Evaluation of the emotional benefit of a fragrance using Eye-tracking and emotional pictures

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Introduction:

The aim of this study was to develop a new method to measure the emotional impact of fragrances, in order to provide scents with a sensory and emotional experience to consumers. We focused on the measurement of **cognitive visual attention** or **"eye-tracking" technology**, a technique that measure visual attention on centers of interest (in this case emotional images). We chose it because it is a non-invasive, quick and easy method allowing for access to the unconscious emotional responses of participants.

Few articles are available on the literature regarding the link between visual attention and emotional state [1][2][3]. For example, Joorman and al. show that people with depressive disorders spent less time looking at positive images than healthy subjects. Thus, visual attention seems to be closely correlated with emotions, and it makes sense to study this component for our analysis of the emotions generated by perfume samples.

Moreover, even if not many studies are available on this topic in perfumery, a few authors worked on the link between olfaction and visual attention and showed that people spend more time looking at a photo related to the scent, rather than other incongruous photos [4][5].

Thus, based on the literature, **we assumed that a participant who spent time looking at an emotional image, while smelling the fragrance, was in an emotional state similar to the one reflected by that same image.** To verify this hypothesis, we also measured emotions using implicit reaction time test (IRT). This method measures the strength of congruence between two objects (here an olfactory stimulus and an emotion), by measuring the response time to association questions.
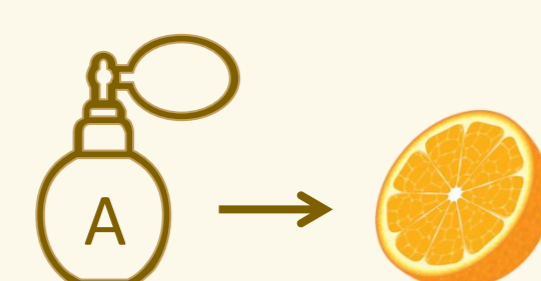
Materials & Methods:

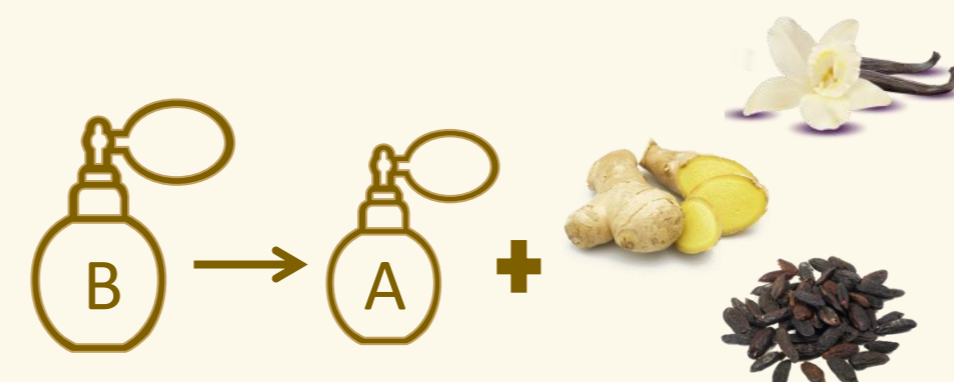**Participants:** 33 subjects (26 women and 7 men)

Products:
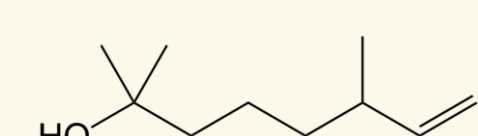
Training product: Dihydromyrcenol

Fragrance A: Masculine scent with oranges notes

Fragrance B: Same perfume base with additional spicy notes

Participants had to smell the training product first, to familiarize themselves with the method, while the two others stimuli were presented afterwards in a random order.

Methods:

Eye-tracking: participants were asked to look at a board of 18 emotional pictures* while smelling the fragrances, and their eye movements were followed using eye-tracking. The duration of fixation on each image was recorded.

Chosen picture: participants had to indicate the two emotional images most in line with each fragrance.

