

# 2014 YCCSA SUMMER SCHOLARSHIP PROJECT SUBMISSION

This form is for prospective project supervisors to submit their projects to be included in the YCCSA Summer Scholarships Programme for 2014.

It is the purpose of the Summer School that any projects submitted are interdisciplinary in nature.

<b>Date</b>	28 <sup>th</sup> January 2014
<b>Main Supervisor's Name</b>	Professor David M Howard
<b>Main Supervisor's Department</b>	Electronics
<b>Co-supervisors' name(s) and Departments</b>	Robert Hollingworth (Music), Jez Wells (Music), Helena Daffern (Electronics)
<b>Project Title</b>	Exploring singers' tuning strategies
<b>Project Description</b>	<p>One characteristic of <i>a cappella</i> (unaccompanied) singing is that each singer has complete control of their sung pitch. Today's pianos are tuned in <i>equal temperament</i> which means that every semitone has the same frequency ratio (the 12<sup>th</sup> root of 2). This means that in terms of pure-sounding intervals, only the octave is in-tune; other intervals could be better tuned. When singing <i>a cappella</i>, there is no tuning reference (to a piano or anything else), so singers can select their pitches independently. The most musically consonant, or <i>pleasing</i>, tuning results when the individual pitches of notes in chords are in integer frequency ratios. In practice, this means that individual harmonics in the notes will match in frequency, which is what contributes psychoacoustically to perceived musical consonance as opposed to musical dissonance [e.g. Howard and Angus, 2009]. In terms of music perception, this has the potential to heighten the moments that are consonant and therefore this increases the consonance to dissonance range that can be achieved in musical performance.</p> <p>This project aims to make measurements of what singers do in the context of singing in an <i>a cappella</i> group by asking them to sing along to stimuli that consist of the other three parts synthesised electronically with pitches altered to enable tuning to be explored in detail. Stimuli will be designed as part of the project and these will be varied in terms of the individual fundamental frequencies (essentially the pitches), vowels, presentation (to the left and/or right ear) and loudness in a manner that relates to individual chords, chord sequences and extracts from <i>a cappella</i> repertoire. Pilot experiments [Howard et al., 2013] have indicated that there are differences in singers' tuning depending on the temperament of the three parts played as stimuli.</p>
<b>Required skills</b>	This project involves working with computers for sound synthesis in PureData

	(could be learned as it is based on some existing files) and data analysis in Excel. Care in carrying out experiments as well as the ability to work independently and communicate clearly with others both verbally and in writing are essential skills. An organised approach to liaising with subjects and running experiments is essential. Background knowledge in musical tuning and/or choral singing experience would be an advantage.
<b>Project dates</b>	Monday, 14 July 2014 and finishing on Friday, 12 September 2014
<b>Other information</b>	n/a
<b>References</b>	<p>Howard, D.M., Daffern, H., and Brereton, J. (2013). Four-part choral synthesis system for investigating intonation in a cappella choral singing, <i>Logopedics Phoniatrics Vocology</i>, <b>38</b>, (3), 135-142.</p> <p>Howard, D.M., and Angus, J.A.S. (2009). <i>Acoustics and psychoacoustics</i>, Oxford: Focal Press.</p>

When complete, please email the form to [sarah.christmas@york.ac.uk](mailto:sarah.christmas@york.ac.uk)