This is the second annual (2023/4) report for **Bee-ing Human** (RPG-2021-358).

Full digitisation of our two texts (1609 and 1623) (WP1).

We have now fully digitised Olivia Smith's 2022/3 transcriptions of the 1609 and 1623 editions of Butler's *Feminine Monarchie*. Tiago Sousa Garcia began this work by automatically transforming the transcriptions of the two editions into basic TEI-conformant encoded transcriptions. Following this, he created the TEI Customisation for the project (a set of machine-readable instructions that explicitly sets out our specific use of the TEI), from which he was able to derive our encoding manual and editing guidelines, and generate the *schema* used by our editing software (*Oxygen*) to validate the encoding, ensuring that all changes Olivia and Jennifer Richards make to the edited text obey our encoding and editing principles. From this, he made several manual passes over the basic encoding to correct any encoding mistakes and enrich its semantics, and moved from a simple division of chapters and paragraphs to a richly encoded text that is fully interconnected and also contains markup for personal names, bibliographic references, material textual phenomena, quotations etc. He then began the process of encoding the textual variation between the two editions: a) setting out the encoding principles to record the variation; b) creating the necessary documentation to guide us through software development best practices; c) creating a basic reading version of the textual variation to help with review; d) setting out a process that allowed us to review all changes before accepting them (i.e. review process and branch protections on github). With these procedures in place, the bulk of comparative encoding work was then undertaken by Olivia Smith, with guidance from Tiago where necessary, and with Jennifer checking (see below). After variation is recorded for each chapter, the changes to the encoding are reviewed three times before they are merged into the main file: first from a technical standpoint (by Tiago), then from an editorial standpoint (by Jennifer), and then as a group to iron out any problematic passages (Jennifer, Tiago, and Olivia). At the time of writing this report, we have reached chapter 8 (out of 10) in this process, and we expect to complete this stage by the start of October 2024.
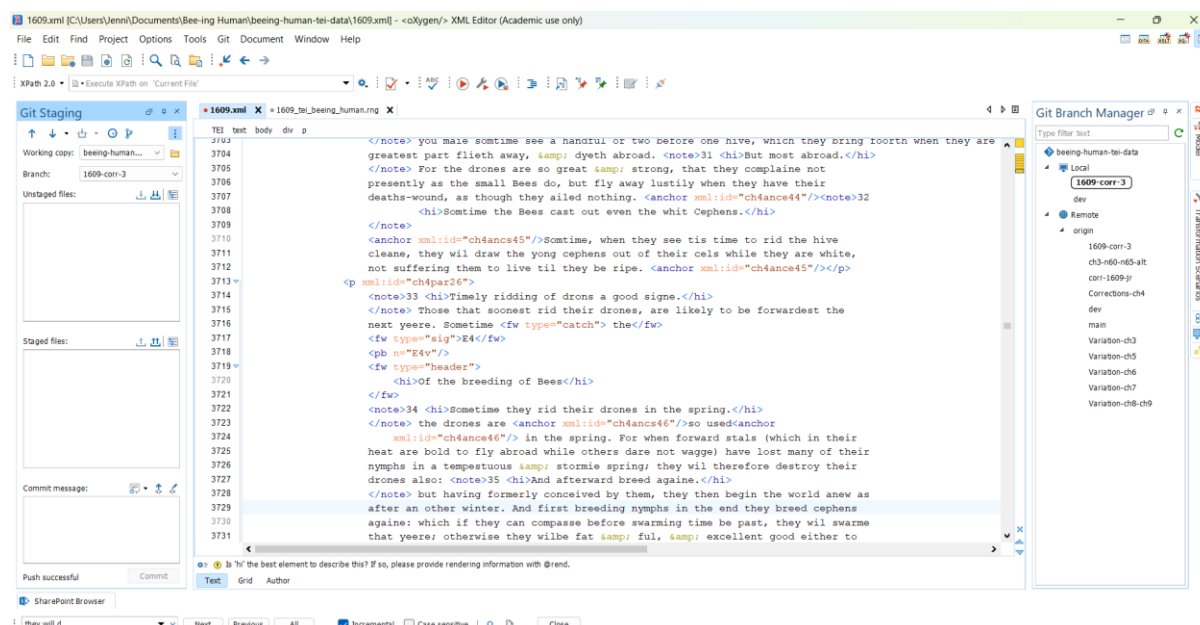
Butler's four-voice song, *Melissomelos* (WP1)

