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Sensory kaleidoscope – Taking skin feel to the next level taking sensory from nature

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Sensory Kaleidoscope – Taking skin feel to the next level

Session 7: Sensory & Advanced Characterization & General

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Dr. Brian Yang & Anna Howe

Advances in Cosmetic Formulation Design Conference

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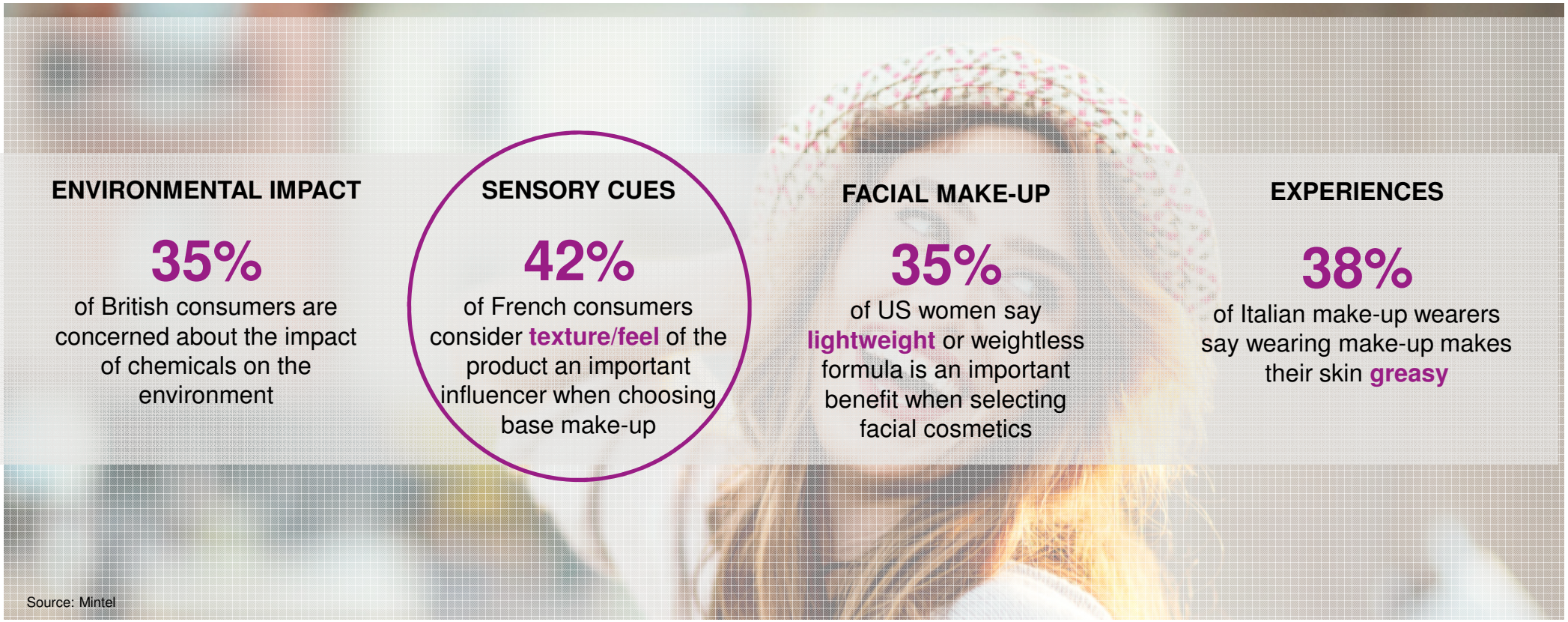
Agenda

- Marketing – Skin feel as a deciding factor
- Current approach in sensory characterization
- New Approach – Sensory Kaleidoscope
  - ✓ Theoretical background
  - ✓ Factor analysis
  - ✓ Visualization of complex data
- Why and where are particles used?
  - ✓ Sebum & oil absorption
  - ✓ *In vitro* mattifying effect
  - ✓ *In vivo* mattifying study on forearm
  - ✓ *In vivo* gloss reduction on face
- Differentiating particles with Sensory Kaleidoscope
  - ✓ Cellulose
  - ✓ Polymethyl Methacrylate
  - ✓ Nylon-12
  - ✓ Zea Mays (Corn) Starch
- Conclusion – Benefits at a Glance

Market needs

- Skin feel of is one of the main influencing factors for cosmetic purchases and loyalty to care products
- Sensory and Texture are important topics in the cosmetic market
- Producers of personal care products are interested in sensory benefits of ingredients

Consumers' interests



ENVIRONMENTAL IMPACT

35%

of British consumers are concerned about the impact of chemicals on the environment

SENSORY CUES

42%

of French consumers consider **texture/feel** of the product an important influencer when choosing base make-up

FACIAL MAKE-UP

35%

of US women say **lightweight** or weightless formula is an important benefit when selecting facial cosmetics

EXPERIENCES

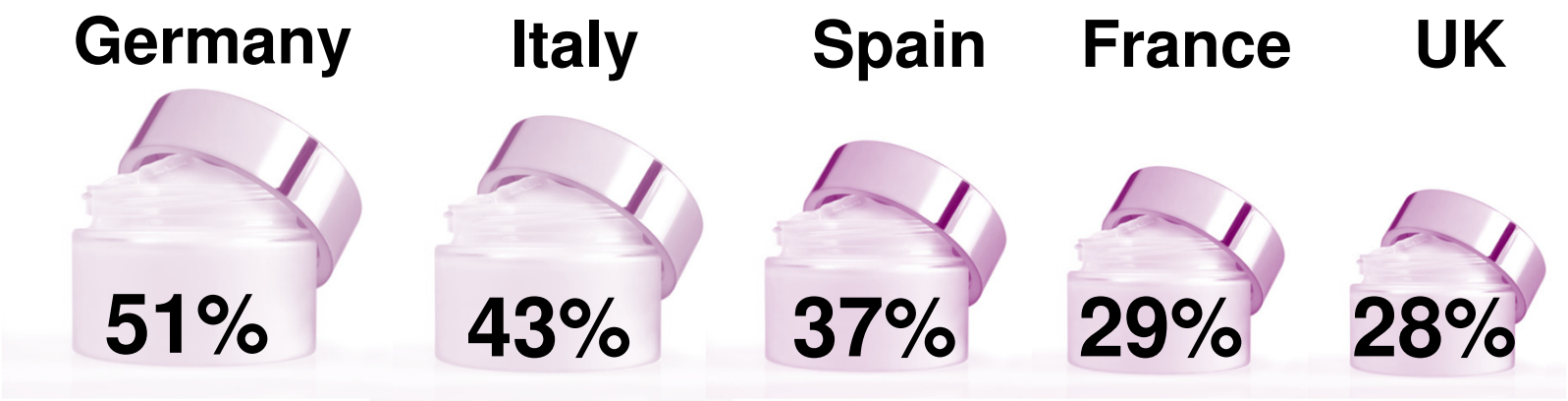
38%

of Italian make-up wearers say wearing make-up makes their skin **greasy**

Source: Mintel

Consumers interact with products in-store

"I interact with facial skincare products on shelf before making a decision (eg. Smell the product, try it on the hand etc.)"



Source: Maeva Lopez, Transforming Textures, Mintel 2016
Mintel Consumer Data Charts; Mintel Reports
Base: France 927; Germany 921; Italy 954; Spain 914; UK (skincare 890 – make-up 784)

Sensory characteristics are a key driver in cosmetic product development.

Their differentiation and visualization in a clear and understandable way is essential for communication.

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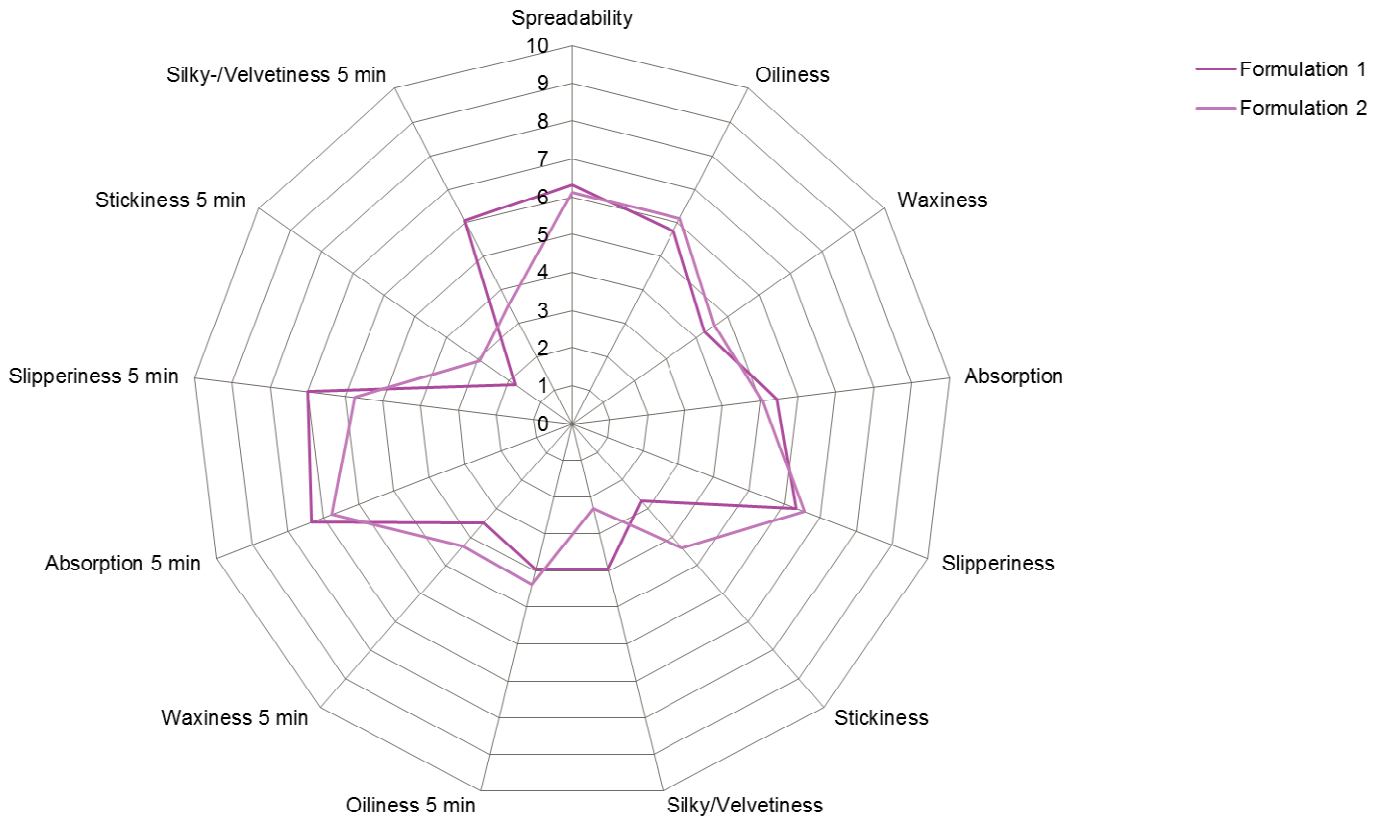
Visualization of sensory data in a radar chart



