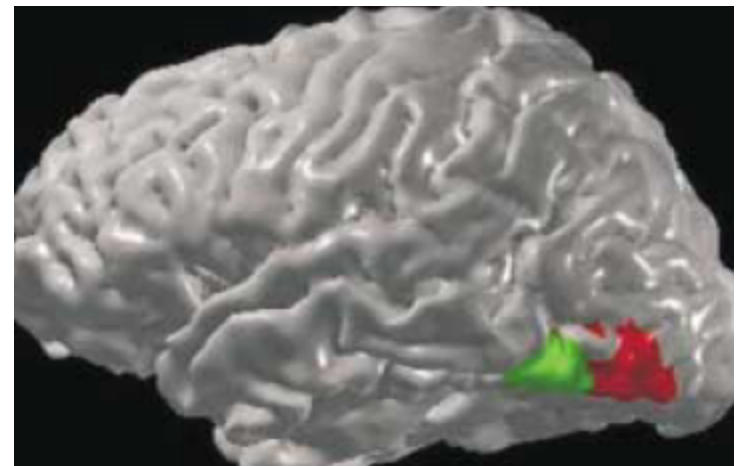
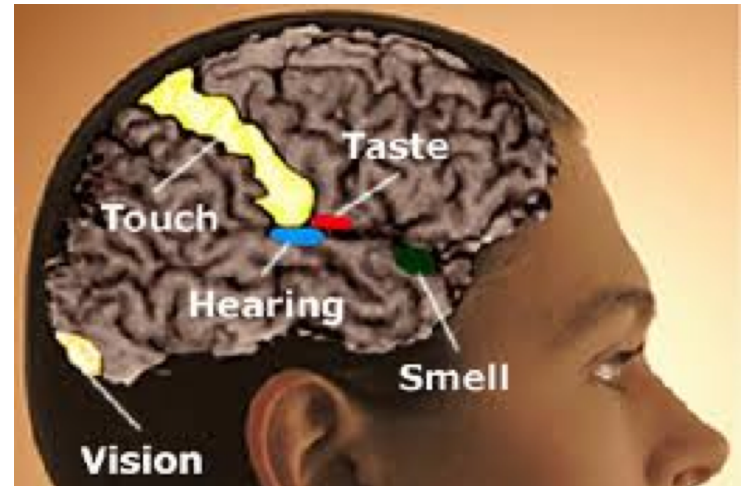
Synesthesia linked to altered states

- Elated states (music ...)
- Meditative trances
- Orgasms, labor
- Ecstatic experiences
 - Scriabin, Kandinsky, Rimsky-Korsakov, Messiaen



Brain bases

- Reinforced connections between brain regions
- Specific: Letter region connected to color region
- Or general: Tendency for increased connectedness



Case of Elisabeth

NeuroImage 43 (2008) 192–203



Contents lists available at [ScienceDirect](#)

NeuroImage

journal homepage: www.elsevier.com/locate/ynimg



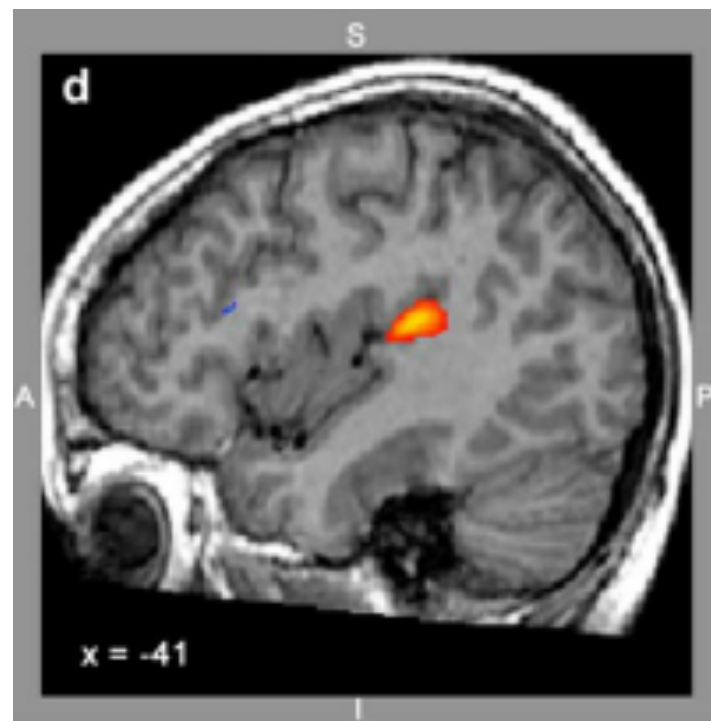
The multiple synaesthete E.S. — Neuroanatomical basis of interval-taste and tone-colour synaesthesia

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Case of Elisabeth

- Neuroimaging white matter tracts (vs control group of musicians)
- Increased density of connections in temporal (auditory & emotional) regions
- Brain difference a cause or a consequence?



