

Physical Saliency and Cognitive Saliency

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Information Structural Evidence
in the Race for Saliency

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1. Definitions and approaches for the notion of salience

- Some entry points and approaches for salience
- Some existing works
- Salience as a general cognitive mechanism
- A “generic” characterization of salience

2. Four dimensions of salience

- Prior salience and new salience
- Visual salience and linguistic salience
- Physical salience and cognitive salience
- Immediate effect salience and continuous effect salience

3. Future works

Saliency phenomena put an element from a linguistic or visual message forward (“pop-up” effect):

- ⇒ Which research fields are concerned by saliency?
- ⇒ What are the factors of saliency?

Saliency as a multifaceted concept:

- ⇒ What are the relations between the various facets of saliency?
- ⇒ Is it still possible to characterize saliency as an unified concept?

Many uses, many categories, many distinctions:

- ⇒ visual saliency vs. internal saliency (psychology) → saliency vs. relevance
- ⇒ cognitive saliency vs. ontological saliency; entrenchment vs. saliency (cognitive linguistics, cf. Schmid 2010)
- ⇒ prosodic saliency vs. semantic/pragmatic saliency (linguistics and natural language processing, cf. Zhang et al. 2006)
- ⇒ procedural saliency vs. sensory saliency (computer science, cf. Ruksenas et al. 2008)

Perceptive entry point

- an entity that is **visually** salient stands out as a priority when we perceive a visual scene, so that it becomes important with cognitive concerns (so that it attracts attention and distracts from other visual elements)
- an entity that is **linguistically** salient stands out as a priority when we understand an utterance, so that it becomes important with cognitive concerns (so that it attracts attention and directs our reaction or answer on it)
- **Salience** = degree of attention to perceived entities
- **Salience factors** = perceptivity (identifiability), natural simplicity, brightness, stability, originality (new entity)

Cognitive entry point

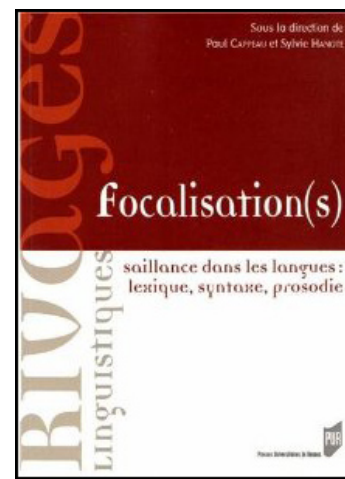
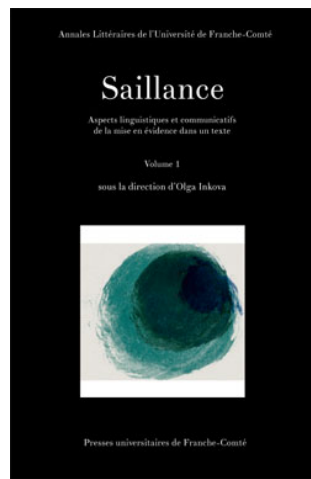
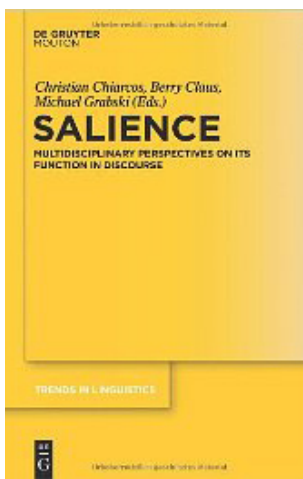
- **Salience** = degree of attention to entities that are mentally represented
- **Salience factors** = focus of attention, familiarity, accessibility, and disturbing, curious, enigmatic aspects (problematic entity)

Concerning visual perception

- **Origin** = theories on colours and forms, Gestalt criteria for perceptual grouping... (Diderot, Goethe, Itten and Bauhaus, Wertheimer 1923)
- Salient features, psychological works on perception and attention (Treisman 1980, Camus 1996, Rousselet & Fabre-Thorpe 2003)
- Saliency models in (machine) vision (Itti 1998, 2000, 2001...)

Concerning language

- **Origin** = works on anaphora resolution (Sidner 1979, Grosz and Sidner, Centering Theory in 1995, Stevenson & Poesio 2001)
- Works on information structure, with the notions of focus, theme, topic...



First movement: salience is one of the constitutive criteria for the definition of a new (emerging) linguistic notion

- Ariel (1990) = salience is one of the four constitutive criteria of the notion of referential accessibility
- Chafe (1994) = salience is one of the 3 constitutive criteria of the notion of identifiability

Second movement (current works on reference and discourse): salience results from a number of factors

- Grosz and Sidner (1986), Centering Theory (1995), etc.
- issues in corpus linguistics: annotating all the factors (and not salience feelings)
- issues in natural language processing: machine learning techniques in order to assign weights to factors and to compute the resulting salience scores

Saliency seems to be more global than the notions from information structure works, and than visual aspects and linguistic aspects

- ⇒ we operate in the second movement
- ⇒ we consider saliency as a general cognitive mechanism, like invariance or optimization in Gestalttheorie
- ⇒ we study and characterize visual saliency and linguistic saliency in parallel
- ⇒ first result: identification of generic factors, that fit well with visual concerns as well as linguistic concerns
- ⇒ second result: identification of four dimensions for saliency studies

Visual saliency and linguistic saliency can be exploited simultaneously in NLP applications

- ⇒ same methods for the resolution of anaphora and exophora
- ⇒ same importance in Human-Machine Dialogue (Kelleher 2004, 2005...)

