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Measuring physical and visual material properties to determine their perceived degree of naturalness

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This project aims to understand how the physical characteristics of a material determine whether it is perceived as being natural or synthetic. Materials and objects exhibiting "naturalness" are considered to be highly desirable and "natural" is often associated with health and well being, whereas "synthetic" can carry negative connotations. An international team of researchers, including metrologists, psychologists, neuroscientists and mathematicians, are developing and using novel state-of-the-art measurement facilities and techniques to investigate how the human sensory systems (visual and tactile) interact to interpret a physical stimulus in its environment and to identify which physical parameters are most critical in determining the perception of naturalness. The results will not only have application in automotive design, furniture, clothing and improved medical prostheses, but may also be used to inform development of more realistic virtual reality systems for both recreational and serious gaming. This paper describes how the physical properties (reflectance, colour, gloss, texture, hardness, surface topography, roughness etc) of pre-selected test samples are measured at the National Physical Laboratory, (NPL). In parallel, psychophysical evaluations of perceived naturalness for pseudo-identical samples are conducted at Barcelona University and the neural interpretation of these surfaces is investigated through neuro-imaging of participants on a magnetic resonance imaging (MRI) scanner in Trinity College Institute of Neuroscience. Leading edge data analysis and classification methods are then used to establish relationships between the physical measurements and the perceived naturalness, taking account also of the neural and cognitive processes involved. Initial results are encouraging and give credibility to the aim of creating a predictive model for naturalness with a sound metrological basis, which may be extended in future to other perceptual phenomena.