IRT: names of emotions are displayed one by one on a touchscreen tablet, and participants must respond with "yes" or "no", depending on whether the scent smelled just before the test made them feel this emotion. Measuring reaction time captures the strength of unconscious associations. The faster is a response, the stronger is the congruence between the emotion and the scent.
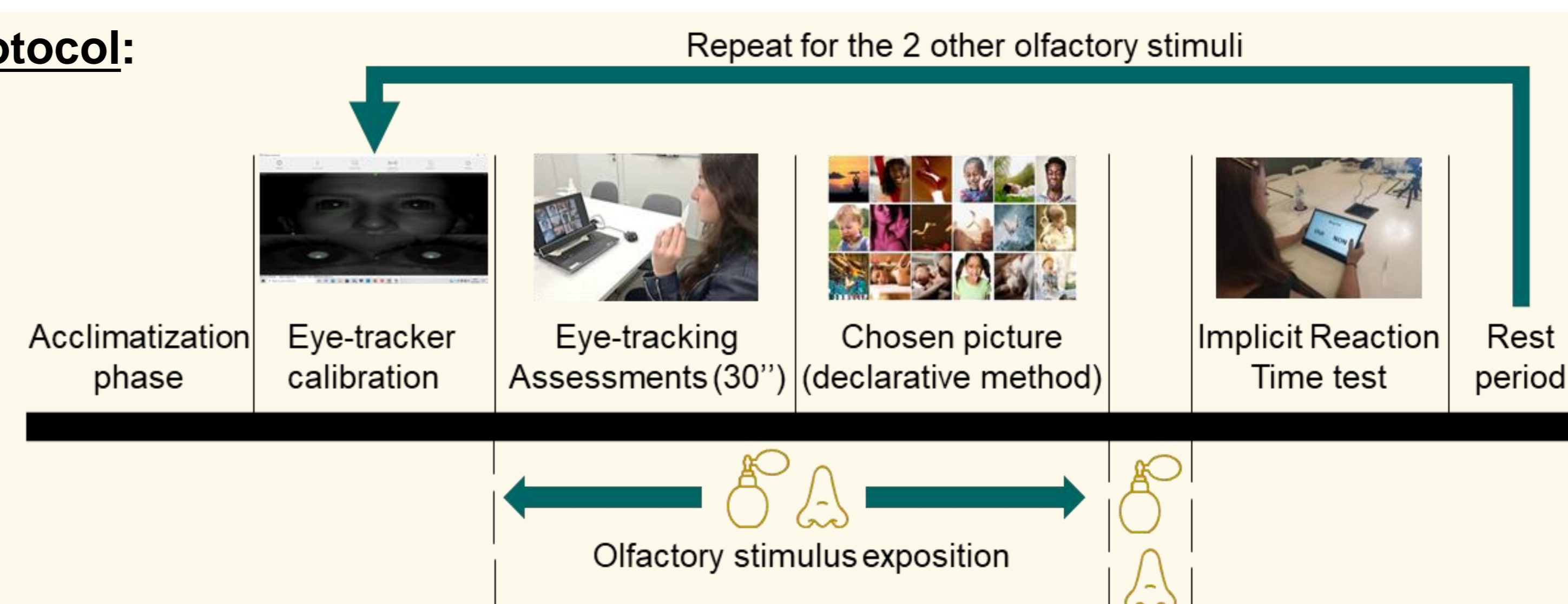
* Emotional pictures were validated using an online survey (with 480 respondents), in order to identify the three photos being most representative of each emotion, from a pre-selection that we made.

Studied emotions:

Sensuality   Well-being   Tenderness
Energizing   Joyful   Disgust

Emotions were selected for their interest in the perfume industry.

