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This output is a single PDF document containing:
1. context and overview of the ecology of resources used by #DataCreativities
2. a table of the resources (tools), and the resulting data.

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#DataCreativities collaboration: Data Sources and Ecology of Resources

In mid 2020, as Australia began to feel the full force of the Covid-19 crisis, a group of researchers from across the University were brought together by a common interest: to uncover how our education and creative industries sectors are reacting and adapting to an environment mediated by physical isolation, social disruption, and health and economic crises. This group formed a collective under the title #DataCreativities to explore this research theme. At the heart of the #DataCreativities approach is a desire for research to be data led – that is, #DataCreatives first seeks out data sources, then extracts data, then explores the narrative that can be constructed from that data, and uses this to guide the formulation of research questions. Several months into the collaboration, the #DataCreatives team realised that one of the strengths of the collective was the framework within which the team was operating. That is, the ecology of resources we leveraged to develop an online ecosystem to allow collaboration, communication, and co-design of a data-led, creative, research program.

This document and accompanying files outlines the #DataCreatives ecology or resources. The impetus for this is threefold, principally:

1. As a record of how we interact, communicate, and create in the online space. We utilize a range of tools and mechanisms to facilitate collaborative research, and it is important to document these as a record of this collaboration's work.
2. As a blueprint for future collaborations. A key aspect of #DataCreatives is the trialling of new technologies and tools. Some are effective for our purposes, and some are not. Through outlining these technologies and tools, including the context in which they were implemented, this manifesto acts as a blueprint for future collaborations.
3. As an act of research in itself. Like many creative industries and education sectors, especially in Victoria, #DataCreatives operates in an exclusively online environment. Additionally, the team consists of researchers, educators, and practitioners who, in addition to being part of the #DataCreatives collective, continue to produce work in these creative industries sectors. Therefore, as the entire #DataCreatives collective are ingroup members of creative industries collaborations (by virtue of being part of the current team), and as various members are ingroup members of specific creative industries sectors (as educators, practitioners, and consumers), we contend that the #DataCreatives ecosystem reflects ecosystems of other creative industries sectors which are the target of our study.

Framework for understanding online collaboration and data discovery

Our online activities are conducted via a range of platforms (e.g. Zoom, Twitter, email). These platforms capture data about our actions such as audio, video, text, and metrics. The data captured represents our data trace – the digital footprint of our actions and interactions on a particular platform. Since most platforms are activity specific, the location of a data trace is predicated on the

activities being performed. For example, YouTube is well equipped (affords) for video streaming which suits online performances (activity), therefore YouTube is a good place to find data on trends in live streaming concerts (data trace).

The relationship between activity, platform, and data trace is captured withing the system of (inter)actions – a framework for understanding the association between desired goals and the mediums through which these are realised. By applying the principles of the system of (inter)action to the present discussion of tools and techniques in this document, we can better understand how we came to choose different platforms. Additionally, we may develop a stronger understanding of what motivates others in education and creative industries to choose certain platforms, which may lead us to uncover data traces that inform our examination of how education and creative industries sectors are showing resilience in the face of Covid-19.

The following is a brief overview of the system of (inter)action (shown in Figure 1). All (inter)actions within the online world begin with a Goal. Goals may be directional or non-directional. A directional goal is one in which a presenter delivers content to an audience, as in a concert or a lecture for example. A non-directional goal has two functions. First, it provokes discussion and thus establishes dialogue as in, for example, a student discussion group or a reading group. Second, it creates co-constructed knowledge as in, for example, a collaborative composition or a group assessment. The primary difference between discussion and co-construction is the construction of knowledge. The slanted brackets indicate that these categories of goals exist on a spectrum – for example, discussion may be a necessary precursor to co-construction as it provokes dialogue which leads to the creation of new knowledge.

One's goals will influence the Flow of an (inter)action. Here, Tempo and Mode a closely interlinked. Tempo refers to the speed with which (inter)actions are performed. Tempo sits on a spectrum between immediate, as in live chat, and delayed, as in forum posts or responsive artwork. Mode refers to how the (inter)action is performed (e.g. writing a blog post or creating an image). Some modes allow for engagement through Manipulation (e.g. games and virtual reality) while others allow for engagement through Exchange (e.g. writing, images and "reactions" to posts). Modes are often combined in fluid ways as indicated by the slanted brackets (e.g. as in the simultaneous use of chat and text while playing a game). The desired Tempo of an (inter)action may influence the choice of mode (e.g. a Zoom call – audio visual – to achieve immediate (inter)action). Conversely, a desired Mode may influence the Tempo (e.g. it may only be possible to use text chat, which will influence rate of (inter)action). Mode and Tempo are inextricably linked and contribute to the Flow of the (inter)action.

