WP 5

Visual perception

Second progress meeting

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Visual perception

- The visual appearance of a product is often a decisive parameter in the judgement process of a customer
- The measurement of the visual appearance of surfaces requires the knowledge of the material structure, its interaction with the incoming light, and the possibility to measure the optical properties with at least the same acuity as a human observer.
- None of these three prerequisites are appropriately fulfilled nowadays:
  - written procedures and standards are not available or not sufficiently detailed.

WP 5 Objectives

- The objectives of this workpackage are:
  - To provide a synthesis between subjective visual attributes and quantitative physical parameters
  - To highlight metrological and uncertainty requirements for these characterisation;
  - To improve definitions of visual attributes;
  - To realize reference systems for comparison and industrial testing;
  - To correlate visual intensity response stimuli to material characteristics and environment attributes

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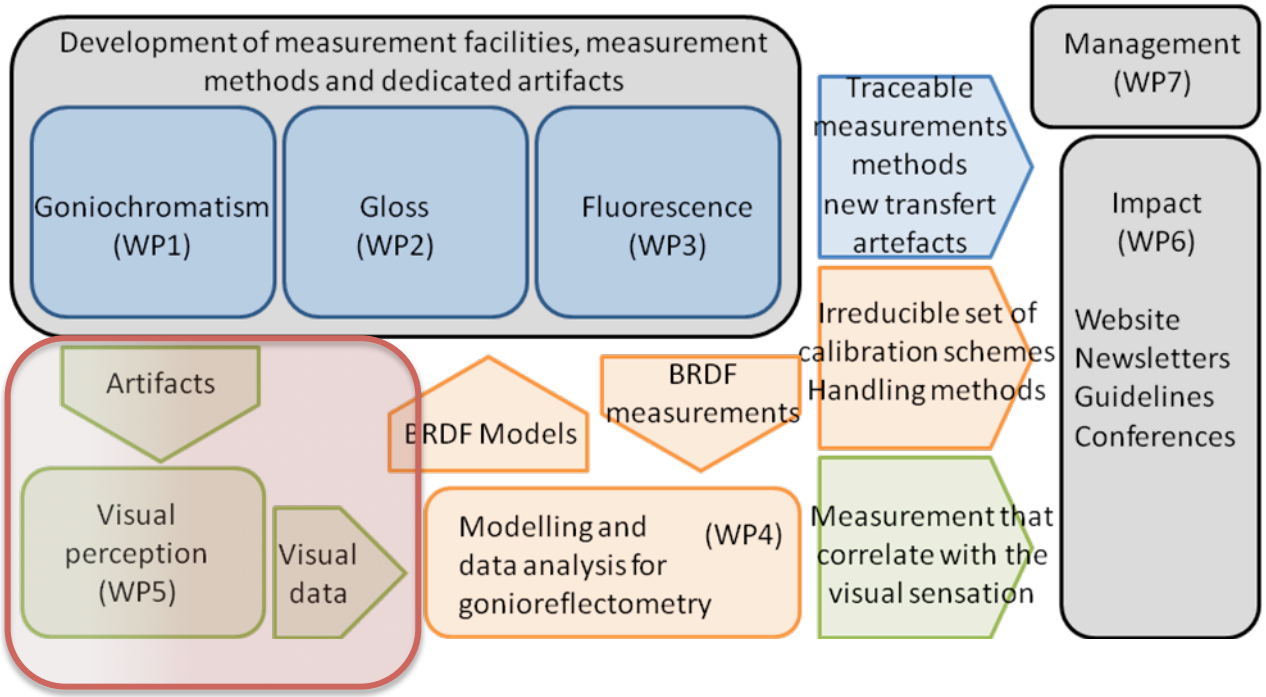
WP5 overview



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WP5 GANTT

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Deliverable	Leader	Sep-13	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
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5.2.1	CNAM																																					
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5.2.4	INRIM																																					
5.2.5	INRIM																																					
D5.3.1	REG(UA)																																					
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D5.6.3	REG(UA)																																					
D5.6.4	REG(UA)																																					
D5.6.5	CNAM,																																					

