Technical Plan

Section 1: Summary of Digital Outputs and Digital Technologies

There are three main technical components of the project, each of which will utilise the data generated by the *Mapping Metaphor* project. These components are:

1. A new and freely available *Metaphor in the Curriculum* website through which PDF based worksheets and lesson plans can be downloaded and a version of the metaphor map that has been tailored for use by secondary-school pupils can be accessed
2. A 'metaphor map' app that will be released for both iOS and Android platforms that will feature a self-contained version of the Mapping Metaphor data and will thus be usable without an internet connection. The app will be downloadable for free from the Apple App Store and the Google Play Store.
3. A set of interactive, metaphor related activities that will be freely accessible through both the website and the app. These activities will include facilities to automatically evaluate a user's chosen answers and provide them with feedback and links to the metaphor map.

Section 2: Technical Methodology

2a: Standards and Formats

The new *Metaphor in the Curriculum* website will provide an access point for around 40 worksheets and lesson plans, which will be created in Microsoft Word and then published in the PDF format, a well-established and easily accessible document format. The website will use current web standards for presenting and styling content: HTML5 and CSS3. The version of the metaphor map that will be available through the website will be functionally identical to the version created for the *Mapping Metaphor* project but will feature minor cosmetic changes (e.g. an updated colour scheme) to integrate with the interface for the new website. Explanatory text will also be updated to suit the new target audience. These changes are minor and the bulk of the codebase for the visualisations will be identical across both versions. The decision to locate a new version of the map within the new website rather than linking to the version on the existing website was made primarily to enable helptext to be tailored to the new audience and to make the process of going from the interactive exercises to the visualisation and back more seamless. The metaphor map uses the free and open source d3.js and jQuery JavaScript libraries to generate visualisations as SVG images. As with the existing version, the new visualisation will connect to the existing *Mapping Metaphor* MySQL database via AJAX calls to PHP scripts which return the required data in the JSON format, a well-established open standard for plain text data.

The app that will be created for the project will use the same core technologies: HTML5 for page structure, CSS3 for styling, the d3.js and jQuery JavaScript libraries to provide the logic and visualisations generated as SVG images. The app will also employ the jQueryMobile user interface system. The major difference to the web version is that the app will function without an internet connection. In order to achieve this all the metaphor data will be stored within the app itself as JSON files. There will be about 20,000 metaphor connections stored in this format, which will take up around 2-3Mb, a size which will present no problem for publication and download through the App and Play stores.

There will be around 10 interactive activities available through the website and the app. These will be created using jQuery and will utilise user interface components from the free and open source jQuery UI resource. Data for the activities will be stored in JSON files and user answers will be stored using HTML5's localStorage and sessionStorage capabilities to enable users to return to their answers after visiting other parts of the website / app or during a later session.

2b: Hardware and Software

The technical infrastructure for the project will make extensive use of free and open source software. The website will be developed using the PHP server-side scripting language and will connect to the existing *Mapping Metaphor* MySQL database. Both the website and the app will use the d3.js and jQuery JavaScript libraries. The app will not be a 'native app' (i.e. separate versions won't be written for iOS and Android using their native programming languages, Objective C and Java respectively) but will instead use a single codebase with all logic handled by JavaScript. The project will make use of the free and open source Apache Cordova APIs in order to 'wrap' this codebase and provide the device-specific native backing code to enable the app to function on the iOS and Android platforms. This approach is perfectly suited to the project as it enables one single codebase to be used for both the web, iOS and Android versions. It will therefore be easier to maintain and will make creating new versions for different platforms a very straightforward process (e.g. if a Windows Phone version is demanded at a later date).

2c: Data Acquisition, Processing, Analysis and Use

The Digital Humanities Research Officer (DHRO) will begin documenting the requirements of the app following on from the first focus group session in May 2015 and a document detailing the functionality of the app will be made available for the second focus group in September 2015. An initial unwrapped version of the app featuring the visualisations but not the interactive exercises will be completed before the first classroom testing session in October 2015. This version will be located on a web server and will feature the HTML, CSS and JavaScript structure of the app but will be usable within a web browser on any platform rather than including the platform-specific wrappings supplied by Apache Cordova.