The Flow of an (inter)action shapes the Medium (what we have above called the platform) in which that (inter)action is performed. In creative industries associated with organisations, especially education and research, mediums may be Institutionally mediated. For example, LMS and internal communication systems. These mediums are typically designed to be fit for a wide variety of purposes, of which creative industries is only one. Public mediums may be commercial, such as YouTube or Slack, or open source, such as GitHub Pages or blogs. Mediums can often sit between commercial and open source, such as Flicker which allows for scaled back free accounts, or Slack which does not incur a fee but data has a limited retention period. Ultimately, it is the Goal and Flow of the (inter)action which influences the Medium used and thus the location of the data trace. For example, if you are looking for data traces

of collaborative composition, you are more likely to find these in Mediums which allow for non-directional (inter)action and a Flow with a close to immediate tempo that utilises Modes which mirror the goal of the activity (e.g. preference for audio and visual over graphic).
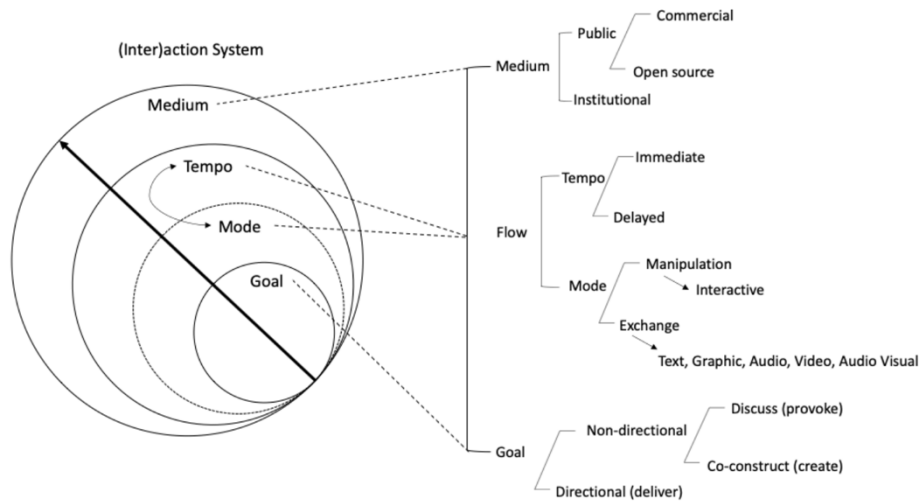

Figure 1. (Inter)action system. View this figure at https://doi.org/10.26188/13198433.

Goal	Tool	Affordances	Usage	Data Trace	Alternatives
Communication, collaboration and process	Zoom	talking in real time, sharing screen (showing), chat.	We are holding fortnightly team meetings using Zoom, alternating with fortnightly discussion meetings. Smaller sub-groups of team members also meet via Zoom as needed. The use of videoconferencing technology for meetings was necessitated by COVID-19, but has also allowed us to record meetings, both for the benefit of those who are unable to attend, for later analysis, and to incorporate into research outputs. We share screens within Zoom in order to demonstrate visualisations and work through data structures. We share links in the Zoom chat, both to our own documents, and to potential data sources, examples of visualisations, and useful tools. The Zoom white board and annotation features have provided us with a mechanism for conducting visual retrospectives to reflect on our progress to date and brainstorm where to go next.	Audio and video recordings; Transactional time series data (call history); Chat text	Teams, Skype

| Communication, collaboration and process | Microsoft Teams | channels, posts, comments, upload files, reactions | Outside of meetings, we communicate with one another through chat in Teams. We have a collaboration Teams site, with a number of different channels for things like links and resources and upskilling. Most the chat takes place in the general channel. The Teams site also services as the repository for many of the documents, data files, and research records associated with the collaboration. In the Files section of Teams we have a folder structure for storing all of the collaboration documentation. The files stored here are living documents and can be collaboratively edited by all members of the team. They are often created on the fly, shared, and edited during Zoom meetings. The downside to Teams is that there is little transparency over how it displays certain file types (eg. whether it plays animated gifs posted in chat) and its tendency to automatically rename plain text files to remove the .txt file extension. It is also not clear how or whether it is possible to export chat text from Teams. We've used Team's chat for data exploration, with quick data visualisations posted for discussion that leads to questions that lead further data visualisations. | Number of posts; Number of posts in channels; Number of comments to posts (through all modes, vid, text etc); Kinds of files uploaded (vid, text, etc); Like buttons | Slack channels has features for keeping track of different conversation threads but without the integration into the MS tools it would have been harder to collaborate. |