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Deliverable summary

JRP Deliverable	Deliverable description	Lead Participant	Other Participants	Deliverable type	Delivery date	Dependency	Activity Description (From Annex Ia or from the relevant REG document)
5.1.1	Definition of artefacts for investigation	CNAM	INRIM, REG(KU Leuven), REG(UA),	Report	M13	D1.1.1, D2.1.1, D3.5.3, D3.4.1,	The aim of this task is to define the artefacts and their characteristics that must be used in the subjective tests: • Determining the necessary visual characteristics of the artefacts. • Selectioning the available artefacts of WP1, WP2, WP3 (minimum of 4 artefacts). • Ranking the metrological characteristics measured in WP1, WP2, WP3
5.2.1	Investigation on the visual perception of gloss	CNAM	REG(KU Leuven),	Report	M27	D5.1.1 D2.1.1, D2.2.1, D2.2.2	
5.2.2	Intercomparison on gloss perception	CNAM		Data	M28	D5.1.1 D2.1.1, D2.2.1, D2.2.2	Using the artefacts defined and selected in task 5.1 and virtual stimuli,CNAM REG(KU Leuven), INRIM will perform several subjective experiments (at least 3 esxperiments) to investigate perception scales and threshold of visual attributes.
5.2.3	Intercomparison on gloss perception	CNAM	REG(KU Leuven),	Data	M28	D5.1.1 D2.1.1, D2.2.1, D2.2.2	
5.2.4	Intercomparison on gloss perception	CNAM	INRIM	Data	M28	D5.1.1 D2.1.1, D2.2.1, D2.2.2	
5.2.5	Publication of data of Intercomparison on gloss perception	CNAM	REG(KU Leuven), INRIM	Report	M32	D5.2.2,D5.2.3, D5.2.4	
5.2.6	Requirements for reference set of perceptive gloss scale	INRIM		Report	M30	D5.1.1D5.2.5 D2.1.1, D2.2.1, D2.2.2	select and test a reduced set of the artefacts (Task 2.1) to be representative of the different perceptual aspects of visual sensation of gloss), a minimum of 3 artefact will be considered to deduce the requirements to establish a reference set.
5.3.1	Methodologies on the colour difference for gonioapparent materials	REG(UA)		Report	M18	D1.5.1, D2.2.2, D3.5.4, D5.1.1	test ΔE colour formulae for gonioapparent panels in different measurement geometries (considering at least minimum 2set up) with a standard grey scale for marking the ΔV value

WP5 work programme

- Fill the break out file distributed by Paola
- Risks of WP5 – delay at the end of the project:
  - Subjective experiments shall highlight threshold conditions.
  - The design of experimental set up requires a strong feedbacks-links with WP1, WP2, WP3 and WP4
  - Preliminary results discussion between partners

Task 5.1 (Start M12, End M13)

The aim of this task is to define the artefacts and their characteristics that are to be used in the subjective tests.

- In order to perform subjective tests on the perception of visual attributes, it is necessary to choose artefacts, different in their visual attributes, that have metrological characteristics that are very well defined.
- In this task several coloured artefacts, different in gloss, fluorescence and texture will be considered

Task 5.1

- Deliverable M13

5.1.1, Identification of artefacts suitable for visual experiment CNAM, INRIM, REG(KU Leuven), REG(UA)

Dependency D1.1.1, D2.1.1, D3.5.3, D3.4.1

The aim of this task is to:

define the artefacts and their characteristics that must be used in the subjective tests:

Determine the necessary visual characteristics of the artefacts.

Select the available artefacts of WP1, WP2, WP3 (minimum of 4 artefacts).

Rank the metrological characteristics measured in WP1, WP2, WP3

Task 5.2 (startM12, end M30)

The aim of this task is to investigate reference systems for defining intensity scales of gloss visual attributes stimuli.

Date M27 – M32

Task 5.2

- Deliverables

- D5.2.1 D5.2.2 Investigation on the visual perception of gloss, CNAM,
- D5.2.3 Intercomparison on gloss perception, CNAM
- D5.2.4 Investigation of perceptual thresholds, INRIM
- D5.2.5 Reference set of gloss, INRIM

Task 5.3 (start M12 End M30)

- Definition of perception scale of visual attributes for colour and sparkle/graininess

The aim of this task is to investigate reference systems for defining descriptors and scales for goniochromatism and sparkle/graininess visual attributes stimuli

M18 – M30

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Task 5.3

- Deliverables
- D5.3.1 Methodologies on the colour difference for gonio - apparent materials, REG(UA)
- D5.3.2 Report on threshold contrast for goniochromatic samples, INRIM, REG(UA)
- D5.3.3 Visual scales for detection and comparison of sparkle, REG(UA)
- D5.3.4 Visual scales for detection and comparison of graininess, REG(UA)

Task 5.3

- Deliverable M18
- Methodologies on the colour difference for gonioapparent materials REG(UA)
- Dependency D1.5.1, D2.2.2, D3.5.4, D5.1.1
- The aim is to test ΔE colour formulae for gonioapparent panels in different measurement geometries (considering at least minimum 2set up) with a standard grey scale for marking the ΔV value

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Task 5.4 (Start M13 End M30)

- Influences of the spectral environment on the perception of the visual attributes

The aim of this task is to investigate how visual environmental conditions (i.e. level of illuminance, level of adaptation, spectral composition of light) affect the perception of visual attributes.

