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# Identifying the physical features of basic sensory descriptors: the ultrasonic microrheology as a starting point

Vincent Gauthier, Emmanuel Caplain, Stéphane Serfaty  
 Laboratoire SATIE – CY Cergy Paris Université, 5 Mail Gay Lussac, 95000 Neuville-sur-Oise  
 \*Corresponding author e-mail: [vincent.gauthier@cyu.fr](mailto:vincent.gauthier@cyu.fr)

## Highlights

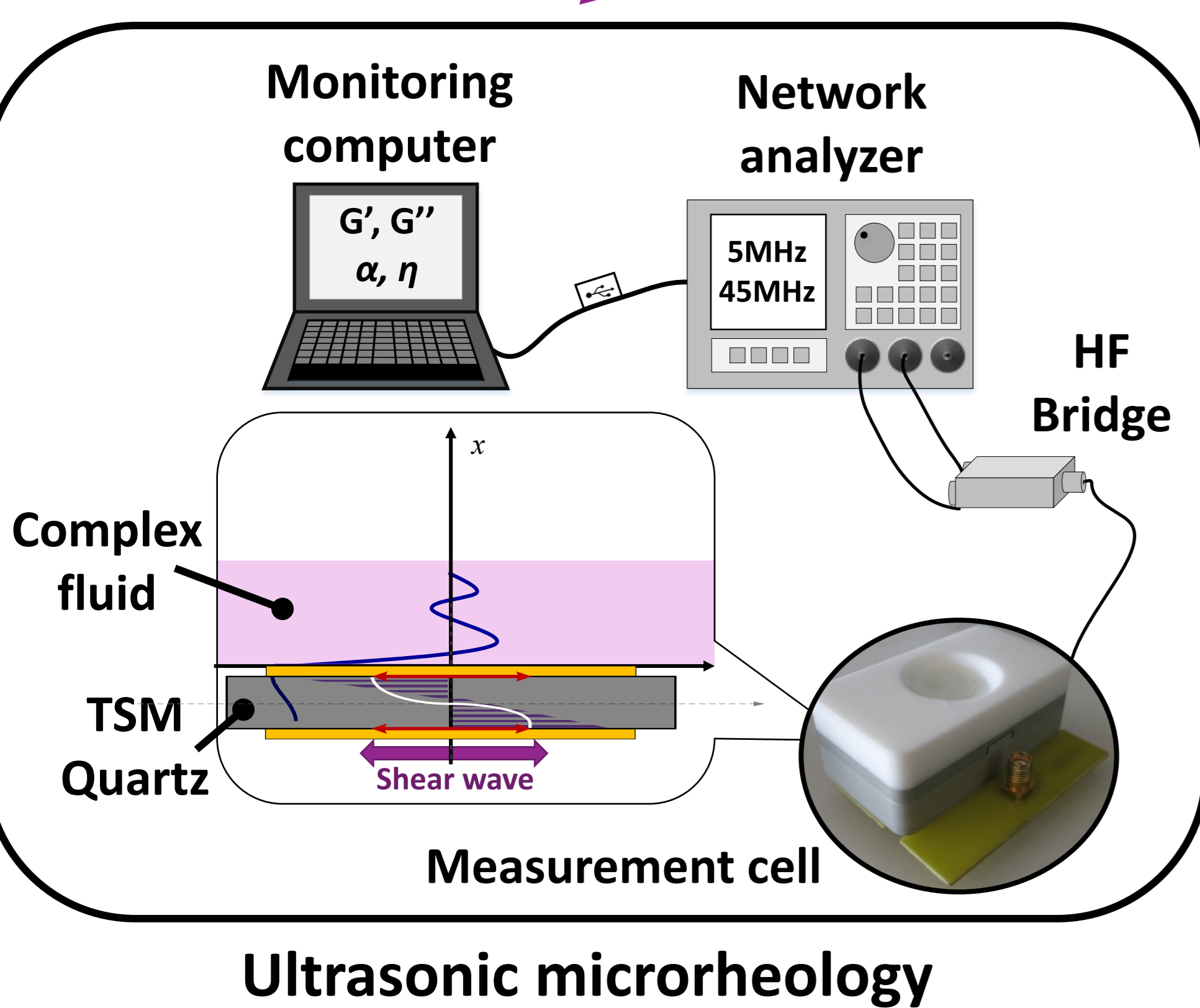
- Qualification of sensory descriptors from a physical point-of view
- Ultrasonic microrheology adapted to cosmetic products sensory evaluation
- Finding physical features of sensory descriptors without statistical tool – proof of concept