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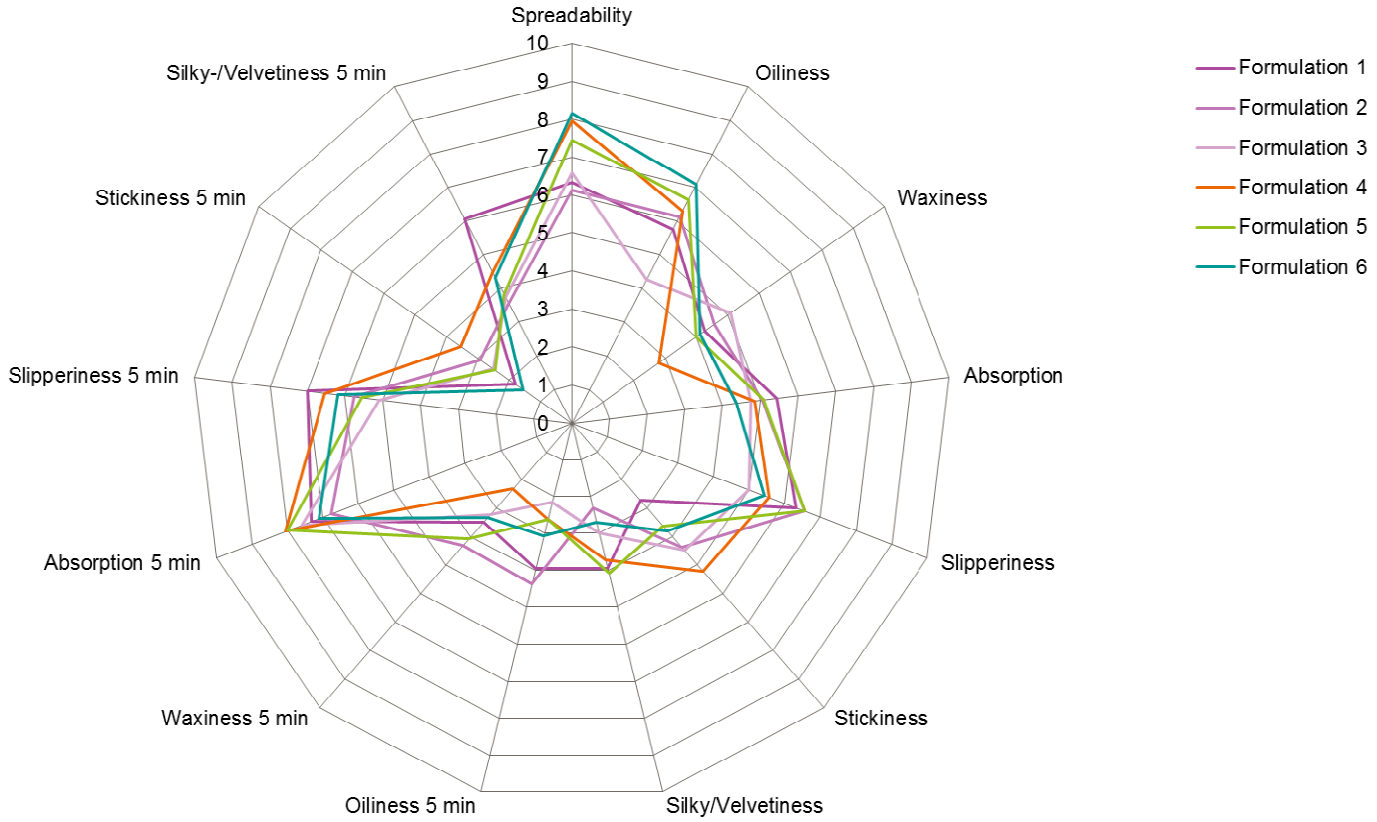
Visualization of sensory data in a radar chart



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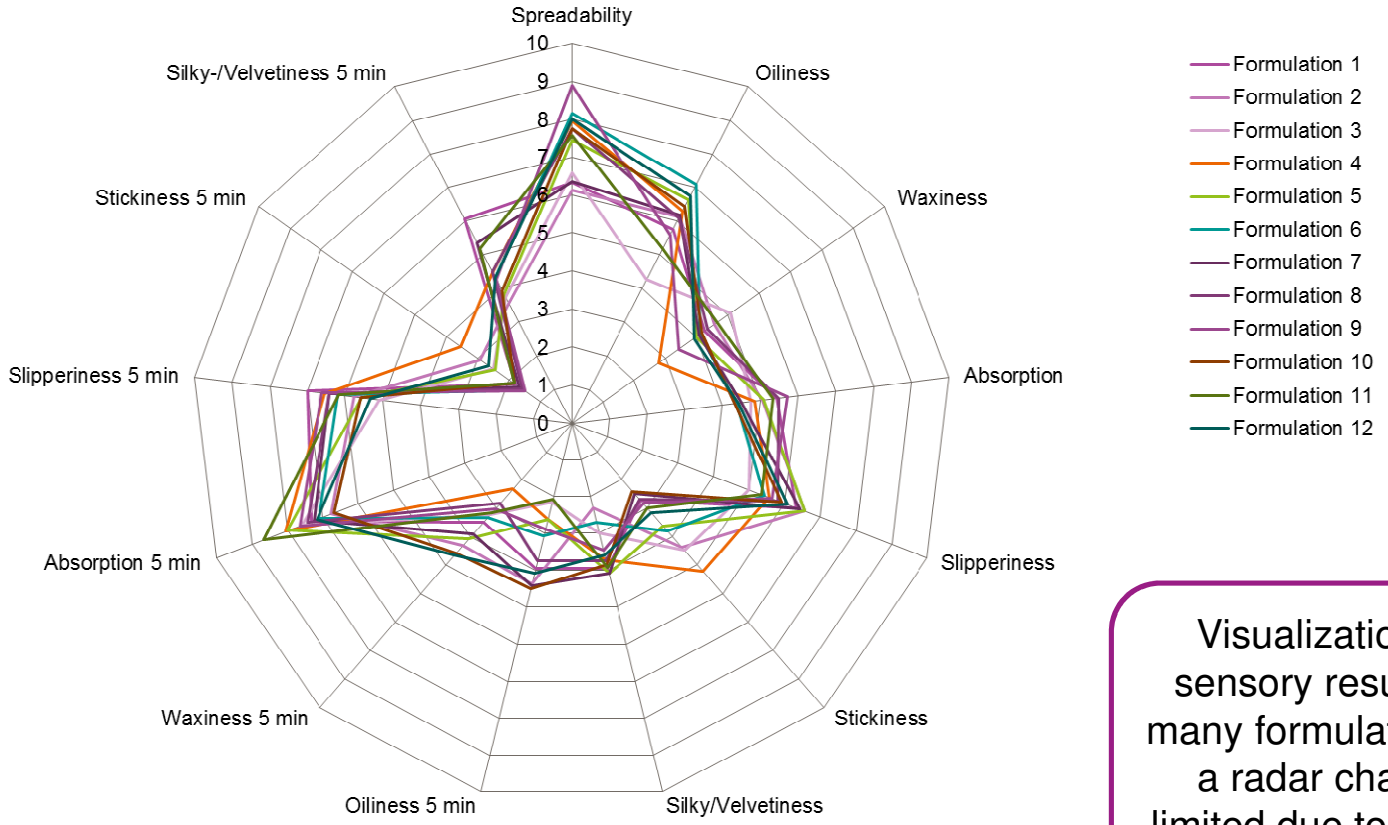
Visualization of sensory data in a radar chart



Visualization of sensory results of many formulations in a radar chart is limited due to clarity.

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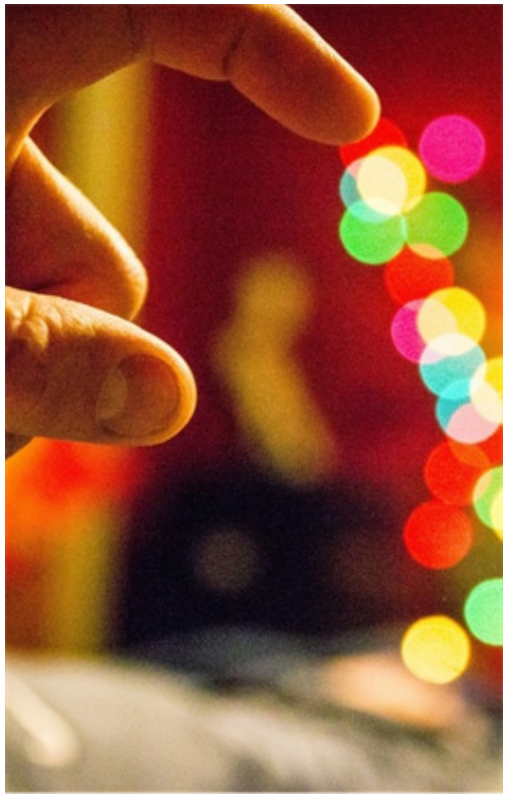
We were looking for a different approach

Focusing on the impact of ingredients on sensory profiles, we wanted to create a tool that...

