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## Crafting Conductive Circuits in Glass

Engaging the theme of Curating Maker Cultures, this presentation features methods and processes used in the development of conductive circuits in handcrafted glass and copper combined with interactive sensors. It will also include a display of resulting objects, which have been created in a series of cross-disciplinary workshops that demonstrate the exposure of existing potentials for combining artisanal glassmaking with digital manufacture and interactive electronics.

For over a decade, National Glass Centre Research at the University of Sunderland has been developing digital making in a material that has a long history of making by hand. In particular it has pioneered the creative use of waterjet cutting in glass, and has pursued a shift toward digital craft in its curriculum. This project, however, seeks to consider continuity in craft as a way of thinking rather than as distinct areas of practice and encouraging new and best practice using both digital and manual making. This collaboration with the Craft Futures research group at Northumbria University and their combined Centre for Doctoral Training involves academic and student researchers from both universities as well as Newcastle University's OpenLab.

The project seeks to provide a demonstration of a new area of thinking in which the combined skills of makers drives forward new opportunities of forms of interaction with crafted objects and for traditional craftspeople to form a connection with digital possibilities in creative work. While there are many coders and potentials for interactions, the exploration of handcrafted glass and copper constructions offer new possibilities for interfaces. Glass is a material that can be formed through skillful blowing, casting, cutting and kilnforming. It adds potential uses of colour, transparency, weight and potential for optical effects. Combined with sensors a myriad of effects can be achieved.

So far the workshops have yielded experiments in 3-dimensional circuits through integrating glass with a conductive material. Copper, a compatible material, has been embedded within melted glass to create an interface for an LED 'light-writer' that can produce a range of RGB colours transmitted through the glass surfaces. A colour sensor is being developed to compare synthetic light to objects in coloured glass. Contoured air pockets have been waterjet cut and trapped within solid glass blocks to create circuits using solid or liquid conductive materials. Screenprinting techniques are being used to create ornamental circuitry within glass tiles. Copper wire cages form 'electric veins' that constrict unique blown glass vessels. The project is ongoing and it is anticipated that objects can be demonstrated at Making Futures. This study is an exploration of materiality and the creation of artefacts as meaningful moments in art, craft and design. By working with researchers with a broad range of craft specialisms, we are using this collaboration to rethink the partnership of materials.