

Tactile field and the dual nature of touch

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1. Introduction

There are important overlaps between visual and tactile contents. In particular, many properties, such as shapes and sizes, are represented both by touch and vision.

Nevertheless, vision and touch may have distinct spatial modes of presentation of the same properties (Fulkerson 2014).

Visual field: topologically connected „container” in which entities are perceived to be located (Cheng 2019).

Question: Is there a tactile spatial field? (e.g., Martin, 1992: *no*; Scott, 2001: *yes*)

My thesis: there are two tactile spaces.

- (1) Interoceptive space of tactile sensations – it is a spatial field.
- (2) Exteroceptive space of tactile objects – lack of evidence for field-status.

Touch is ‘bipolar’: a tactile experience has both interoceptive and exteroceptive aspects. For example:

Exteroceptive aspect: an object is round.

Interoceptive aspect: a pressure inflicted on a skin fragment.

2. Spatial field

Three characteristics of perceptual spatial fields which (a) explicate the „container” metaphor and (b) grasp the crucial features of visual field.

(1) *Topological connectedness*.

There is a continuous spatial path between each two locations within a spatial field.

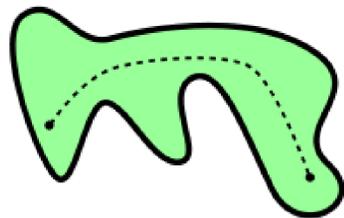
(2) *Relation independentness*.

The topological structure of a spatial field does not supervene on pattern of relations between entities positioned within a spatial field.

(3) *Possible emptiness*.

Some locations in a spatial field can be empty.

Visual field is topologically connected, its structure is the same no matter the represented relations between perceived entities, it can contain empty places.



3. Interoceptive tactile field

(A) Bodily representations constituting interoceptive tactile space:

Skin space: represents body relying on the array of cutaneous receptors (Cheng and Haggard 2018).

Long-term body schema: represents body as a stable structure of bodily parts (de Vignemont 2014).

They possess characteristics supporting the field-status of interoceptive tactile space.

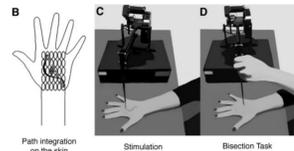
Topological connectedness: topologically connected array of skin receptors and topological relations between body parts.

Relation independentness: structure of space determined independently of relations between sensations.

Possible emptiness: ability to represent bodily locations in which no sensation is present.

(B) *Path integration studies*: localizing a middle point between starting and ending points of tactile stimulation (Fardo et al., 2018).

Success in such tasks require experiencing continuous bodily space, extending between the starting and the ending point, which is not occupied by any tactile sensations.



4. Lack of exteroceptive tactile field

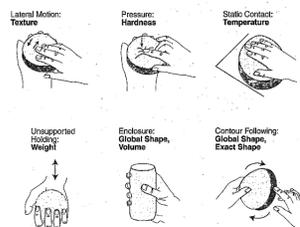
(A) Spatial field from cutaneous information?

Not sufficient to represent the topological structure of the external space.

(B) Spatial field from combination of cutaneous and kinesthetic information?

Tactile exploratory procedures allow representing topologically connected, empty paths in the external space (Klatzky and Lederman 2002).

Problem with *relation independentness*: representing topological structure of external space supervenes on represented relations between body parts and external objects.



(C) Peripersonal space as a tactile, exteroceptive field?

There are multimodal, visuo-tactile neurons coding space close to the body. Such neurons are sensitive to stimuli approaching the body.

Egocentric, relational space and not topologically connected spatial field (Holmes and Spence 2004).

5. Conclusions

Three characteristics of the perceptual spatial fields: (a) *topological connectedness*, (b) *relation independentness*, (c) *possible emptiness*.

There is strong evidence that these characteristics are satisfied by the interoceptive tactile space:

(A) Field-status supported by features of relevant bodily representations.

(B) Results of behavioral studies such as experiments on path integration.

No such evidence is present in the case of the exteroceptive tactile space. In particular, combining cutaneous and kinesthetic information do not guarantee relation independentness.

It is plausible that there is interoceptive tactile field, but the presence of exteroceptive tactile field is unlikely.

6. References

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Illustrations: Section 2: https://en.wikipedia.org/wiki/Connected_space, Section 3: Fardo et al. 2018, Section 4: Lederman and Klatzky 2002.

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