- Is interactive, where sensory characteristics can be easily compared
- Is customer-friendly and intuitive, where you can choose to look at what you are interested in
- Is based on a sound scientific basis
- Enables the development of cosmetic products with a desired skin feel



Sensory Kaleidoscope – the interactive sensory tool

- Skin feel of is one of the main influencing factors for cosmetic purchases.
- The novel interactive tool Sensory Kaleidoscope offers the opportunity to develop a product with the desired skin feel, taking consumer experience to a whole new level of sensation.
- The tool allows to explore the skin feel from different perspectives.
- It can be used to understand the sensory contributions of
  - Emulsifiers
  - Emollients
  - Particles

Factor analysis
Theoretical background

Aim: Reduction of multiple variables to more complex background variables (= factors).

Discover or confirm dependencies between variables.

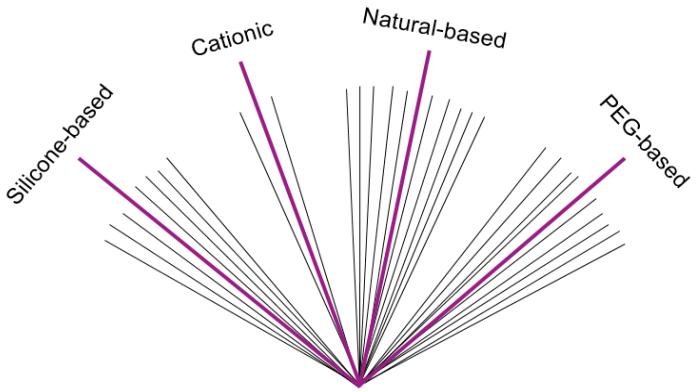
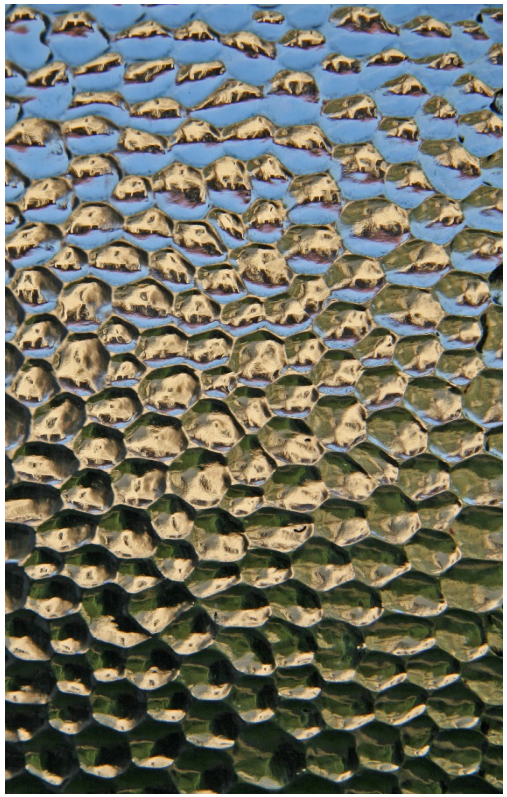


Figure: schematic representation of the dimensional reduction by the example of Evonik‘s emulsifier portfolio

→ Compaction of information



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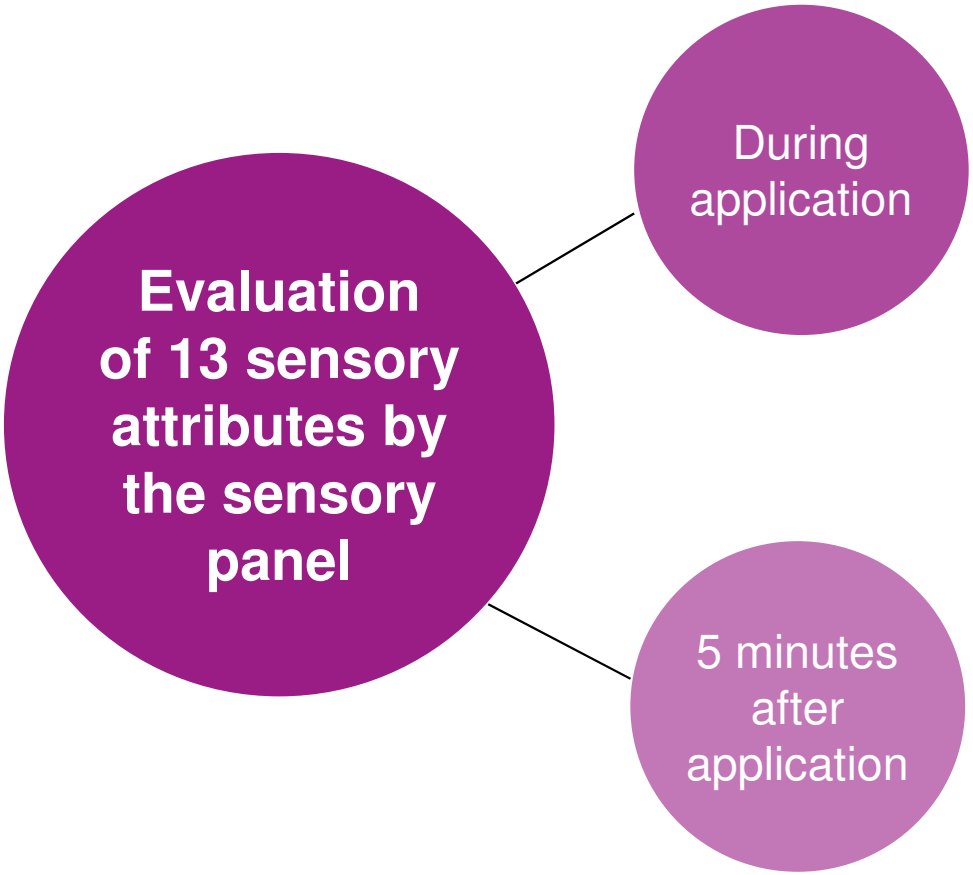
Sensory Panel
13 Attributes



- Ease of distribution
- Oiliness
- Waxiness
- Absorption
- Slipperiness
- Stickiness
- Silky-/Velvetiness

- Oiliness
- Waxiness
- Absorption
- Slipperiness
- Stickiness
- Silky-/Velvetiness

⇨ 13 „dimensions“

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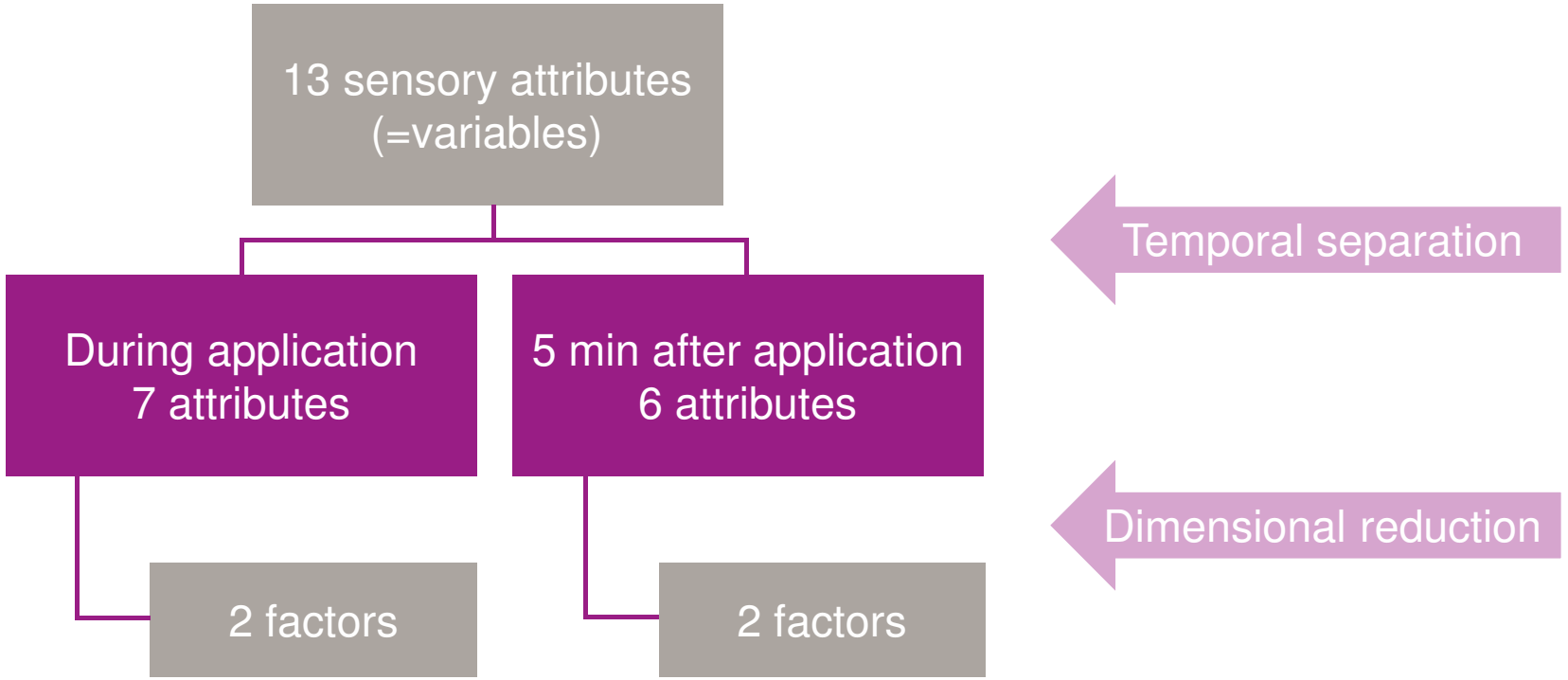
Factor analysis
Practical application