## Introduction

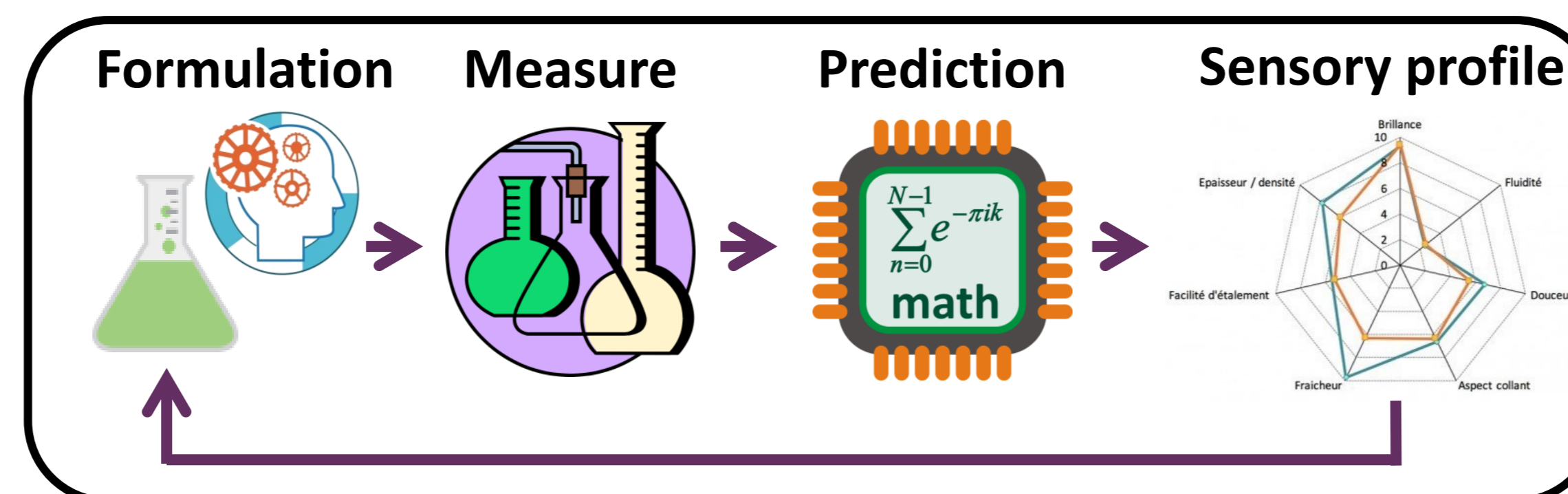
Considering instrumented sensory analysis problematics, there is a need to find accurate enough measurement devices and correlation models to optimize sensory properties of cosmetic products. Ultrasonic microrheology, based on resonant quartz sensors and optimized for complex fluid characterization, has been proved to be relevant for cosmetic product evaluation [1]. It is applied here to find correlation between microrheological quantities (shear modulus  $G'$ , viscosity  $\eta$ , and structural coefficient  $\alpha$ ) and basic sensory descriptors (spreading easiness and penetration).