During 2023/4 we developed and deployed Magnus Williamson's transcription of Butler's song, *Melissomelos* (2022/3), in the first of two performer residencies. The professional vocal group Ensemble Pro Victoria showcased *Melissomelos* at Newcastle University's 2024

'Early Music @ Newcastle' season in King's Hall on Thursday 29th February, as the centrepiece of a programme showcasing natural sounds in Renaissance music. A [film](#) of the performance, by Evripidis Karydis and Simon Rushton, will be included in our digital Bee Book. This was the first time we heard *Melissomelos* performed beginning-to-end, without any omissions, and in line with Butler's instructions. An important adjunct to the filmed performance was a series of 'Singing-from-Facsimile' workshops in which copies of Butler's 1623 edition were used in performance. This brought together specialist expertise from within Newcastle (Magnus Williamson and PhD student Michael Winter), together with Visiting Professor Kerry McCarthy and doctoral researchers James Tomlinson (University of Oslo) and Erik Bergwall (University of Uppsala). This work has helped us resolve two challenges: (i) ambiguous word underlay: Butler's instructions for the performance of *Melissomelos* have been resolved, and his instructions for the repetition of stanzas clarified ('Sing this to the second Tune: and then end with the first verse of the first Song: repeating in either the two last Straines'); (ii) the question of how to render the untexted (naturalistic) sections of *Melissomelos*: whether these should be sung to 'sol fa' syllables, or hummed, or sung to a vowel, or an imitation of bee-humming, or played on an aerophone. We have adopted different approaches: at the full-length performance, we used recorders.

Testing for judgement bias (WP2)

Judgement bias tasks are an important method for studying emotion-like states in non-human animals by assessing their responses to ambiguous stimuli based on previous training with distinct rewarding and non-rewarding stimuli. This method has also been applied to insects, particularly bees, revealing interesting cognitive biases and possible emotion-like states. Concerns have been raised that these behaviours could be influenced by factors other than the judgement of ambiguity, e.g. motivation levels or attention to stimuli. Vivek Nityananda and Balamurali G.S.'s (Balu) lab developed a version of the judgement bias task for bumblebees where one stimulus is more rewarding than the other. In this task, bees must choose between different locations to obtain the rewards, requiring active decision-making and minimizing the influence of motivation and attention. This active choice judgement bias task has shown that shaken bumblebees exhibit pessimistic biases in visual

tasks, supporting the idea that their responses reflect genuine emotional states. However, the underlying functions of these states and whether they can be transmitted between individuals, as seen in vertebrates, remain unexplored in invertebrates. This opens new research avenues into the social transmission of emotional states in insects and the broader implications for understanding emotion-like phenomena across different animal taxa.

In their experiments, Vivek and Balu asked whether stress-induced negative affect states are transmitted from one bumblebee to another through close interaction, akin to emotional contagion in birds and mammals. If so, individuals who did not undergo stress inducing treatments (shaking, pinching etc.) should exhibit pessimistic judgement biases towards ambiguous stimuli, after interacting with a stressed individual. They found that non-stressed bees did not exhibit any pessimistic biases after interacting with stressed bees suggesting that these states are non-transmissible. However, when subjected to a different stress inducing treatment which mimics predator attack more naturally–i.e. pinching with forceps– most of the bees tested exhibited optimistic biases towards ambiguous stimuli. However, this was not significantly different from the optimistic choices made by non-stressed bees. Together, their results suggest that the internal states that result from stress are highly dependent on the type of stress and that cognitive biases are non-transmissible in bumblebees. Pinching induces the release of alarm pheromones in bees, which could affect the behaviour of the conspecifics. Hence, in the next experiment they tested whether interacting with a pinched bee and getting exposed to the conspecific alarm pheromones induces affective states in bees. Surprisingly, interaction with a pinched bee and exposure to alarm pheromones released by it resulted in pessimistic cognitive biases similar to shaking.