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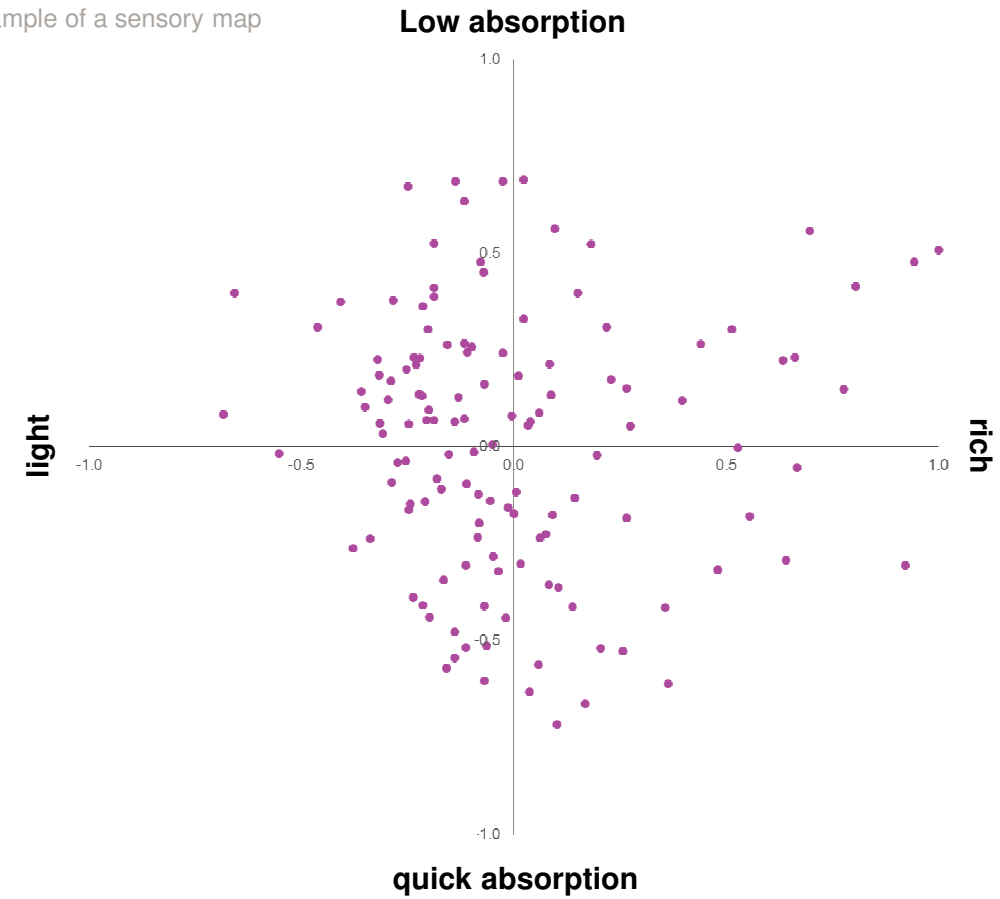
From factor analysis to Sensory Kaleidoscope

Example of a sensory map



Input of much information, no guidance yet.

Translation into groups/areas which can be understood easily.

+

Information how to reach sensory area.

Sensory Kaleidoscope

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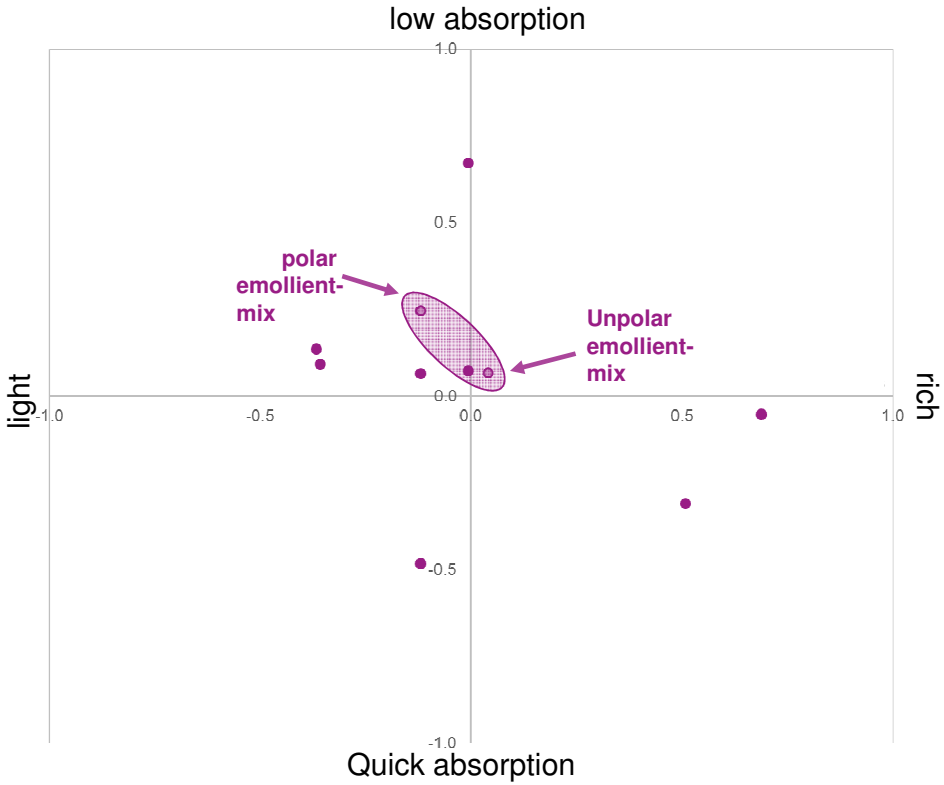
General concept of Sensory Kaleidoscope tool (I)

Sensory map during application



Generic Formulations

O/W Emulsion

Phase	Ingredients	w/w%
A	Emulsifier	1.00 -3.00
	Consistency enhancer	1.00 - 3.50
	Emollients	12.00 - 19.00
B	Glycerin	3.00 - 5.00
	Water	add 100
C	Carbomer	0.00 - 0.20
D	Sodium Hydroxide (10% in water)	q.s.
E	Preservative	0.70

W/O Emulsion

Phase	Ingredients	w/w%
A	Emulsifier	2.50
	Consistency enhancer/waxes	1.00
	Emollients	25.00
B	Salt	0.50 - 1.00
	Water	add 100
C	Preservative	0.70

- The recommended emulsifier concentration is used for each emulsifier and is therefore subject to variation.
- The concentration of the other components ranges due to differences in generic lotion and generic cream formulations.

- **Sensory area starts from generic and comparable formulation for every emulsifier.**

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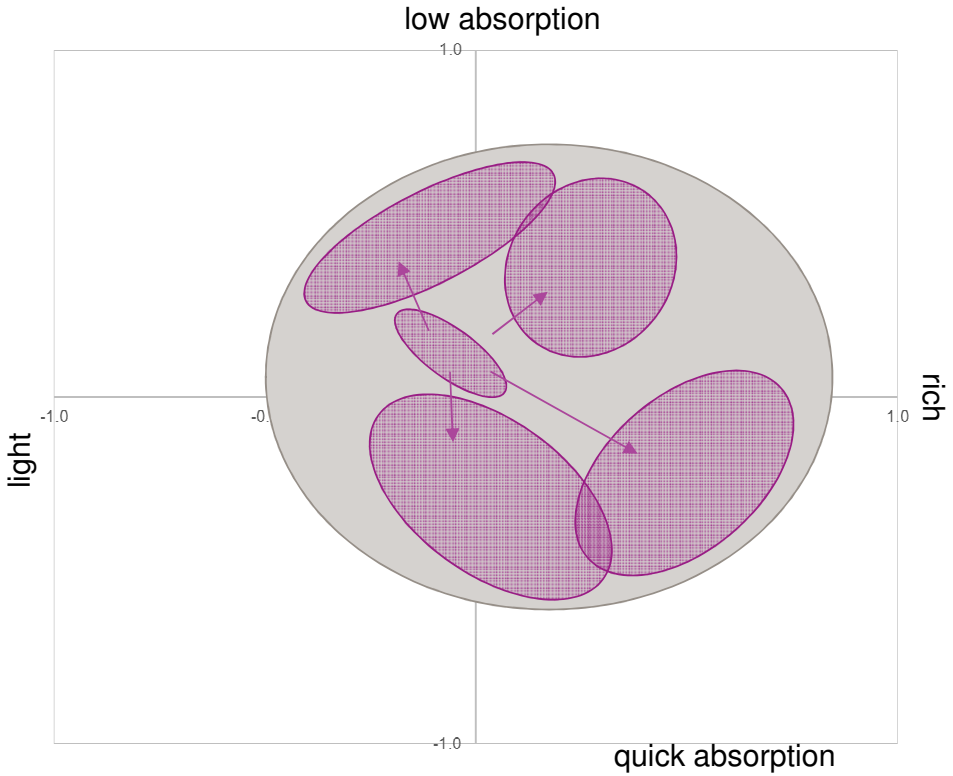
General concept of Sensory Kaleidoscope tool (II)