## Methods

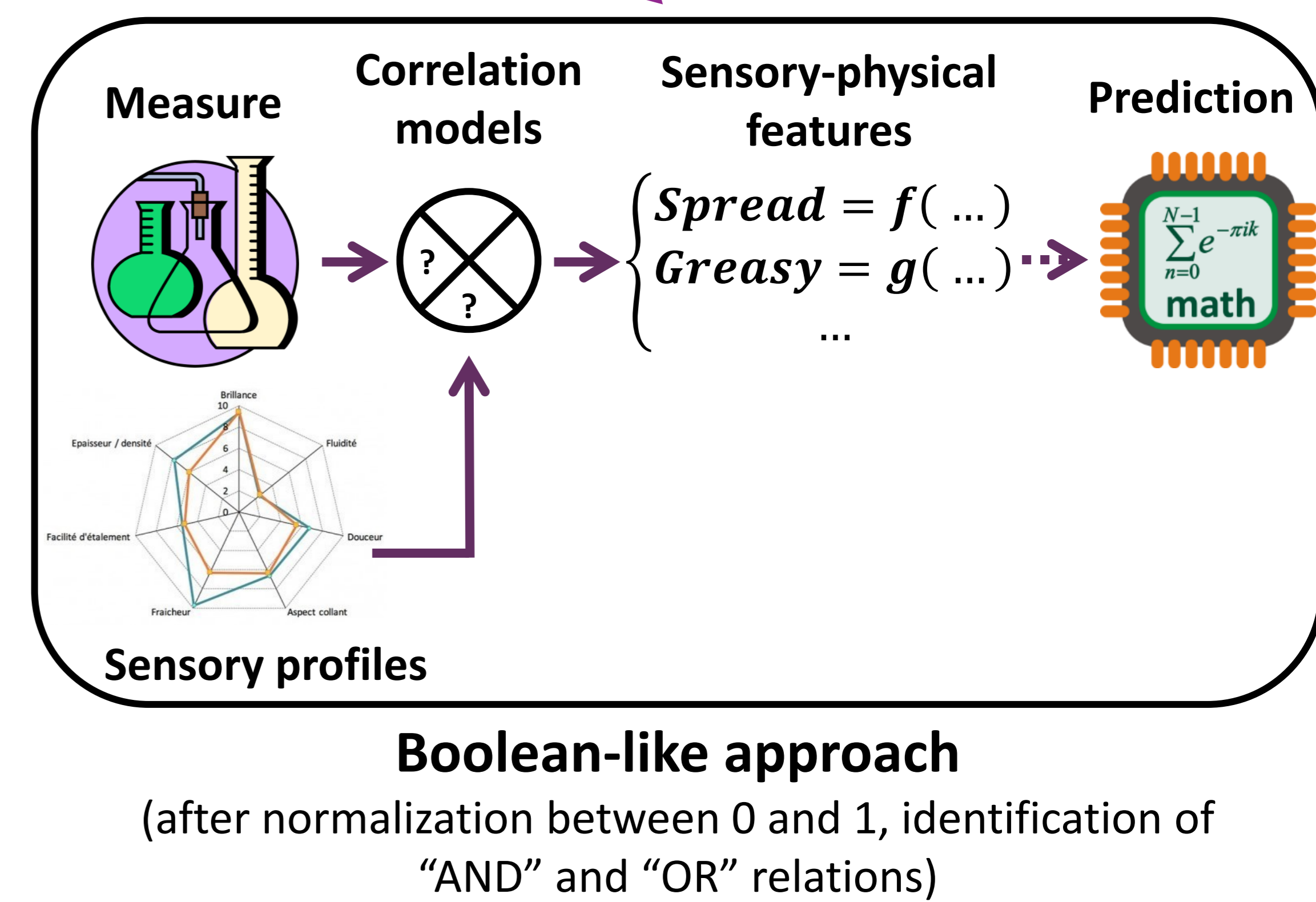
### What (relevant) measure?