In the next experiments they investigated whether stress induced affective states could be associated with sensory stimuli and could be recalled by exposure to the sensory stimuli associated with these states. To test this, they stressed bees by shaking each one in the presence of an olfactory stimulus (peppermint oil) before tests and testing them after exposing to the odour associated with the stress. However, stress induced affective states were not associated with the sensory stimuli by the bees and they did not exhibit pessimistic cognitive biases. In the ongoing experiments we are investigating whether these different forms of physical and chemical stressors affect the innate or spontaneous preferences exhibited by bees towards certain colours. Bees, like most insects exhibit spontaneous preference for certain colours, which is hypothesised to be adaptive as it helps inexperienced foragers find rewarding flowers during initial foraging flights. These preferences help not only inexperienced foragers, but also experienced ones as they rely on these preferences in unexpected and rapidly changing habitat conditions. Since these preferences are of utmost importance for bees and their ecology, it is imperative that we

understand whether stressors will affect these preferences from an animal welfare point of view. Vivek has had accepted/published two papers in 2024.

The Design of the Digital Bee Book

The design of our Bee Book is now complete. Tiago took an iterative process approach, where design elements were shared with the team and then reworked in response to suggestions. He wanted to balance accessibility and responsiveness with innovation and semantic design, and to make design choices that echo both the contents of Butler's book and our interdisciplinary methodology. We settled on a landing page inspired by the hexagonal shapes of cells in a hive and the title page of *The Feminine Monarchie*. The site content is organised in views with discreet 'cells' of content, the latter aspect in line with well-established web conventions (article view). The iterative design phase was entirely done in a design tool, Figma, and Tiago is now starting its implementation in code. It is likely that some further detail changes will result from the implementation, but the broad design language will remain consistent with what the team has seen and agreed. We expect this implementation to be complete or near completion by the start of the third year of the project.

See also https://newcastlerse.github.io/beeing-human-web/

Interdisciplinarity and musical composition WP3

A key question we ask repeatedly is: how can we think productively together? We have approached this question about working across disciplines by:

1) Reading together. We have read the newly accessible text of Butler's *Feminine Monarchie*, and brought our different interdisciplinary expertise to bear on i.

2) Through a knowledge of process. The different teams have made their processes transparent: the humanities team visited the science lab, the musicologists explained the

technicalities of sound and recording, and the literary editing framework has been open from the start. We have brought our different specialist processes into view and re-view.

3) We have also, paradoxically, collaborated at points of impasse: moments where the disciplines *don't* meet. We have had robust discussions about incompatibilities, e.g. the impermeability of the metrics of science publication (largely set in place by funding systems). While these feel like moments of distance, they are also a form of collaboration.

This project has several independent WPs but they are held together by the openness of all the team to different disciplinary perspectives, and by our connectors: Tiago, who is building the digital Bee Book, and Bennett Hogg, the lead of WP3. In the grant application we had various actions planned for WP3. As the project has developed so has this been revised. We will no longer record domesticated and wild bees etc. We note that there are extant recordings created by other projects, with whom we are now in contact. Our aim instead is to foreground the meaningfulness of the sonic dimension. Hogg is exploring ways to set contemporary scientific texts in the form of electro-acoustic 'madrigal' fragments. The science texts have already been discussed by the team in our meetings (WP2). Hogg is also adapting the wordless 'piping' of Butler's music (WP1). These sources will be transformed into short settings that will play as readers navigate through the digital Bee Book, and connect to a central, stand-alone composition, that partners with Butler's of four-part song.

Looking ahead to 2024/5

In 2024/5 our interdisciplinary reflections will be given focus through reading and conversation about approaches to emotions; we will be sharing and discussing work published on this topic from different perspectives (humanities and science).

The encoding of the text will continue: we intend to enrich it with markup related to the interests of the team, and to add full editorial annotation to Chapter 5 together.

We have tested, and will use Image Compare, a tool developed by the Oxford Visual Geometry Group (VGG) to aid us in collating the various textual witnesses of 1623 so we understand its print history, and we will develop and implement the encoding guidelines to record the collation variance, and feedback on our experience to VGG.

We will finalise the encoding and visualisation of the musical text.

We will have a beta version of the digital book publicly available by the start of 2025 to collect user feedback, including from our advisory board, to improve it before final release. We will also reserve time to create a number of 'digital experiments', mini web applications that will allow users to explore our data and research in an innovative way, which we will make available through the digital book, and reflect on the experience as part of its content.

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