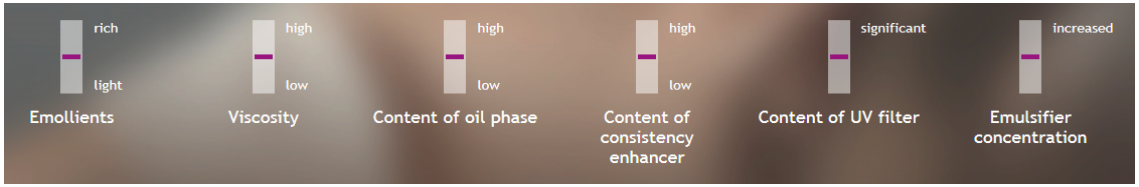
Sensory map during application



Expansion to cover broad sensory area

Information which aspect of the formulation is relevant for reaching the edge of the specific sensory area

- Emollients
- Viscosity
- Content of oil phase
- Content of consistency enhancer
- Content of UV filter
- Emulsifier concentration



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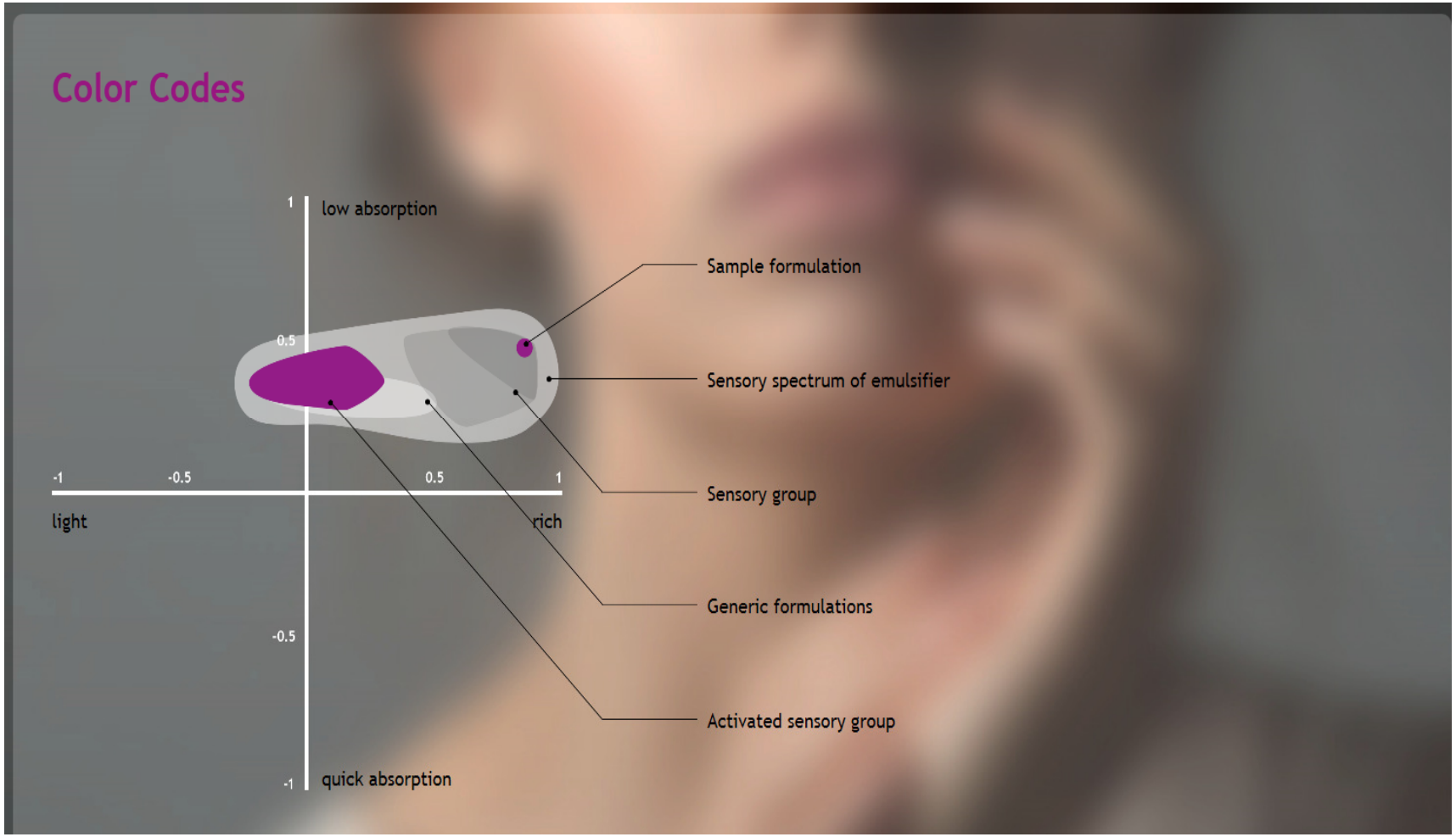
Color codes of Sensory Kaleidoscope



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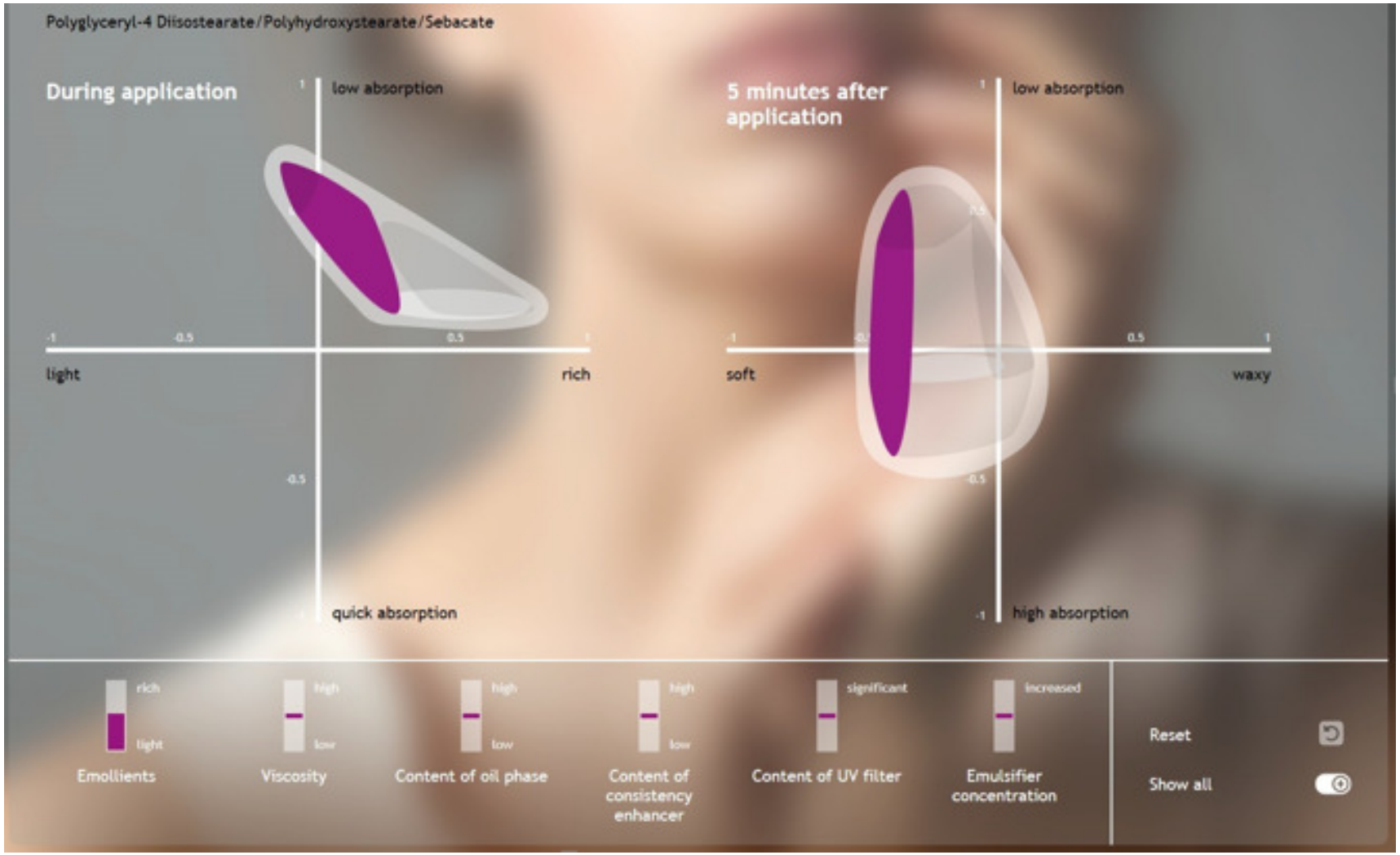
A Closer Look



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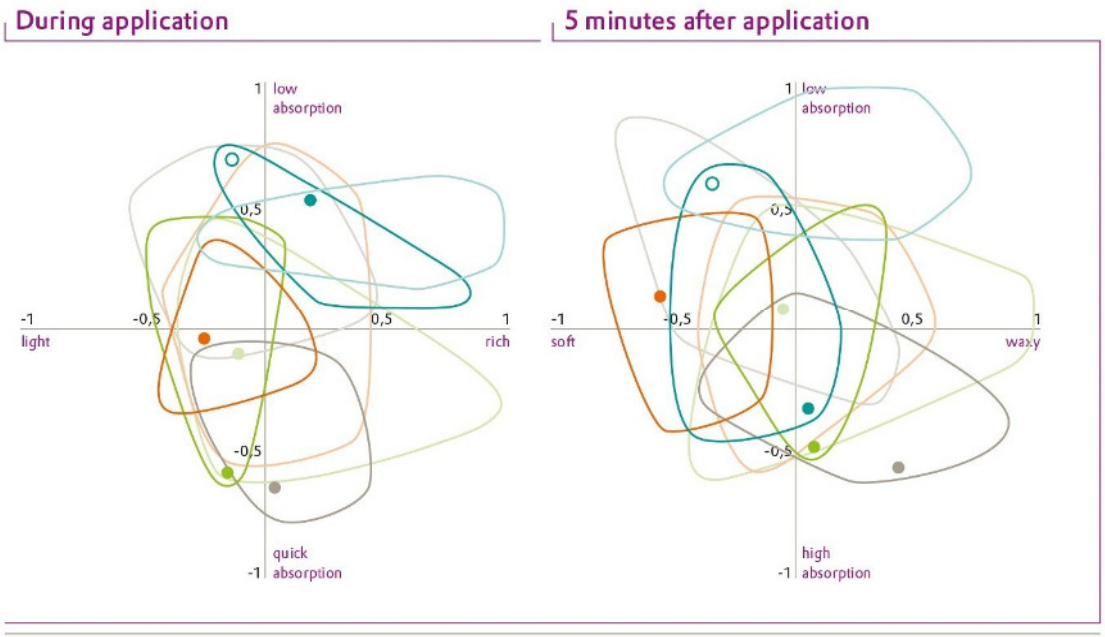
Visualization of complex data
Emulsifiers



