Linking Consumer Sensory Perception with Rheology and Texture Measurements for Six Cosmetic Emulsions

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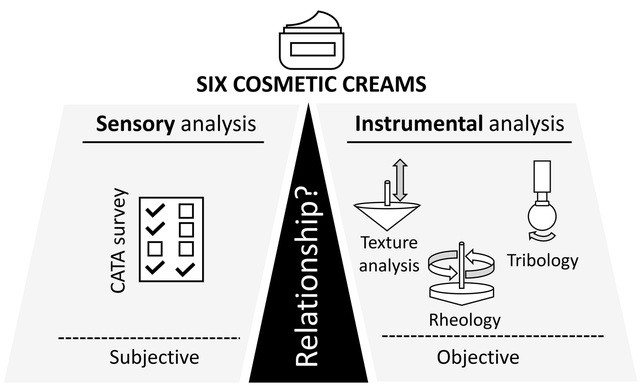
Introduction:

THE TASK
The sales potential of cosmetic products is greatly influenced by sensory performance and skin feel. To meet consumers' expectations, it is essential to evaluate consumers' perception of products.

SOLUTION 1
Rapid sensory profiling methods, such as Check-All-That-Apply (CATA) surveys have been developed to bridge traditional consumer-based and expert-based approaches.



SOLUTION 2
Texture analyzers, rheometers, and tribometers offer an objective, accessible, and affordable approach to characterize emulsions.

OUR RESEARCH GOAL
To correlate the results from different instruments and reveal links between the instrumental measurements and sensory evaluation of six cosmetic emulsions.

Materials & Methods:

MATERIALS

	Ingredient (INCI name)	Steric-stabilized O/W		Liquid crystal O/W		W/O	
		E1	E2	E3	E4	E5	E6
		% (w/w)					
Oil phase	Heptyl undecylenate	15	10	15	10	15	10
	Olive oil	-	5	-	5	-	5
Emulsifiers	Polyglyceryl-10 stearate	5	5	-	-	-	-
	Cetyl alcohol	3	3	-	-	-	-
	Sorbitan stearate (and) Sorbityl laurate	-	-	4	4	-	-
	Polyglyceryl-10 hexaoleate (and) polyglyceryl-6 polyricinoleate	-	-	-	-	1	1
	Lauryl PEG-9 polydimethylsilcoxyethyl dimethicone	-	-	-	-	1	1
Water phase	Water	71	71	75	75	77	77
	Propanediol	5	5	5	5	5	5
	Propylene glycol (and) Diazolidinyl urea (and) Methyl paraben (and) Propyl paraben	1	1	1	1	1	1

METHODS

Subjective measurement
- 50 untrained consumers, CATA survey
- Statistical analysis: Skillings-Mack test, hierarchical cluster analysis, and multiple factor analysis

Instrumental measurements[1]

Rheology
- Discovery hybrid rheometer DHR-3 (TA Instruments, New Castle, DE), 40 mm 2°cone and plate geometry
- Continuous flow testing and oscillatory measurements

Texture
- TA.XTPlus texture analyzer (Texture Technologies Corp., Hamilton, MA), TTC spreadability fixture
- Firmness, work of shear, stickiness, and adhesiveness
- Trigger type 'pre-travel', 5 mm travel

Tribology
- Discovery hybrid rheometer DHR-3 (TA Instruments, New Castle, DE), ring on plate geometry
- 3M TransPore tape

Statistical analysis: Univariate Poisson regressions

CHECK-ALL-THAT-APPLY (CATA) PRODUCT EVALUATION SURVEY

When I **look at** the product in the jar it looks:

☐ Glossy/shiny ☐ Thick/creamy ☐ Bright white
☐ Dull/flat ☐ Thin/milky ☐ Off-white

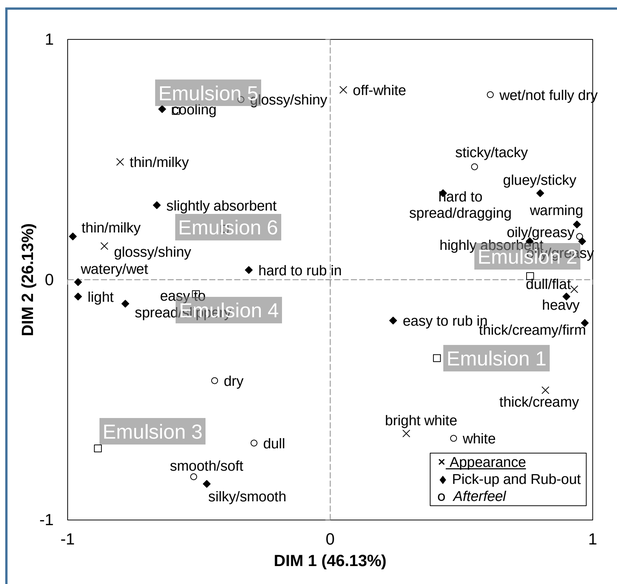
When I **apply** the product to my skin the product feels:

☐ Cooling ☐ Warming
☐ Easy to spread/slippery ☐ Hard to spread/dragging
☐ Thick/creamy/firm ☐ Thin/milky
☐ Hard to rub in ☐ Easy to rub in
☐ Highly absorbent ☐ Slightly absorbent
☐ Watery/wet ☐ Oily/greasy
☐ Silky/smooth ☐ Gluey/sticky
☐ Light ☐ Heavy

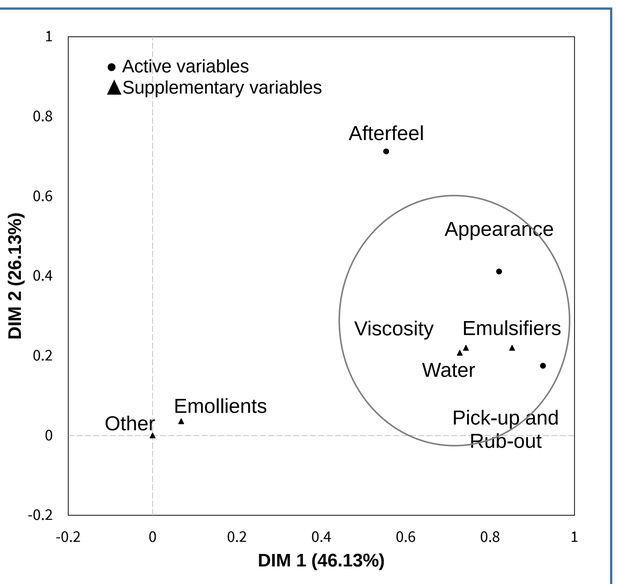
3 minutes after application my skin feels/looks:

☐ Glossy/shiny ☐ Dull
☐ Oily/greasy ☐ Smooth/soft
☐ Wet/not fully dry ☐ Dry
☐ Sticky/tacky ☐ White

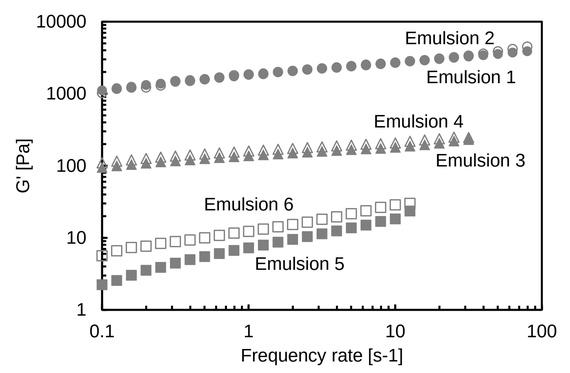
Results & Discussion:



Large discrimination of emulsions via terms[2]

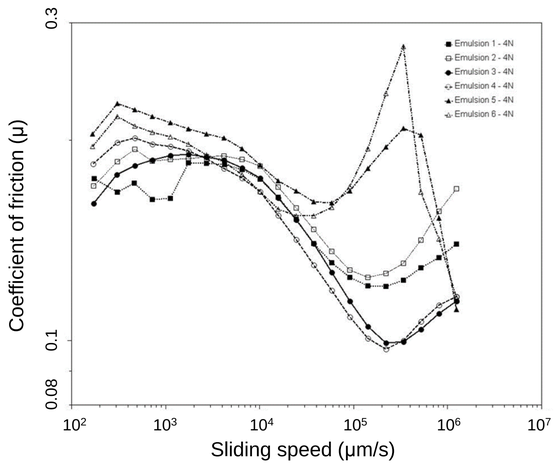


Emulsifiers are the primary drivers of skin feel[2,4]



TEXTURE ANALYZER RESULTS				
Sample	Firmness	Work of Shear	Stickiness	Adhesiveness
	g	g.sec	g	g.sec
E1	32 ± 3	38 ± 5	-12 ± 1	-23 ± 3
E2	41 ± 2	49 ± 4	-15 ± 0	-24 ± 3
E3	11 ± 0	10 ± 1	-5 ± 0	-6 ± 5
E4	13 ± 1	13 ± 1	-6 ± 1	-11 ± 1
E5	4 ± 0	3 ± 0	-5 ± 0	0
E6	5 ± 0	4 ± 0	-5 ± 0	0

Measuring firmness and work of shear can reliably predict consumer perception of emulsions[3]



DROPLET SIZE (μm)		
Sample	Before homogenizing	After homogenizing
E5	57 ± 13	25 ± 12
E6	60 ± 21	29 ± 11

Tribological evaluation detected differences among emulsions – droplet size could be factoring into this

The sensory study and instrumental analysis could categorize the six emulsions according to the emulsifier - and therefore emulsion type-, and also to the emollient.

Conclusions:

Untrained consumers were able to find the similarities and differences that were engineered into the products. These similarities and differences were clearly visible in the instrumental measurements, which categorized the emulsions into three groups – as it was designed. The emulsifier had the dominant role in driving the sensory properties of the emulsions.

We were able to find statistical relationships and provide quantitative information on the strength of the correlations between the sensory study results and texture-rheology results. In addition, the newly gained tribology results are comparable to the previous instrumental measurements and the sensory study results, which will allow us to identify previously unexplored links.

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