### Aim



### How to model?



### What learning set of product?

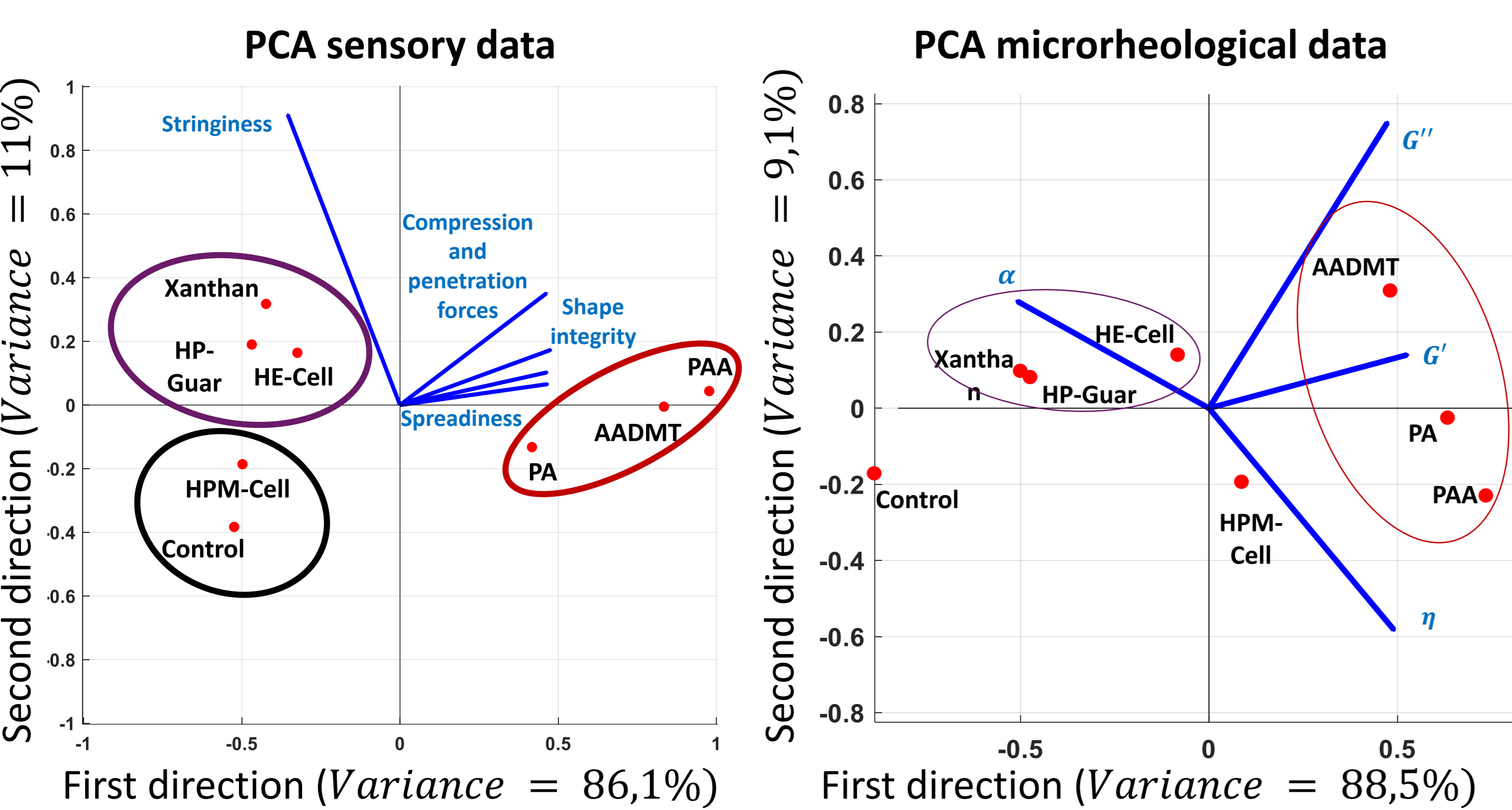
- Academic products from URCOM Lab [2] :
- Evaluate the relevance of microrheology
- Validate the physical features identified

EBITouch® Kit [3]:  
 Learning set for physical features identification

## Results

The principal component analyses of the academic products (Sensory profile Vs, microrheological data) are consistent

It is possible to identify logical relation between microrheological data and sensory sensation described by the EBITouch® Kit couples of *spread easiness* and *penetration*