Oil-in-water:

- **Bis-PEG/PPG-20/5 PEG/PPG-20/5 Dimethicone; Methoxy PEG/PPG-25/4 Dimethicone**
- **Polyglyceryl-6 Stearate; Polyglyceryl-6 Behenate**
- **Cetearyl Glucoside**
- **Polyglyceryl-3 Methylglucose Distearate**
- **Distearyldimonium Chloride**

Water-in-oil:

- **Cetyl PEG/PPG-10/1 Dimethicone**
- **Polyglyceryl-4 Diisostearate/Polyhydroxystearate/Sebacate**
- **Diisostearoyl Polyglyceryl-3 Dimer Dilinolate**

The use of statistical methods and the resulting concentration on two factors make it possible to display a broad set of data in a simple, two-dimensional coordinate system

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Where and why are particles used?

Face care	Color cosmetics	Sun care	Body care
			

...improves absorption & reduces oiliness on skin

...absorbs human sebum

...provides a mattifying effect

...provides sensory cues

How do we know?

Differentiating sensory particles

In vitro sebum & oil absorption	*In vitro* mattifying effect	*In vivo* mattifying study	*In vivo* gloss reduction	Sensory profiling

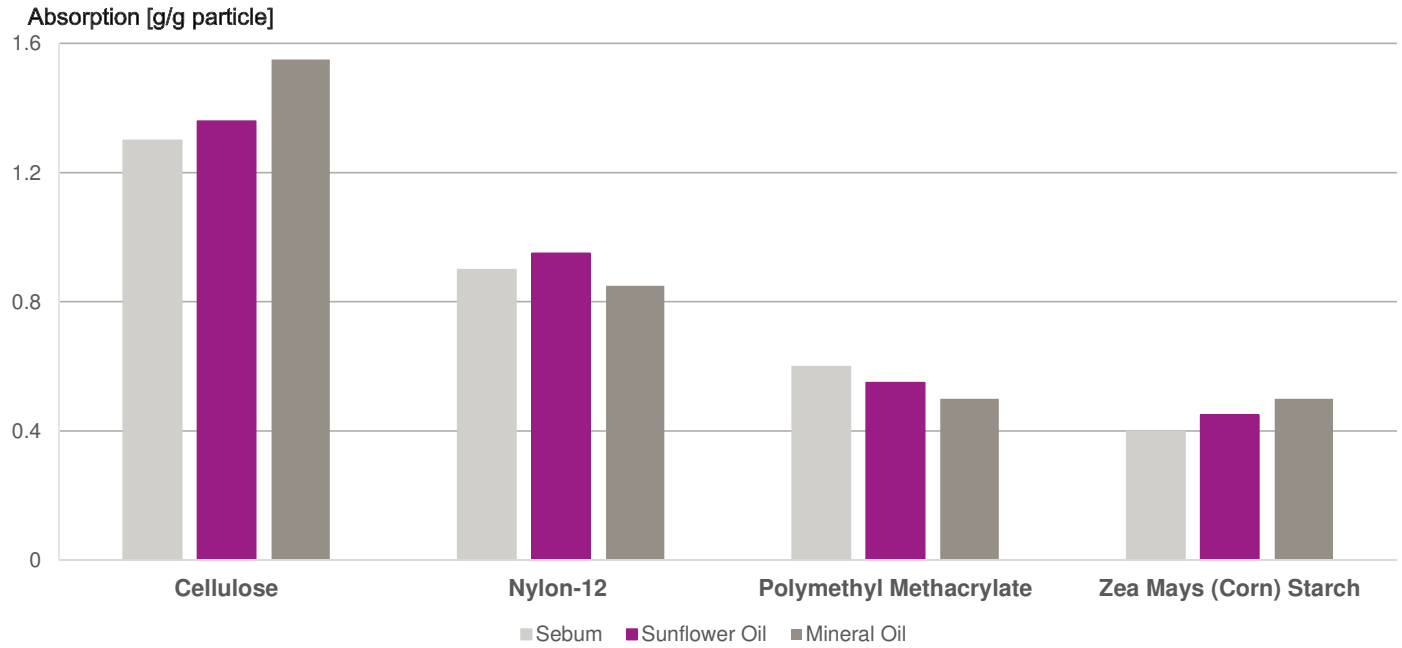
Particle Evaluation
2% use level

- Cellulose – Plant Fibers
- Polymethyl Methacrylate – Synthetic Polymer
- Nylon-12 – Synthetic Polymer
- Zea Mays (Corn) Starch – Polymeric Carbohydrate

✓ Powders – range of particle sizes
✓ absorb sebum & oil
✓ exhibit mattifying properties
✓ used in cosmetic emulsions

Sebum & Oil Absorption
In vitro study

Sebum resp. cosmetic oil is added to particles and maximum absorption is visually assessed.



- All particles absorb sebum & oil
- Due to its porous fiber structure, Cellulose is most efficient
- 100 g of Cellulose can absorb 130 g of human sebum.

» see test method

» back to study overview

* Commercial human model sebum according to Bey

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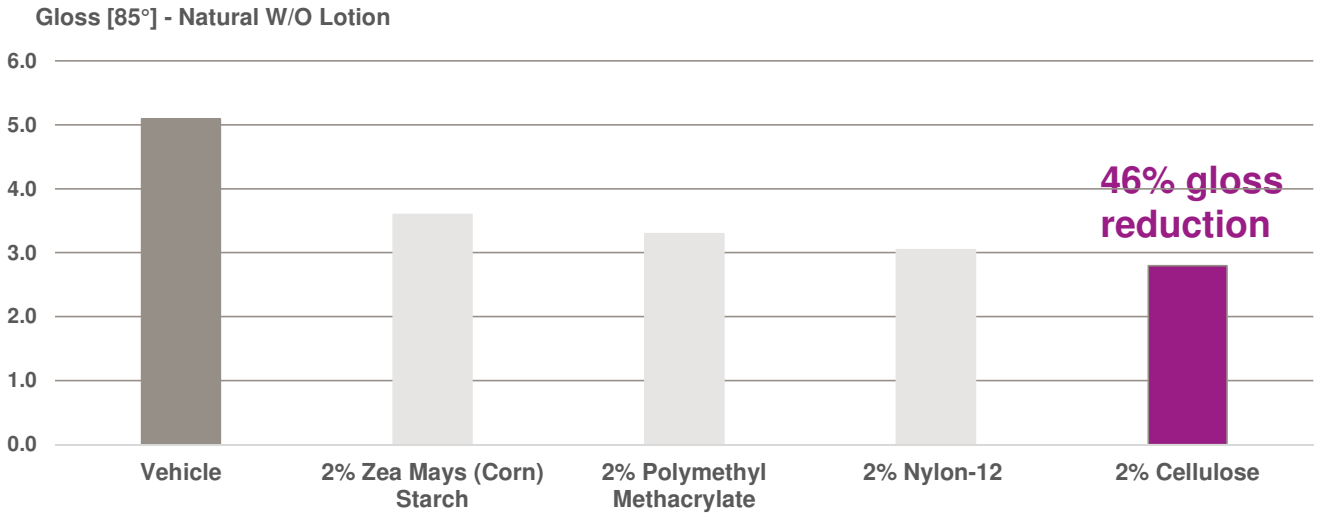
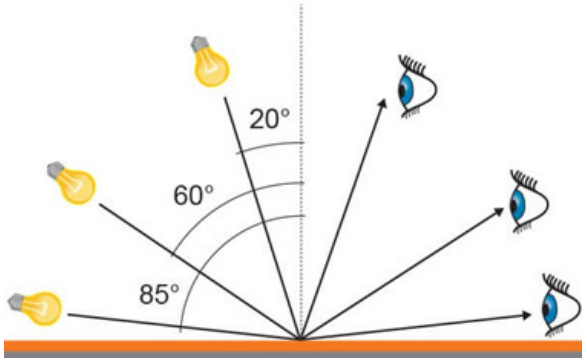
Mattifying effect
In vitro study

2 mg/cm^2 test formulation were applied on PMMA plates.
Changes in gloss value was determined with a Byk-Gardner Micro-TRI-Gloss after 5 min.





» see test formulations (AL 11/16 series)

All particles have a mattifying effect. Cellulose has the strongest gloss reduction of the W/O emulsion.

