

## **Princeton Research Day sample research summaries**

### **Humanities**

**Kaicong Wu**

**GS Architecture**

#### **Developing Architectural Geometry through Robotic Assembly and Material Sensing**

The design and construction of architecture used to be a close loop in which components from a design proposal are predefined before they are fabricated and assembled. However, advances in robotic fabrication and computational geometry have opened up new possibilities for including automatic material selection and assembly into the loop. We introduce a design method for computing and constructing architectural geometry through negotiating between the design intentions and the constraints of assembling materials. The method is similarly to how the Caddisfly Larvae (one special insect) builds its cocoon exclusively with found materials. A small scale experimental structure has been modeled and partially built from EPS foam sheets, using an industrial robotic arm to pick, cut and subsequently assemble the components of the structure. To reduce waste, a sensing procedure was developed to automatically generate component based on the form of the found material piece and fit it in the existing structure. We aim to investigate how the sensor enabled robotic fabrication can potentially contribute to innovative forms of the assembled structure. The outcomes of this project are the built structure as well as the partial records of the sensing and assembling process.

**Sarah Town**

**GS Music**

#### **Clave Contraband: Rhythmic Experimentation Among New York City's Timberos**

Every Latin musician in New York City knows the notorious "clave police," zealous enforcers of clave conventions who tirelessly call attention to musical material that "crosses" clave, demanding rectification. In Cuban dance music, clave is ubiquitous: its dry, high-pitched timbre cuts through the thickest of sonic stews, while its syncopations undergird the music's rhythmic logic. The latest example of this dance-oriented repertoire, timba, emerged in Havana the late 1980s, a product of street and conservatory, and a balance of pop danceability and jazz virtuosity. Along with Cuba's 1990s economic reopening, its sounds and techniques circulated internationally and trickled into the United States in the shadow of the Buena Vista Social Club. Musicians in New York City from Cuba and elsewhere began to produce timba in a variety of forms, from cover tunes to new compositions, to timba-inflected performances of jazz and pop classics. The new environment implies different inspirations and constraints, and musicians respond, at times challenging generic boundaries in the process. They timbify sections of other songs, interpolate rhythmic elements from other genres, and cross and uncross clave. Through multiple media, transcription, and analysis, my poster presentation surveys a range of timba-related rhythmic experiments that New York-based musicians produce through composition and improvisation,

and considers the ways in which their work reflects on timba, clave, and the reality of playing music in New York City. I argue that these musicians expand notions of timba and clave, without losing the relationship of each to social dance.

**Selena N. Kitchens**

**UG Classics**

**Sulpicia Writes Herself: A Female Author in the Roman Literary World**

Roman love elegy is primarily preoccupied with two topics: love and the act of writing. Like all genres of Roman literature, our examples of elegy are almost entirely written by men--men who write about their female beloveds as sources of love, hate, and poetic inspiration. Women are almost entirely silent in the genre. Almost entirely, but not completely. My research project explores how a female author, Sulpicia, the only Roman female poet whose corpus survives, inverts the tropes of "male-centric" Roman love elegy and through these inversions demonstrates space for a female authorial voice in the genre. In particular, I will use the first Sulpicia poem to show how Sulpicia rhetorically "links" her body to her poetry in order to assert the female authorial control that is implied (but then undermined) in male-authored elegy. In doing so, I will raise what I think are important questions about how we think about the positions, abilities, and autonomy of women in Ancient Rome and how we can read what little direct evidence we have to best challenge our own preconceptions when writing about under-exposed facets of the ancient world.

## **Natural Science**

**Julian West**

**GS Chemistry**

**U can do it: The Hidden Talents of Uranium**

Nuclear Weapons. Nuclear Power. Dangerous Radioactivity. These are the first thoughts when most people think of uranium. Surprisingly, < 1% of all uranium (the rare  $^{235}\text{U}$  isotope) can sustain nuclear fission, meaning that these worries and dangers apply to only a tiny minority of the element. However, the stigma from fissile  $^{235}\text{U}$  has led to the well-behaved major isotope  $^{238}\text{U}$  being unfairly interned at enrichment facilities with little prospect for productive use. We aim to reintegrate  $^{238}\text{U}$  into catalysis research and show it to be a unique, productive member of the chemical community.

## **Engineering**

**Zeyu Jin**

**GS Computer Science**

**Text-based Speech Editing**

Recorded audio narration plays a crucial role in many contexts including online lectures, documentaries, podcasts, and radio. Once a recording is done, editing the audio can be an arduous task, especially for non-experts. We aim to make speech editing as simple as working in a text-pad. Previous works have addressed basic edits such as navigation and word removal and our focus is to enable word replacement and insertion where a user can type new content and have it synthesized automatically in the voice of the context speaker. Our solution is based on voice conversion: for new content, we synthesize its audio (called query) using a virtual voice such as Siri. Then, we convert it to the context speaker's voice using our novel voice analogy method in which we concatenate pieces of context-speaker's speech signal to approximate the query. Finally, we blend the new content into the context using overlap-add method. To demonstrate the feasibility of our method, we developed an app called Voxoshop where it takes a speech recording and its transcript as input, and allows a user to navigate and edit speech through text. We also demonstrate the extensibility of our voice conversion method by converting human singing voice to violin performance that is more expressive and natural than most state-of-art violin synthesis methods.