Romain Viala, Yakov Ben-Haim, Stéphane Vaiedelich and Scott Cogan, Value of information in the conservation of a heritage cello: An info-gap decision theory approach, *Journal of Cultural Heritage*, to appear.

Abstract Decision-making for the conservation of heritage stringed musical instruments, especially their playing conditions, can be supported by science-based models. Mechanical stresses induced by string tension can prevent an instrument from being played if the risk of damage is too high since they can lead to plastic strains and permanently damage a rare object. Science-based modeling tools, such as the finite element method, require detailed knowledge of the mechanical and material properties of the instrument. However, many of these properties are uncertain, such as material properties, relative humidity conditions, or existing crack defects. Info-gap decision theory provides a framework to address uncertainty and to evaluate the robustness of decisions in situations where there are significant gaps in information. This is applied here to the decision-making process to determine whether an instrument is playable or not an antique cello by Pietro Guarneri, E.1555, kept in the Musée de la musique-philharmonie de Paris. The instrument shows local damage from insect galleries. The decision that needs to be made is whether or not the instrument can be played without damaging it. The info-gap robustness metric evaluates how wrong our physics-based model can be with respect to the baseline material properties without jeopardising the validity of this decision. Toward this end, a finite element model is created and a static analysis is performed to compute the stress field near the damaged area resulting from string tension. A robustness analysis is performed to compute the info-gap robustness curves for different uncertainty scenarios with respect to both the elastic properties and the yield stresses of wood with unknown properties. In this illustration, it is shown that it is more effective to reduce uncertainty in the elastic properties rather than yield stresses to ensure a robust decision concerning the playability of the instrument.

Keywords Cultural heritage, info-gap, wood mechanics, decision-making, static analysis, finite element method.

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