* Picture source:http://www.elcometer.com/de/glanzmessung.html

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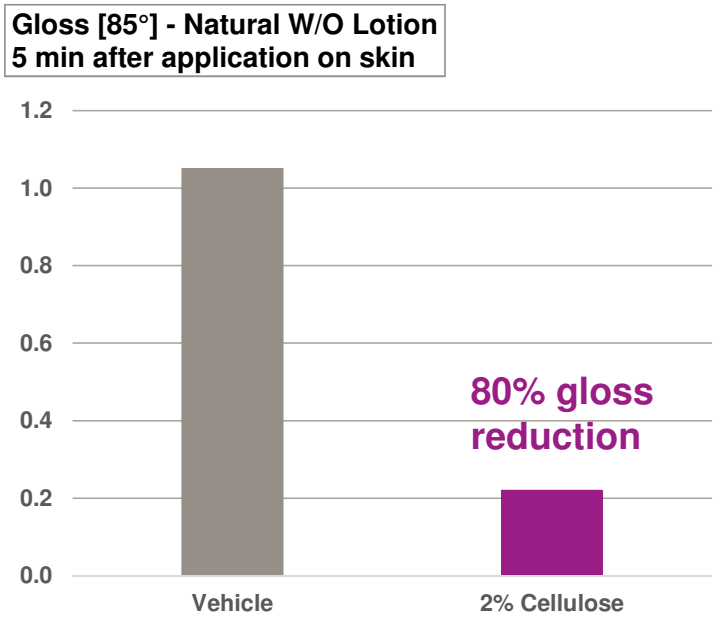
Mattifying effect
In vivo study

2.5 mg/cm^2 test formulation were applied on the volar forearm (one formulation each arm) of 10 panelists. Increase in gloss value was determined with a Zehntner ZGM 1130 glossmeter after 5 min.



» back to study overview

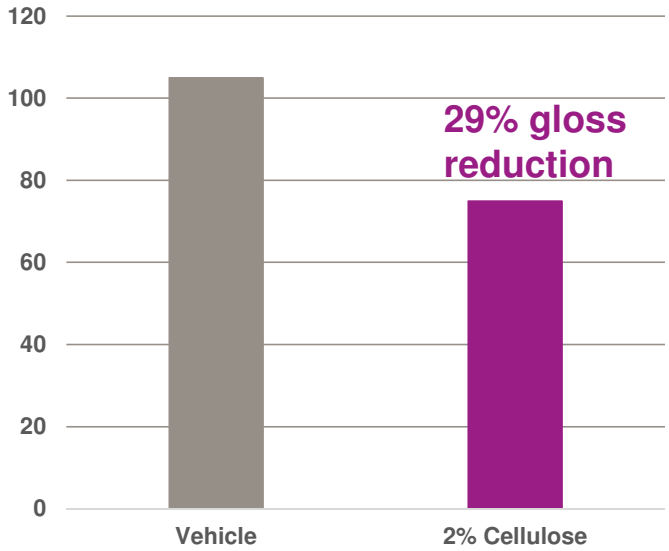
» see test formulations (AL 11/16 series)

Cellulose perceivably mattifies the gloss of a W/O emulsion on skin.

Gloss reduction
In vivo study

A half side test was conducted on the face of 10 panelists applying each 300 µL W/O lotion with and without Cellulose. Gloss was determined by VISIA-CR photography before application and after 5 min. Gloss was evaluated by image analysis.

Gloss value [a.u.] 5 min after application on face - Natural W/O Lotion



» back to study overview

» see test formulations (AL 11/16 series)

Panelist – after 5 min
Vehicle

Panelist – after 5 min
2% Cellulose

Cellulose reduces the gloss of a W/O emulsion.

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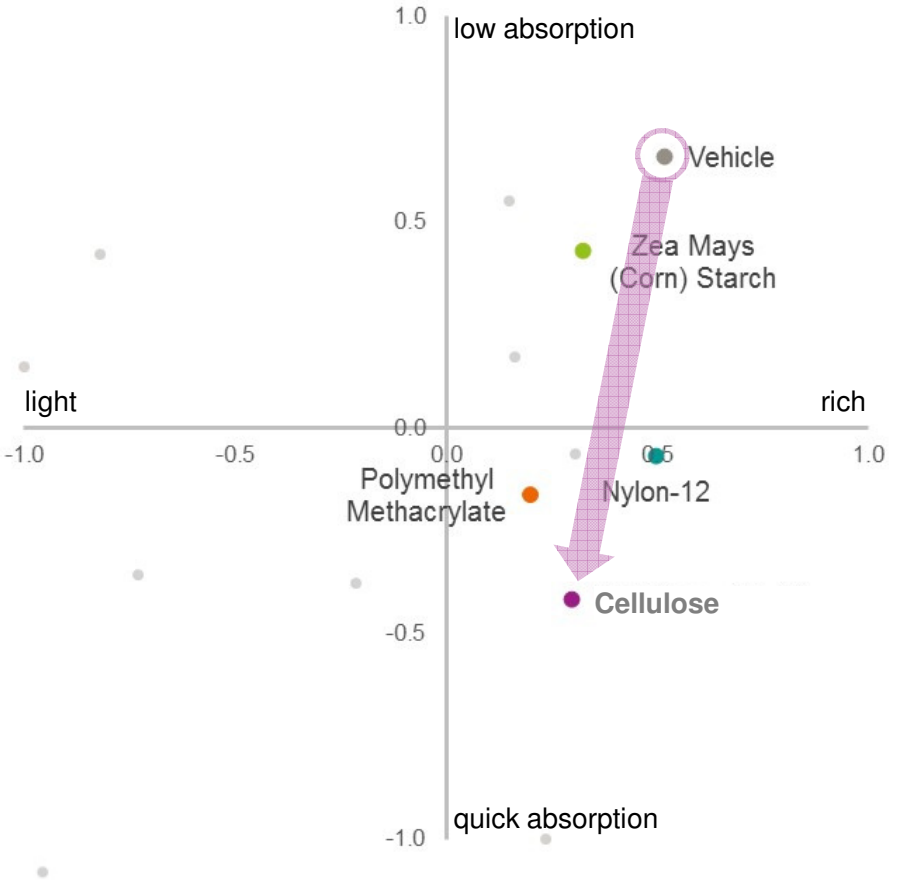
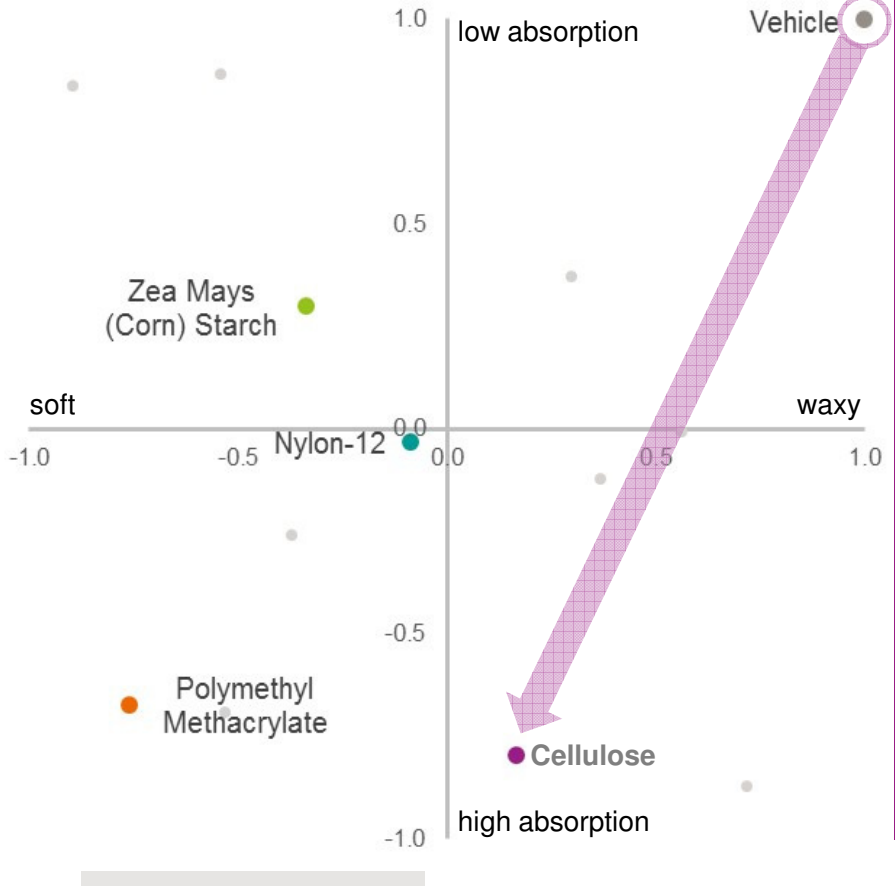
Sensory Profiling - Sensory Kaleidoscope

Particles in a Polyglyceryl-4 Diisostearate/Polyhydroxystearate/Sebacate Chassis

During application



5 minutes after application



Cellulose efficiently improves the absorption of a Natural W/O Lotion.

The relative effect is very large for a W/O chassis.