Protocol:

Repeat for the 2 other olfactory stimuli

Acclimatization phase → Eye-tracker calibration → Eye-tracking Assessments (30'') → Chosen picture (declarative method) → Implicit Reaction Time test → Rest period

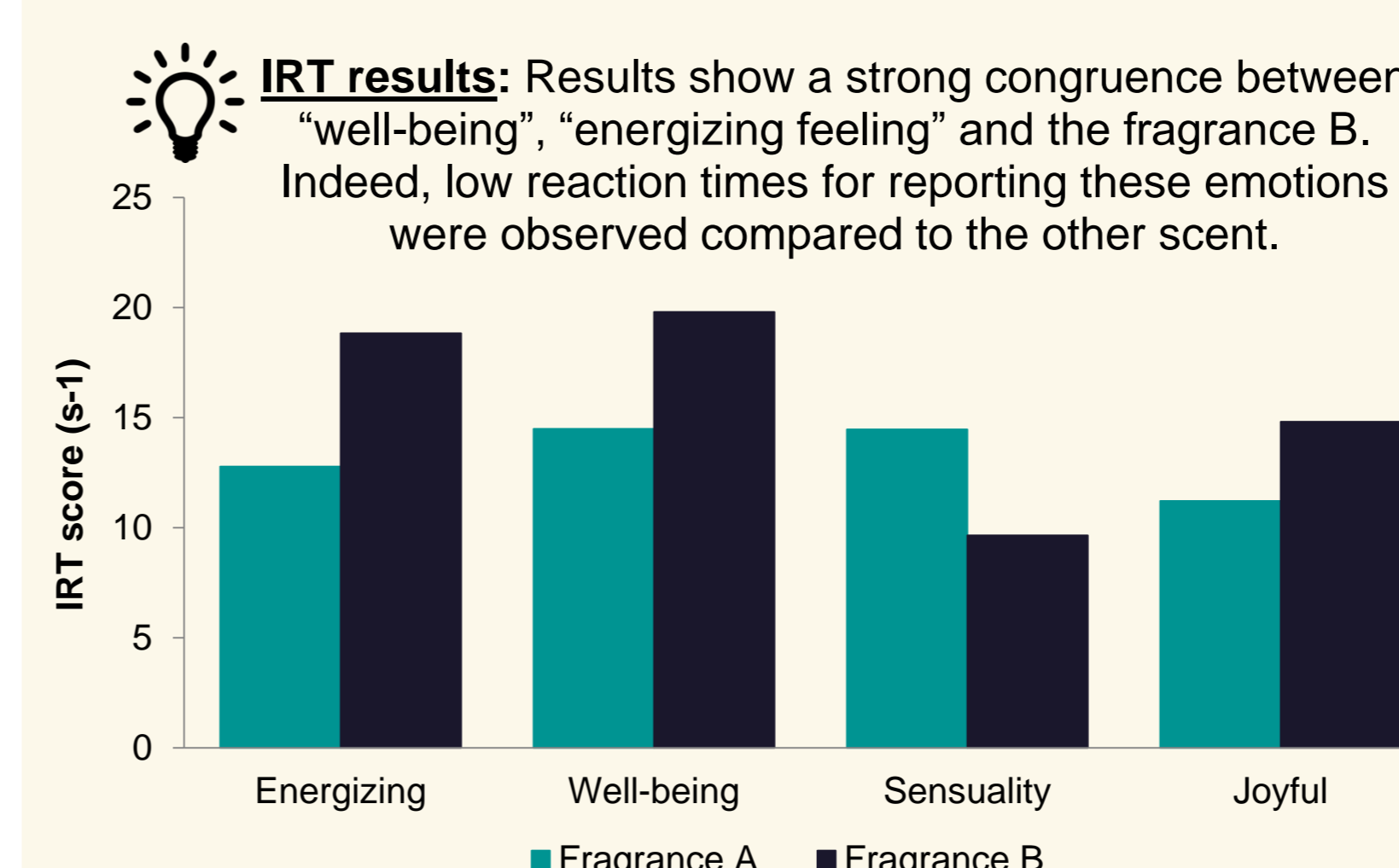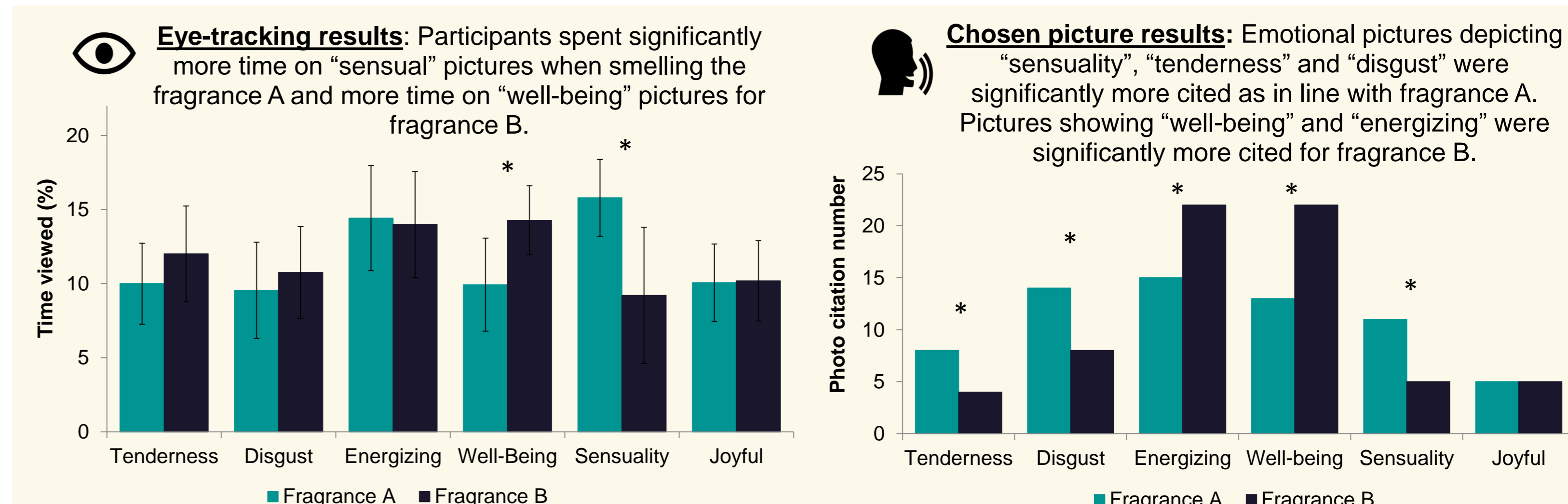Olfactory stimulus exposition