M24- M30

Task 5.4

- Deliverables:
- D5.4.1 Measurement report on the influences of lighting source CRI and spectrum on colour perception, INRIM, REG(UA)
- D5.4.2 Influences of light source spectrum and CRI on the pass fail decision for colour and sparkle/graininess, REG(UA)
- D5.4.3 Report on the effect of ambient light and colour background on gloss, REG(KU Leuven)
- D5.4.4 Report on the influences of gloss variation on colour perception in works of art pigments, INRIM
- D5.4.5 Report on the robustness of the prediction model for sparkle and graininess according to the colour of the sample REG(UA)

Task 5.5 (Start M26 End M31)

- Influences of geometrical environment on the perception of the visual attributes

The aim of this task is to investigate how geometrical attributes of viewing conditions and objects (i.e. angle of observation, viewing distance and object geometry) affect the perception of visual attributes.

M28 – M31

Task 5.5

- Deliverables
- D5.5.1 Effects on colour scale and sparkle induced by geometry of observation and surface geometry, REG(UA)
- D5.5.2 Report on the viewing distance vs the gloss visual scale, REG(KU Leuven)
- D5.5.3 Report on the influence of the solid angle of illumination on the sensation of gloss, CNAM
- D5.5.4 Report on the robustness of the prediction model for sparkle and graininess according to distance of observation, REG(UA)

Task 5.6 (Start M30 End M35)

- Procedures and guidelines

The aim of this task is to develop procedures and provide guidelines for standard test methods for visual evaluation of glossy, goniochromatic, sparkling and grainy samples, in order to build a common base essential for comparing results issued from visual evaluation

M31 – M35

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WP5 stakeholder breakout session

- Industry is not interested in visual perception experimental activities and results
  - They prefer to have standard quantitative requirements
- Quantitative data obtain following standard condition are not exhaustive
  - They are good for catalogue or products selection
  - Often they create problems in design or in the evaluation of prototype
  - Design tool often accept only global parameter and not goniometric data
- Different lighting conditions with near surfaces
  - The colour of the same material can be different when view from different angles (horizontal and vertical surface of the same object)
  - Inter-reflections changes the spectra of the incident radiation
  - Evaluation of colour using different sources – metamerism aspects
- Differences between normative measurement conditions and practical conditions
  - Translucent materials and glass units
- Aging of material and problems of replacement when the uniformity of colour is important
- Visual perception used in the final inspection of products for defects
  - mechanical defects
  - colour uniformity
  - Surface characteristics

WP breakout session

- Good- not good decision
- Accuracy and visualization problems of colour using monitor
  - 8 bit resolution is not adequate for same colours
  - Monitors dynamics and contrast
  - Fluorescent colours
  - Colours outside the monitor gamut
- Differences between approaches
  - Improved sample characterization (not only global parameters but also gonio-photometric characterization)
  - Use of improved colour models not only xyz or Lab
  - Need of visual appearance experiment during the design phase
  - Guidelines for the correct design and realization of these subjective experiment

Task 5.6

- Deliverables
- D5.6.1 Guidelines for standard test method for visual evaluation of goniochromatic samples INRIM, REG(UA)
- D5.6.2 Guidelines for lighting arrangements to improve visual experience in exposition INRIM, REG(UA)
- D5.6.3 Guidelines for viewing cabinets for sparkle and graininess sample evaluation, REG(UA)
- D5.6.4 Guidelines on the influence of the pigment particle size on the comparison of sparkle and graininess REG(UA)
- D5.6.5 Guidelines for new standard test method for visual evaluation of gloss, CNAM

Stakeholders

- Appearance, not only visual, is the first impact of consumers with a product.
- What is the human resolution in given observation conditions for a given product?
  - Are the appearance characteristics considered adequate for the product purpose? .
  - Are the linked physical quantities correctly choose and their “degree of correlation” is high enough?
  - How are these quantities measured?
    - Standard conditions?
    - Instruments
    - Measurement conditions
    - Measurement methodologies
    - Measurement uncertainty …

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Stakeholders

- Measurement uncertainty - appearance subjective resolution
  - The evaluation of measurement uncertainty is a tool not a cost
  - Development of optimized measurement systems
  - Standard requirement for specific products
- Tender specification and requirements are adequate to subjective condition of perception
  - Tolerances in manufacturing
  - Uncertainty in product characterization

Stakeholders

- Reflection – Transmission
  - glass industries - TC10 Optical properties of glass of International Commission on Glass
- Extension in the near infrared interested but not considered for low impact in visual perception
  - Glass industries
  - Material for building
- CEN Standardization
  - EN 16268 - Perfomance of reflecting surfaces for luminaires
- Peculiar materials (like retro-reflectors) not considered
  - Standard give detailed measurement and requirements
- Measurement systems and reference samples
  - In site experiments on new products or solutions