» back to study overview

» see test formulations (AL 11/16 series)

* » see spider diagrams

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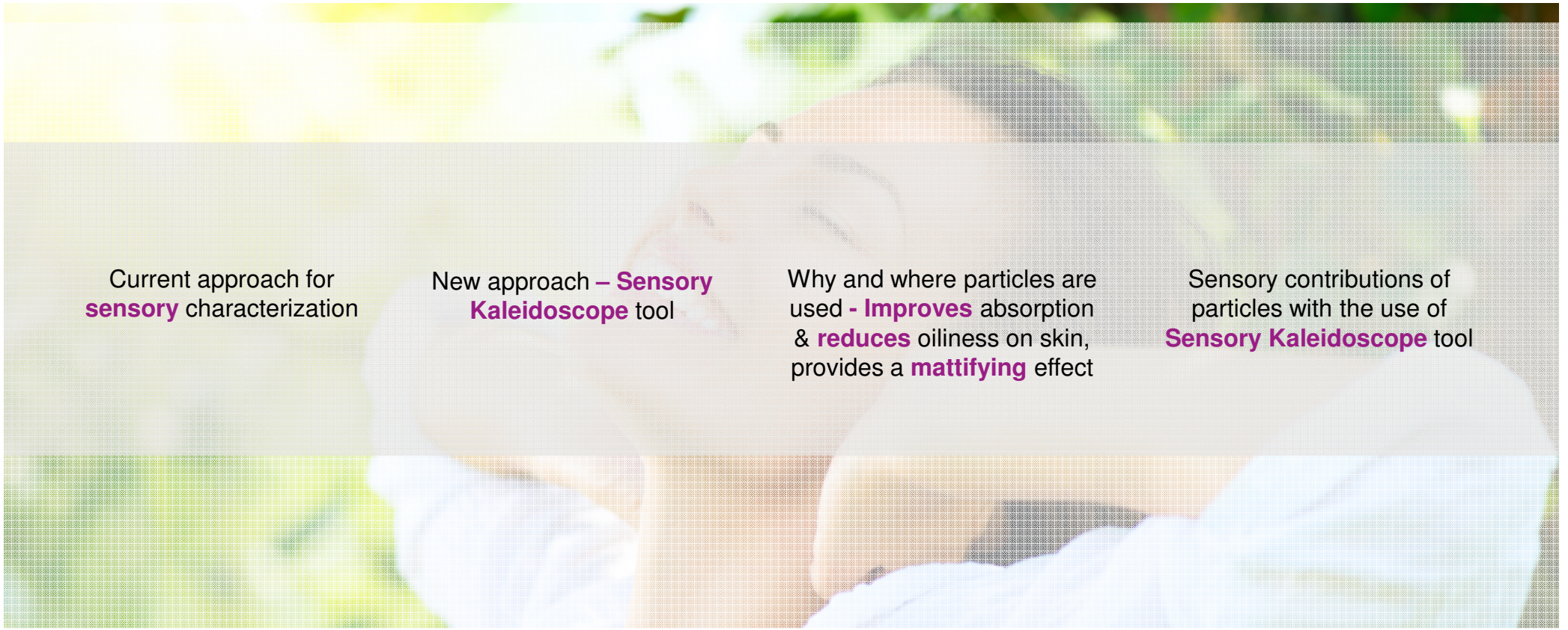
Conclusions



Current approach for **sensory** characterization

New approach **– Sensory Kaleidoscope** tool

Why and where particles are used **- Improves** absorption & **reduces** oiliness on skin, provides a **mattifying** effect

Sensory contributions of particles with the use of **Sensory Kaleidoscope** tool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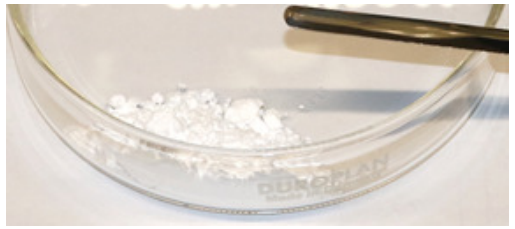
Sebum & Oil Absorption
In vitro study method

Two grams of particles are weighed in a petri dish and oil is added until a chewy texture is obtained where no more oil can be absorbed by the particles. The point of maximum absorption is visually assessed and the absorption capacity is indicated in gram oil per gram particle [g/g particle].



sebum is composed according to Bey standard*

18.0% free fatty acids
32.8% beef tallow
3.6% fatty acid triglycerides
18.3% lanoline
3.7% cholesterol
12.0% hydrocarbon mixture
11.6% cutina (Glyceryl Stearate)

In order to maintain fluid behavior of model sebum for visual assessment of maximum absorption capacity, sebum, cellulose and petri dish are equilibrated in a chamber at 60 °C and the measurement is conducted in the chamber with opened doors, resulting in an air temperature of ~50 °C and cellulose/sebum temperature of 40-45 °C during the measurement.

* Bey, K., Die Analyse von Hautfetten aus getragener Wäsche I; Fette, Seifen, Anstrichmittel Volume 65, Issue 8, 1963, pp. 611-618

» back to *in vitro* study

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In vitro & *in vivo* studies & sensory profiling test formulations

Natural W/O Lotion (AL 11/16-48,51,56,58,60)

Phase	Ingredients	w/w %	w/w %	w/w %	w/w %	w/w %
A	Polyglyceryl-4 Diisostearate/ Polyhydroxystearate/Sebacate	2.50	2.50	2.50	2.50	2.50
	Hydrogenated Castor Oil	0.40	0.40	0.40	0.40	0.40
	Cera Alba	0.60	0.60	0.60	0.60	0.60
	Caprylic/Capric Triglyceride	7.50	7.50	7.50	7.50	7.50
	Isoamyl Cocoate	6.00	6.00	6.00	6.00	6.00
	Simmondsia Chinensis (Jojoba) Seed Oil	5.00	5.00	5.00	5.00	5.00
	Cellulose		**2.00**			
	Nylon-12			**2.00**		
	Polymethyl Methacrylate				**2.00**	
	Zea Mays (Corn) Starch					**2.00**
B	Water	72.50	70.50	70.50	70.50	70.50
	Glycerin	3.00	3.00	3.00	3.00	3.00
	Panthenol	0.50	0.50	0.50	0.50	0.50
	Magnesium Sulfate (Magnesium Sulfate Heptahydrate)	1.50	1.50	1.50	1.50	1.50
	Sodium Benzoate; Potassium Sorbate; Water (Euxyl K 712, Schülke & Mayr GmbH)	0.50	0.50	0.50	0.50	0.50
	Citric Acid (10% in water)	q.s	q.s	q.s	q.s	q.s

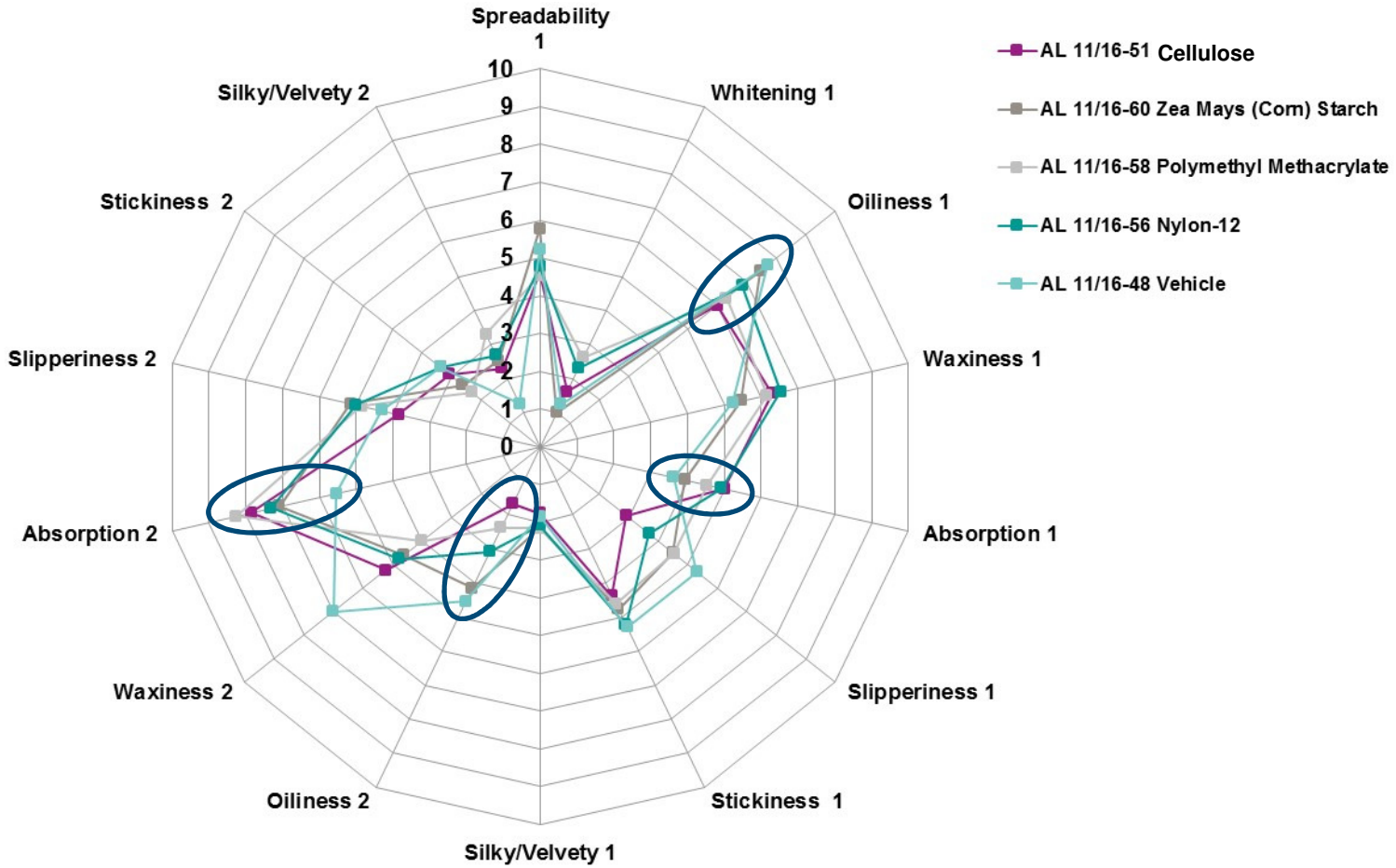
Processing

1. Heat phase A to approx. 85 °C.
2. Adjust the pH value of phase B to approx. 5.5.
3. Add phase B (room temperature) slowly while stirring.
4. Homogenize.
5. Cool with gentle stirring below 30 °C and homogenize again.

» back to *in vitro* study
» back to *in vivo* arm study
» back to *in vivo* face study
» back to sensory profiling SK 2.0
» back to sensory profiling spider

Sensory Profiling

Spider diagrams for Polyglyceryl-4 Diisostearate/Polyhydroxystearate/Sebacate formulations



Cellulose efficiently improves absorption and reduces oiliness of a Natural W/O Lotion.

The relative effect is very large for W/O systems based on GPS.*

» see test formulations

* » back to sensory profiling

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