Data analysis:

👁 t-test (α =10%)

🗣 z-test for 2 proportions (α =10%)

💡 IRT score calculation* for each scent and emotion

$$\text{IRT score (x emotion)} = \sum_{n}^{subject\ k = 1} \frac{1}{Subject\ k\ reaction\ time\ (if\ answer\ "yes"\ to\ the\ x\ emotion)}$$

* This score is a representation of the congruence between the emotion and the scent, taking into account the response times but also the number of positive responses = **the higher the score the stronger the link between scent and emotion**.

Results & Discussion:

👁 **Eye-tracking results:** Participants spent significantly more time on "sensual" pictures when smelling the fragrance A and more time on "well-being" pictures for fragrance B.

🗣 **Chosen picture results:** Emotional pictures depicting "sensuality", "tenderness" and "disgust" were significantly more cited as in line with fragrance A. Pictures showing "well-being" and "energizing" were significantly more cited for fragrance B.

* Indicate significantly different results at 90% confidence level

💡 **IRT results:** Results show a strong congruence between "well-being", "energizing feeling" and the fragrance B. Indeed, low reaction times for reporting these emotions were observed compared to the other scent.

- Results from « eye-tracking », « IRT » & « chosen picture » methods are in line;

- In these conditions, « chosen picture » method was more performant.

Sum-up:

	👁 Eye-tracking (non declarative)	🗣 Chosen picture (declarative)	💡 IRT
Fragrance A	More Sensual	More Sensual, Tender, Disgust	
Fragrance B	More Well-being	More Well-being, Energizing	More Well-being, Energizing

Conclusions:

As a conclusion, this study shows that two perfumes with close olfactory notes can generate different emotions. The use of eye-tracking combined with emotional images is a spontaneous non-verbal method that can be used to measure complex feelings like "sensuality" or "well-being".

Although more studies are needed to confirm these results and to improve the performance of this method, eye-tracking remains promising for the measurement of emotions in perfumery.

References:

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[5] Durand, K., and al., 2013, Eye-catching odors: olfaction elicits sustained gazing to faces and eyes in 4-month-old infants, *PLOS ONE*.