**Psychophysics experiments (Expe3)**

**ANR COMTACT (Imagerie)**

**Preliminary Study**

A preliminary study has been carried out to identify textures likely to generate different valence assessments.

**Participants**.

44 participants aged between 18 and 48 years (mean age = 22 years, *SD* = 4.83, 36 women), who were French-speaking students at the University of Dijon, took part in this research. Participation was voluntary and anonymous. No participant was excluded from the study.

**Procedure**.

Images of 58 materials and textures were retrieved from online shopping websites. An online survey was developed to present randomly each image using LimeSurvey version 2.65.0. For each image, the participant was asked to imagine touching the material or texture and to evaluate the pleasantness using a Likert scale ranging from 1-very unpleasant to 5-very pleasant.

**Results**.

From the results of the preliminary study, a ranking of the 58 images according to their “imagined tactile pleasantness” was constructed. Then a sub-set of 18 images was selected as follow (Table 1) : 6 images with positive valence (mean = 4.41, *SD* = 0.39) 6 images with neutral valence (mean = 3.03, *SD* = 0.4) and 6 images with negative valence (mean = 2.16, *SD* = 0.44) These 18 images have been used in Experiment 1: Online experiment. Then, based on these 18 images, a corresponding set of 18 samples of materials and textures was created that has been used in Experiment 2: Tactile experiment.

**Experiment 3a**

**Participants.**

245 Participants aged between 18 and 72 years (mean age = 22.98 years, *SD* = 9.53, 222 women) were enrolled in this study. They were all students at University of Dijon, and participation was voluntary and anonymous. All participants provided informed consent before starting and were unaware of the purpose of the experiment.

**Stimuli.**

The entire experiment was conducted using LimeSurvey version 2.65.0 software and managed individually. All experiments were performed in French. For clarity sake, translations are provided in this paper. The sub-set of 18 images with positive, neutral and negative valence identified in the preliminary study was used.

**Questionnaires.**

The following questionnaires were selected to assess individual characteristics of the participants.

**Behavioural characteristics**

**Need For Touch (NFT)**. The NFT questionnaire, originally published by Peck (1999) comprises 12 items, with six assessing autotelic NFT (aNFT) and six instrumental NFT (iNFT). Responses to all items were recorded on a 7-point Likert scale, ranging from 1 (“not at all true”) to 7 (“exactly true”). Mean scores were computed for Autotelic NFT (NFT\_autotelic) and Instrumental NFT (NFT\_instrumental).

**Social Touch Questionnaire (STQ)**. The STQ, originally developed by Wilhelm and al (2001), examines personal attitudes toward social situations involving touch in everyday life. This scale comprises 20 items that assess the impact of social touch on a 5-point Likert scale, ranging from “Not at all” to “Extremely”. A factor analysis of the STQ items resulted in three subscales, as reported by Vieira et al. (2016). The first subscale is named “Dislike of Physical Touch” (STQ\_F1) and describes feelings when being touched by individuals who are not well-known. The second subscale is named “Liking of Familiar Physical Touch” (STQ\_F2) and describes the pleasantness of affective touch from well-known individuals. The third subscale, “Liking of Public Physical Touch” (STQ\_F3), describes a more general attitude towards physical contact with others. Mean scores were computed for each of these factors.

**Psychological characteristics**

**Big Five Inventory**. The short version of the Big Five Inventory (BFI-10) was employed to assess personality, as developed by Rammstedt and John (2007). This questionnaire comprises 10 items, with responses recorded on a 5-point Likert scale, ranging from 1 (Very inapplicable) to 5 (Very applicable). Mean scores were computed for each of the Big Five personality traits, including openness, a tendency to be curious, imaginative, appreciate art and show a preference for novelty and variety (BFI\_openness), conscientiousness, a tendency to be selft-disciplined, compliant, organised and success-oriented (BFI\_conscientiousness), extraversion, a tendency to be dynamic and sociable (BFI\_extraversion), agreeableness, a tendency to be helpful, cooperative and sympathetic toward others (BFI\_agreeableness), and neuroticism, a tendency to experience unpleasant emotions easily, lack of emotional stability and impulse control (BFI\_neuroticism).

**Cognitive characteristics**

**The Plymouth Sensory Imagery Questionnaire**. The PSIQ (Andrade et al., 2014) represents a modernized adaptation of the widely used Vividness of Visual Imagery Questionnaire (VVIQ; Marks, 1973). One of its advantages over the VVIQ is that it assesses imagery across multiple sensory modalities. Participants completed the suite of the PSIQ, which includes five sets of five items each, with each set having a heading such as “Imagine the appearance of…” followed by five items. In our study, however, we concentrated exclusively on the “tactile” and “bodily sensations” subscale, which aligns with our area of interest. Participants rated their mental imagery on an 11-point Likert scale, ranging from 0 (“No image at all”) to 10 (“As vivid as real life”). The scores from the two items were summed to generate a total score (PSIQ\_Touch&Body). Indeed, the subscales “tactile” and “bodily sensations” was the two most strongly correlated, *r* = .71 (Andrade et al., 2014).

**Procedure.**

Participants completed the online questionnaires BFI-10, NFT, STQ and part of PSIQ (items related to the sense of touch and bodily sensation) in a counterbalanced random order before proceeding with the appraisal tasks.

