An investigation of the contribution of proximal vibratory cues in tactile material perception

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Ethical review	Approved WMO
Status	Recruiting
Health condition type	Other condition
Study type	Observational invasive

Summary

ID

NL-OMON52171

Source
ToetsingOnline

Brief title
Propagation waves in tactile material perception

Condition

- Other condition

Synonym
tactile perception

Health condition

somatosensory processes

Research involving
Human

Sponsors and support

Primary sponsor: Technische Universiteit Delft
Source(s) of monetary or material Support: Horizon2020

Intervention

Keyword: material perception, propagation waves, somatosensation

Outcome measures

Primary outcome

The main study endpoint is to quantify the relative contribution of remote vibrational information in the perception of roughness and hardness. The main study parameter is thus the systematic relationship between the elicited percept (discrimination thresholds of roughness and hardness) and the physical parameters manipulated (i.e., the hurst exponent (roughness) and shore value (hardness) of the stimuli).

Secondary outcome

A second study parameter is the mechanical skin deformation (acceleration variation in time) and the load used during the interactions measured via an accelerometer at the back of the hand and a load cell under the stimuli.

Study description

Background summary

While the great majority of haptic research has focused on information collected at the contact surface between object and skin, a recent line of research has shown that mechanical information propagates way beyond the contact surface (i.e., the fingertips) through, and even beyond, the human hand during touch interactions. It has furthermore been demonstrated that these remote vibrational signals (i.e., measured at the dorsal side of the hand) contain rich mechanical information about the properties of manipulated objects

or different gestures.

Importantly, and using a very similar approach as the one proposed here, Libouton et al. (2012) showed how the tactile discrimination of roughness of fine surfaces (i.e., fine sandpapers) remains intact when innervation of the finger is compromised. This holds true both for pathological conditions affecting the innervation of the finger and during ring-block anaesthesia of the index in healthy subjects; indicating the significance of remote vibrotaction in one crucial area of material perception, namely the perception of fine roughness. However, whether this can be generalized to more natural or complex surfaces than sandpapers and the extent to which these remote vibrations are picked up by the human somatosensory system and used in the perception of other material dimensions, remains unexplored.

Study objective

This study aims to investigate the contribution of remote propagation waves in the tactile perception of two important material properties, namely roughness and hardness.

While it is known that propagation waves arise and information is available proximal, very little is known about the behavioural relevance of it; that is, whether and when the somatosensory system uses this information in order to derive at a percept during behavioural tasks like stroking or tapping a surface. The main objective is thus to disentangle the role of local information (at the contact surface) from information propagating to proximal sites during surface property discrimination, rating and material identification tasks and to determine the relative contribution of remote mechanoreceptors in material perception.

Study design

A 2AFC discrimination procedure and a repeated measures design are used. We will directly compare the percepts elicited during exploration of material probes with an anaesthetised index finger and in a control condition without anaesthesia. Potential confounding factors (such as the temperature difference between skin and material and the skin moisture level) are monitored and the vibrational signal is measured using sensors (accelerometer placed on the dorsal side of the hand and a tribometer under the stimulus). All participants will receive both conditions (randomized balanced order). No placebo is administered.

Study burden and risks

Participants will receive Ropivacaïne injections in the index finger. The risks and burden of this procedure have been mitigated by keeping the experimental

time short (maximum 2 1/2 hrs) for each experiment and thus minimising the quantity of the local anaesthetic agent and avoiding other agents with a longer duration of effect like bupivacaine or marcaine. Vulnerable groups (such as children or pregnant women) and participants with any condition indicating an increased risk, burden, or disability to give informed consent will be excluded from this study (cf. Article 4 for more detail). Furthermore, participants will be introduced to the risks and discomfort of the procedure, they will be given sufficient time for consideration of their participation, can ask questions and withdraw their consent or end participation at any time. Beyond the ones associated with the Ropivacaïne injections in one of the two sessions, no risks nor burdens beyond standard (everyday) risks are expected for participation in this study. Beyond financial reimbursement there is no direct benefit for the participants.

Contacts

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Trial sites

Listed location countries

Netherlands

Eligibility criteria

Age
Adults (18-64 years)

Inclusion criteria

1) 18 years or older;
2) No reported psychiatric or neurological disorders;
3) Able to provide informed consent;
4) Voluntary participation with written informed consent.

Exclusion criteria

1) Is pregnant or currently breastfeeding;
2) Has a known Ropivacaïne allergy;
3) Is currently undergoing any other medical intervention or taking part in a study involving one;
4) Has a history of finger/hand/upper limb trauma or disease;
5) Has a disease affecting normal motor functioning.

Study design

Design

Study type:	Observational invasive
Intervention model:	Other
Allocation:	Non-randomized controlled trial
Masking:	Open (masking not used)
Control:	Active
Primary purpose:	Basic science

Recruitment

NL

Recruitment status:	Recruiting
Start date (anticipated):	21-02-2022
Enrollment:	15
Type:	Actual

Ethics review

Approved WMO Date:	20-12-2021
Application type:	First submission
Review commission:	METC Leiden-Den Haag-Delft (Leiden) metc-ldd@lumc.nl

Approved WMO Date:	31-03-2022
Application type:	Amendment
Review commission:	METC Leiden-Den Haag-Delft (Leiden) metc-ldd@lumc.nl

Study registrations

Followed up by the following (possibly more current) registration

No registrations found.

Other (possibly less up-to-date) registrations in this register

No registrations found.

In other registers

Register	ID
CCMO	NL75084.058.21