Visual or linguistic entity

Primordially principle:

- ⇒ the loudest = the most salient
- ⇒ the most recent = the most salient
- ⇒ the most important = the most salient
- ⇒ **salience is linked to importance (or primordially)**
- ⇒ for instance, the discourse entity with the most important thematic role is considered as the most salient entity

Singularity principle:

- ⇒ the only entity that is red is salient
- ⇒ the only entity that is isolated is salient
- ⇒ **the best salience is linked to the highest number of singularities**

A generic characterization of salience

Salience factor	Visual example	Linguistic example
intrinsicness explicit emphasis strategic place isolation repetition symmetry break in continuity implicit rule violation compliance with a standard message structuring physiological predisposition attentional predisposition affective predisposition	big size brightness rule of thirds isolated object spatial regularity spatial symmetry out a linear disposition incongruous disposition classic composition guideline fovea focus space known face	proper name cleft sentence beginning of the sentence apposition repetition chiasmus speaking cadence (deliberate) error usual syntactic construction focus, theme... loud speech cocktail party effect concept with connotations

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3. Future works

Prior salience

- exploiting an existing salience
- typical examples: production of a linguistic utterance based on a prior visual salience (at a theatre: “he is very good” when an actor is put forward for instance by the lights) or a prior linguistic salience (“he is very good” after “I like the main actor”)
- prior salience brings an antecedent for anaphora resolution

New salience

- putting forward a new entity
- typical example: use of a cleft sentence (“it is the main actor that I prefer”) or a particular syntactic construction (topicalization, particularly in French)
- new salience plays a role of preparation to a future action

- Units:**
- visible objects for visual salience
 - discourse entities for linguistics salience

Visual salience factors

- salience linked to luminosity (density) and colour contrasts (Itten 1985 ; Baticle 1985 ; Ho-Phuoc et al. 2012)
- salience linked to a singularity in a set of objects
 - category and physical characteristics (form, colour, size, texture)
 - orientation, dynamics
 - isolation vs. member of a perceptual group
- salience linked to the scene cohesion and structuring
 - explicit emphasis (lighting)
 - dedicated construction (photographic composition, Freeman 1989)
 - strategic place (thirds of the frame, golden ratio)
 - perspectives, balances (vanishing points, balance point)
 - repetitions and symmetries

Salience that is intrinsic to the words

Particular graphemes or phonemes. Some words because of their nature (e.g. proper nouns, cf. Garrod & Sanford 1988). Indexicals because they bring back to the situation.

Salience due to an explicit emphasis

Stress accent. Particular intonation / prosody (Lambrecht 1994). Presence of a deictic gesture. Presence of a pause before and after uttering a word or a noun phrase.

Salience due to a particular syntactic construction

Presentational cleft constructions or topic constructions (“it is ... that ...”). (Lambrecht 1994).

Salience linked to word order and frequency

Privileged positions in the sentence: the beginning (Kessler et al. 1996), the end. Repetition of a word or noun phrase. Presence of a symmetry (Stevenson 2002).

Salience linked to grammatical functions

Subject > direct object > indirect object > other functions.
Vocatives.

Salience linked to lexical semantics

Importance of some semantic features such as “human” or “animate” (Pattabhiraman 1993).
Influences between the discourse entities (teacher > pupil, Wanner & Bateman 1990).

Salience linked to verbal semantics (*thematic roles*)

Importance of the agent, the patient, the theme. Considering the semantics of the verb (aspect, semantic category, number and nature of its arguments), the agent may be more salient than the patient or the contrary (Stevenson et al. 1994, Pearson et al. 2001, Garvey & Caramazza 1974).

Salience linked to sentence semantics (*theme, sentence topic*)

Theme / topic > rheme / comment (but not always and some of the previous parameters have to be integrated here, e.g. subject and/or first position).

Salience linked to discourse semantics (*discourse topic, aboutness*)

Introduction of the topic using a long and explicit noun phrase which has not the subject function (Wolters 2001). Aggregates of discourse entities (macrostructures, cf. van Dijk).

Salience linked to cognitive semantics (*inferences*)

Explicitness > implicitness. Foreground > background (presupposition). Considering the context, given > new, or new > given...

Saliency linked to the form

- some saliency factors have a physical evidence (physical characteristics for a visual element, lexical and syntactic characteristics for a linguistic element)
- then we talk about **physical saliency** or **P-saliency**
- P-saliency relies on objective indications (only P-saliency can be computed in natural language processing or machine vision applications)

Saliency linked to the content

- some saliency factors are linked to cognitive aspects (saliency linked to intention, attention, short-term memory, long-term memory, emotions...)
- then we talk about **cognitive saliency** or **C-saliency**
- evaluating C-saliency can be done on the basis of hypotheses on mental states of the considered speaker

Salience with an immediate effect

- one communicative act
(one picture, one linguistic utterance or pragmatic unit)
- one privileged entity (theme) + a ground or commentary (rheme)
- visual example: advertising...
- linguistic example: one proposition

Salience with an (incremental) continuous effect

- several communicative acts
(film, comic book, discourse, conversation)
- discourse topic
- hierarchic structures: macrostructures, superstructures

- We still need a theory of salience...
- based on a variety of factors
- that makes links between visual, linguistic, and cognitive aspects

- psycholinguistic experimentations to test some factors
- corpus studies
- etc.