Then the appraisal tasks were presented as follow. The 18 images were presented individually in a counterbalanced random order. Each image was tagged with a short name describing the material or texture (e.g. “Velvet”). The first question is related to the frequency with which participants encountered these textures in everyday life. The first question was: “*How often do you encounter this texture?*” A four-point Likert scale was provided, with the following options: 1- *“This texture isn’t at all familiar to me, I hardly ever come across it when gripping or touching everyday objects*”, 2-“ *This texture doesn’t seem very familiar to me, I have the impression that I rarely encounter it when gripping or touching everyday objects*”, 3-“ *This texture seems rather familiar to me, I have the impression that I encounter it from time to time when gripping or touching everyday objects*” to 4-“ *This texture seems very familiar to me, I have the impression that I encounter it very often when gripping or touching everyday objects*”.

The second question pertained to the ability to imagine touching a texture. The second question was: “*Before answering, imagine yourself caressing this texture, feel your fingers moving over the surface, the sensations it usually gives you. You can close your eyes if that helps… Now that you have recovered the sensations associated with this texture, indicate on the following scale how well you are able to mentally recover the sensations associated with the touch of this texture*.” A seven-point Likert scale was proposed, to 1-“*Quite hard to imagine*” to 7-“*Easy to imagine*”. The third question pertained to the pleasantness associated with the texture. The third question was: “*Imagine that you are caressing this texture. Try to feel the sensations it usually gives you. You can close your eyes and imagine… When you feel the usual sensations, and only then, rate this texture on a scale of 1 to 4*”. A four-point Likert scale was proposed, to 1-“*I don't like this texture at all, I don't want it on everyday objects*”, 2-“ *I don't really like this texture, I'd like to avoid finding it on everyday objects*”, 3-“ *I like this texture, I would like to find it from time to time on everyday objects*” to 4-“ *I really like this texture, I would like to find it on everyday objects*”.

**Experiment 3b**

**Participants**.

From the PSIQ score collected in Experiment 3a, a subset of 63 participants was selected for experiment 3b (mean age = 19.66 years, *SD* = 1.31, 58 women). Thirty-seven (mean age = 19.54, *SD* = 0.96, 33 women) are assigned to the low imager group (mean PSIQ - = 3.88, *SD* = 1.89) and twenty-seven (mean age = 19.81, *SD* = 1.68, 26 women) are assigned to the high imager- group (mean PSIQ + = 9.71, *SD* = 0.48). All participants to Experiment 2 filled in complementary online questionnaires: PSIQ (items not filled yet in Experiment 1), SUIS and VVIQ-2.

**Material**.

Based on the 18 images selected in Experiment 3a, physical replicates were created for Experiment 3b. Each sample was installed on a 5 x 4.5 cm wooden surface. Participants went through the three conditions sequentially: tactile-only, visual-only and visuo-tactile conditions. In each condition, participants assessed the tactile pleasantness of 18 textures on a four-point Likert scale, ranging from 1 – “Very unpleasant” to 4 – “Very pleasant”. Between each condition, participants completed a mental imagery questionnaire, the order of which was also counterbalanced: PSIQ (extra items), SUIS and the VVIQ-2.

**The Plymouth Sensory Imagery Questionnaire** (Andrade et al., 2014) measures imagery across multiple sensory modalities. In Experiment 1, only two domains were used: tactile (e.g., “a soft towel”) and bodily sensation (e.g., “having a sore throat”). Here, participants were asked to form a mental image of the five other domains: visual (e.g., “a cat climbing up a tree”), auditory (e.g., “an ambulance siren”), olfactory (e.g., “a rose”), gustatory (e.g., “toothpaste”) and feeling (e.g., “excited”).

**The Spontaneous Use of Imagery Scale.** The SUIS, originally developed by Reisberg and al., (2003), measures the spontaneous use of imagery in daily life. This scale contained 12 items, measures how often individuals engaged visual imagery in their everyday activities. The items were rated on a 5-point Likert scale, to 1-never to 5-always. Score between 12 to 60 is calculated. This test has a very high internal consistency and good convergent validity with the VVIQ.

**The Vividness Of Visual Imagery Questionnaire.** The VVIQ-2, originally developed by Marks (1995), measures the vividness of visual imagery. He consisted of four sets of four items, with each set asking respondents to imagine a particular scene, with their eyes open then with their eyes close. For each item, they must answer four questions about the vividness of details within their image. The items were rated on a 5-point Likert scale, to 1-“no image at all” to 5-“perfectly clear and vivid as normal vision”. Three mean score were calculated: eyes open, eyes close and global score.

**Procedure**.

First, each participant was instructed to wash their hands. Subsequently, they were escorted to a room where they met with the experimenter. The experimenter orally provided the following instructions : *« Today, I will request you to work with approximately eighteen rectangular surfaces, such as this one [showing a surface]. Using the index finger of the hand you use for writing, gently strike the surface from left to right and then from right to left. It is not necessary to apply excessive pressure to the surfaces. Your objective is to evaluate each of them using the Likert scale placed in front of you. There will be three sessions, and a questionnaire will be administered between each session. Please take as much time as you need, and feel free to touch the surfaces as many times as required. did you understand the instructions? Do you have any questions?”*

Each participant underwent the three conditions in the following sequence: tactile-only, visual-only, and visuo-tactile. All tactile evaluation were reported on a Likert scale ranging from 1 – “*Very Unpleasant*” to 4 – “*Very pleasant*”) on the same Likert scale. Between each condition, they were required to complete one of the three questionnaires. In the tactile-only condition, a theatre setting is used to hide the sample from the participants and the participants were asked to assess the tactile pleasantness of each sample through touch without visual information. In the visual-only condition, participants were given the following instructions : “*Imagine that you are caressing this texture. Try to feel the sensations it typically evokes. You can close your eyes and visualize… When you have experienced the usual sensations, and only then, rate the pleasantness of this texture on a scale of 1 to 4.”* In the visuo-tactile condition, participants were instructed to look at the texture, touch it, and then rate its pleasantness.