The interactive exercises and the website (including the slightly reworked version of the metaphor map) will be developed between October and December 2015, with the DHRO working closely with the RA to ensure that the interactive exercises include the desired functionality. The website will be available for testing by the end of December and will feature the metaphor map, the interactive exercises and the pages from which the teaching materials will be downloadable (the materials themselves will be added later).

Also during this period the DHRO will complete an initial version of the app, updating the functionality based on feedback from the testing session in October. This version will also feature the interactive exercises. Specific iOS and Android versions of the app will be generated using Apache Cordova in December 2015 and will be 'soft launched' on the App and Play stores. It can take up to two weeks for apps to be approved and be available for download, and the timing of the soft launch will ensure that the app is available for the third focus group at the end of January.

The PDFs and explanatory text for the teaching materials will be added to the website as they are completed between January and March and further incremental updates will be made to the iOS and Android apps and the website following the third focus group in January and the second classroom testing session in February. Final versions of the app will be published at the beginning of March and the website will be made publicly accessible prior to the launch event in March.

The website will be stored on webservers managed by University of Glasgow IT Services and running Apache. The webservers are backed up nightly to an Ultrium LTO2 unit located remotely from the server. The project archive, which will include both Word and PDF versions of the teaching materials, the source code for the app and all project documentation will be stored on an Active Directory network, supported by 4 domain controllers, located in two separate 'server' rooms at each end of campus. Each server has a RAID disk subsystem and is backed up nightly to devolved backup systems. Both server rooms are protected by both UPS and generators. The backup system creates and maintains two copies of each system state backup which are held on near-line disk, on-site tape and off-site tape. 7 versions of each AD state are retained for 90 days. Project documentation will include the requirements documentation, the input and output documents for the focus group and classroom testing sessions, minutes from project meetings and user instruction documentation.

Section 3: Technical Support and Relevant Experience

All technical development and support will be provided by the DHRO, based at the School of Critical Studies (SCS) at the University of Glasgow. The DHRO was responsible for the development of the website and visualisations for the *Mapping Metaphor* project and has more than 12 years of experience developing resources for digital humanities projects. A list of these projects can be found here: http://www.digital-humanities.glasgow.ac.uk/members/?id=7. The DHRO has detailed knowledge of the *Mapping Metaphor* data and all of the technologies that will be employed in this project, including extensive use of PHP, JavaScript, d3.js, jQuery, JSON, HTML5 and CSS3. He has also previously created two apps using Apache Cordova that are available through the App Store: 'English Grammar: An Introduction' and 'ARIES: Assisted Revision in English Style'. These apps feature interactive exercises that are comparable to the exercises that the current project aims to produce and the DHRO will be able to build upon the experience gained through the creation of these apps.

Section 4: Preservation, Sustainability and Use

4a: Preserving Your Data

The project data will be preserved both during and after completion in a dedicated network area on the University of Glasgow's Active Directory network, with backup procedures as described in 2c. This preservation dataset will include: the source code of the app and the website; the JSON metaphor data as used by the app; the JSON data of the interactive exercises; system documentation including: requirements documentation, full description of system functionality and copies of online user instructions. The project website will also be securely maintained after completion and will be accessible in perpetuity (see following section). The choice of open standards and plain text formats for both data and code should

ensure the project outputs can be straightforwardly preserved and potentially reused in future.

4b: Ensuring Continued Access and Use of Your Digital Outputs

The University of Glasgow has a policy to maintain digital resources resulting from research projects indefinitely. A number of older humanities research projects have been re-coded or updated substantially by technical staff in the College of Arts in recent years to accommodate migration to new servers or changes to existing server technology. Continued management and maintenance of the website will become the responsibility of the technical staff within SCS after project completion.

The project aims to ensure that the iOS and Android apps will be available through the App and Play stores for at least seven years. SCS already has two apps available through the App store and has plans to release more. Facilities are in place to continue to pay the annual Apple developer fee for the foreseeable future (apps are removed from the store if a developer stops paying the fee). There is no such fee associated with Android. As with websites, the responsibility for updating the apps to ensure they continue to work with future versions of iOS and Android will lie with technical staff in SCS.

The choice of open, non-proprietary formats such as JSON and widely established formats such as PDF will help ensure long-term access to the project data.