Emotions in synesthesia

When numbers have personalities

	GENTIL	PAS GENTIL
GRAVE	56 78 65 66 67 68 69 70 71 72 73	1000 3 4 33 34 35 36 37 38 39 40 41 42 43
PAS GRAVE	2 17 24 21 32 31 20 319 4831 6194 73911	1 10 13 16 243 4000 2200 39041 46033 155 650309 185304165

Tactiles textures – Emotions

Ramachandran & Brang (2008)

Bok Choy	Disgust
Corduroy	Confusion,
Denim	Depression, disgust
Leather	Receiving criticism
Moist soil	Content, happy
Textured glove	Willies, wanted to get up and run
Multicolored toothpaste	Anxious
Orange peel	Like an electrical shock
Paper	No emotion
Sand paper (grade 60)	Guilty
Silk sleeping bag	Happiness, safety

Emotions in synesthesia

- Emotions can be a trigger, a synesthesia or a side-effect (modulator)
- As a side-effect it can induce more associations
 - Word – taste – emotion - related thoughts
 - Sound – flashback – emotion - related memories

Disadvantages

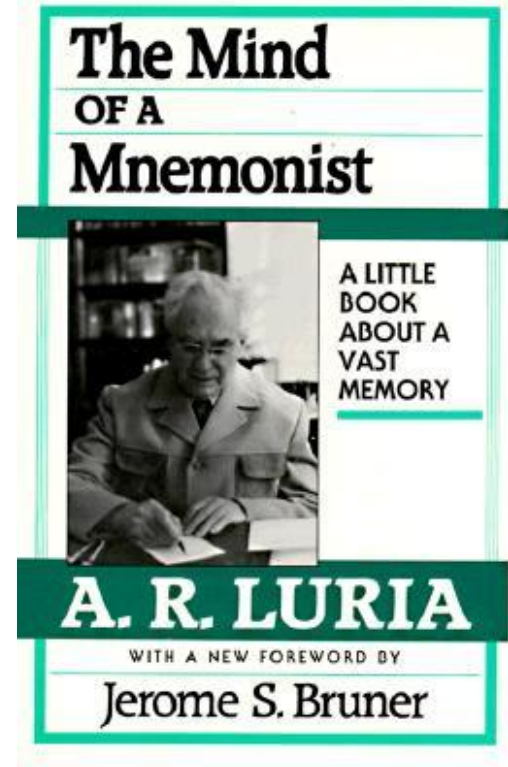
- Sometimes distraction or confusion in perceptions
 - Reading while eating when you have distinct colors for words and tastes
 - Don't like the fit ('Not enough points in the chicken')
- Feeling different
 - Think everybody has them until they talk about it

Advantages

- 6th sense, enriched experience and imagery
- Increased memory
- Increased creativity

Increased memory

- Especially in autism with synesthesia
 - Hyperconnectivity increases associations & distinctiveness of memories
 - Superiority often specific to synesthetic modality
- What if we could increase associations in non synesthetes
 - People with Alzheimer's
 - Typical people



Increased creativity

- Synethetes often have a heavy interest in the arts even when they are not professional artists
- Aesthetic sense more developed
 - Marked preferences
 - Strong intuitive ideas & associations
 - Clear sense of what fits together, what makes sense

Increased creativity

- Openness to experience (Banissy, 2013)
 - Emotional sensitivity
 - Attention to emotions, introspection
 - Imagination (nonconformity)
- Rich mental imagery (Price, 2009)
 - Vivid dreams, hypnagogic imagery
- Absorption
 - High engagement in mental states

Linking synesthesia & creativity

- Enriched imagery and affect drive mental exploration
- This exploration encourages new ways of perceiving or understanding the world

(e.g. Finke, 1990; Houtz & Patricola, 1999).

Synesthesia in artists

- Domino (1989) - Study of 300 fine arts students
- 23% synesthetes (self-report, probably overestimated)
- Synesthetes higher on all 4 measures of creativity compared to non-synesthetes

Artists with synesthesia

- David Hockney (music-color)
- Vasily Kandinsky (probable)
- Joan Mitchell
- Charles Burchfield (probable)
- Van Gogh (possible)

Musicians with synesthesia

- Franz Liszt
 - Instructs musicians ‘Not so rose’, ‘A little bluer’
- Alexander Scriabin
- Theophile Gautier
- Claude Debussy
- Olivier Messiaen
- Arnold Schoenberg
- Leonard Bernstein
- Itzhak Perlman
- Jean Sibelius
- Duke Ellington

Writers with synesthesia

- Nabokov – letter-color, (also his mother, his son)
- Baudelaire
- Rimbaud (probable)
- Ellen Fowler

Kandinsky

- Impression III (concert) inspired by Schoenberg concert (1911)
- Remarked that it was an outstanding example of synesthesia
- Loved music, Musical titles to paintings
- Played cello – saw deep blue



Hockney

- Painted with music
- Music-color syn
- Used syn most in set designs for operas & ballets



GARROWBY HILL BY DAVID HOCKNEY

Museum of Fine Arts, Boston

Joan Mitchell

- Lived with P. Riopelle
- Painted with music
- Music-color syn, several more
- Seeking "the feeling in a line of poetry which makes it different from a line of prose."



Blue territory

Color-organs

- Newton (1704)
- LB Castel (1725)
- Goethe (1810)
- JK Huysmans

Liens

- Elisabeth (musique-couleur & gout) (Discovery)
 - http://www.youtube.com/watch?v=1R_A4tUMOtI
- U. Waterloo (Science Daily)
 - http://www.sciencedaily.com/videos/2007/0107-what_color_is_a.htm
- Mots-couleurs (aveugle)
 - <http://science.discovery.com/video-topics/brain-intelligence/talking-synesthesia-talking-synesthesia.htm>
- Entrevue Cytowic & Frakowiak
 - <http://www.youtube.com/watch?v=SH6K9Wp9764>
- Descriptions personnelles
 - <http://www.threesixtyjournalism.org/FeelColor>