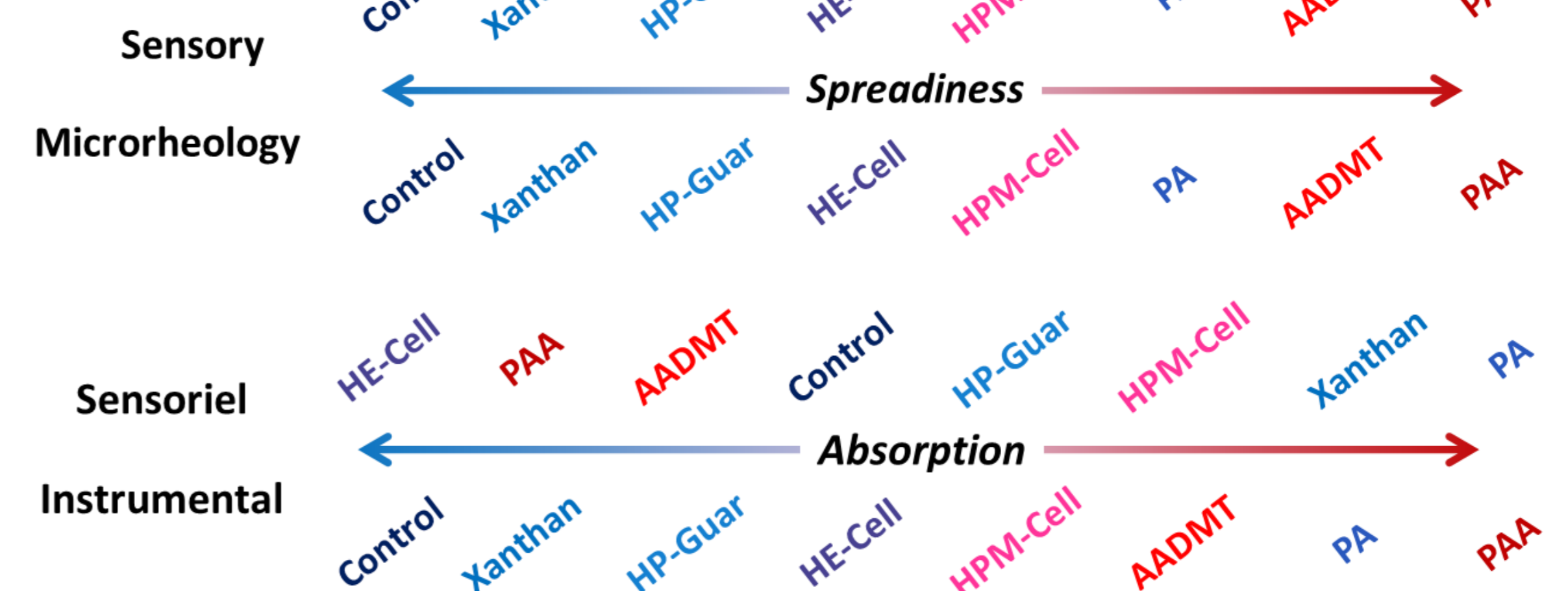


Product	$G'$	$G''$	$1 - \alpha$	$\eta$
Spready	0,00	0,01	0,09	$1 \cdot 10^{-5}$
Non-spready	0,93	1,00	0,44	$7 \cdot 10^{-3}$
Penetrating	0,00	0,00	0,00	0,00
Non-penetrating	1,00	0,34	1,00	1,00

**Spreading** →  $G' \text{ AND } G'' \rightarrow G' \cdot G''$

**Penetration** →  $G' \cdot \eta \cdot (1 - \alpha)$

Works well for *spread easiness*, not for *penetration*



## Conclusions

- Ultrasonic microrheology, with a mesoscopic characterization close to product interactions, is fine enough to distinguish texturing agents.
- The combination of physical parameters coming from microrheology can be a way to identify physical features of sensory descriptors for quantities related to the product structure in itself.
- This solution is not well suited for sensory descriptors related to skin-product interaction : it could be interesting to include those interactions with a biosensor study [4].
- As the Boolean-like approach is similar to artificial neuron behavior, a better correlation model should be reached with artificial neural network. Problems may arise from the learning set, however.

## Acknowledgment and bibliography

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[1] V. Gauthier & Al, "Soft Matter Characterization From Ultrasonic Microrheology and Fractional Calculus," *IEEE Sens. J.*, Jan. 2022, doi: 10.1109/JSEN.2021.3130037.

[2] L. Gilbert, "Caractérisation physico-chimique et sensorielle d'ingrédients cosmétiques : une approche méthodologique", URCOM, Université du Havre, 2012

[3] V. Gauthier & Al, Ultrasonic microrheology for ex vivo skin explants monitoring: A proof of concept, *Biosensors and Bioelectronics*, doi.org: 10.1016/j.bios.2021.113831.