Communication, collaboration and process	Microsoft SharePoint	file upload, file structure, collaborative writing, version control, track changes	Microsoft SharePoint integrates with the Teams site we use for collaboration and is used for file storage. Files stored in SharePoint can be edited using versions of Microsoft products that integrate with the Teams Desktop application or with the browser or can be edited in the authoring application.	Audit log; Files; Folder structure	Share drive, Mediaflux
Communication, collaboration and process	Microsoft Word	text, collaborative writing	Notes of team meetings and drafts of documents have been written in Microsoft Word, stored in SharePoint, and edited collaboratively through Teams.	Text (formatted)	In some cases, for documents that are intended to become research outputs that will be shared openly, the team considered using markdown with Git to author the document, but ended up opting for Word, primarily out of familiarity.
Communication, collaboration and process	Microsoft PowerPoint	Video, image, text, collaboration	We use Powerpoint to create presentations, graphics, and gifs		
Communication, collaboration and process	Microsoft Outlook	emails, calendar invites.	We use outlook for meeting scheduling and more fomal communications.	Calendars – meeting attendance; Communication	

Communication, collaboration and process	Microsoft Excel	Structuring infromation, data storage	Excel was chosen for collecting the metadata about the surveys of interest. We decided on the data dictionary as a team, which we documented in the second sheet, and this data dictionary formed the column headings of the first sheet, which is where the survey metadata was entered.		We could have used survey tools such as Qualtrics or Google Forms, connected to Google Sheets, to gather this data, but it was felt that it would take too much effort to set these up, and that Excel was located with and fit the working practices we already had in place for this collaboration, as well as being a familiar tool.
Communication, collaboration and process	GitLab	Time stamping, assigning people to tasks, text, ranking	GitLab Issues are being used to manage tasks and activities.	Commit history (git log)	GitHub. We chose to use GitLab because it is hosted and managed by the University of Melbourne, whereas GitHub is hosted on public servers that are not located in Australia.
Data analysis and visualisation	Voyant	image, analysis	We are using Voyant (https://voyant.tinker.edu.au/) for exploratory visualisations of text corpora with a graphical user interface and no coding required. This is an instance of the open source Voyant Tools environment (https://voyant-tools.org/) that is locally hosted on Australian servers.		Python and R give control over where the data is hosted, a more private, but slower, option for visualising data.

Data analysis and visualisation	Jupyter Notebooks	text editor, display visualisations, analysis, data wrangling	Some data exploration is using python in a Jupyter notebook. This allows us to meet our obligation to protect the sensitive data that is being shared with the project team.	R has similar capabilities for data exploration but we don't have the same familiarity with the language.
Data analysis and visualisation	Unity	3D experience	Unity is a 3D development platform and game engine that we are using to create an environment in which to develop 3D data visualisations. These will be then be transferred over into Mozilla Hubs for presentation and exploration.	
Sharing research and outputs	Omeka	Displaying outputs, structuring collections, Omeka pages	An Omeka site (https://omeka.cloud.unimelb.edu.au/datacreative /) is being used to showcase research data and outputs as an online gallery. We intend to integrate Omeka with figshare, so that research outputs that are hosted in figshare can be displayed as part of the Omeka gallery.	

Sharing research and outputs	Figshare	structuring collections, upload files (data, images, etc), mint a DOI.	Research outputs such as curated datasets and data visualisations will be deposited in the University of Melbourne's institutional figshare repository (https://melbourne.figshare.com/). This enables them to receive a DOI so that they are citable, and an embed code, so that they can be embedded into an Omeka gallery or a GitLab Page.	Views; Downloads; AltMetrics Research outputs such as curated datasets and data visualisations will be deposited in the University of Melbourne's institutional figshare repository (https://melbourne.figshare.com/). This enables them to receive a DOI so that they are citable, and an embed code, so that they can be embedded into an Omeka gallery or a GitLab Page.	Zenodo, OSF, Dryad, figshare.com, etc. We chose to use the data repository that is hosted and supported by the University. A member of the collaboration team is a systems administrator for figshare and can assist with working out how to use it most effectively, including raising support tickets with the vendors and thinking about integrations with other platforms, such as Omeka.
Sharing research and outputs	GitLab	Video, image, text, collaboration	GitLab Pages are being used to display static data visualisations.	Commit history (git log)	GitHub. We chose to use GitLab because it is hosted and managed by the University of Melbourne, whereas GitHub is hosted on public servers that are not located in Australia.

Sharing research and outputs	Wordpress	text, image	Selected members of the collaboration have access to post on the SoTEL blog. This is a Wordpress blog, hosted on the University of Melbourne website (https://blogs.unimelb.edu.au/sotel/datacreativities/datacreativities-about/).		Blogger, GitLab Pages. WordPress is familiar and easy to use, is supported by the University, and was already in use by one member of the research collaboration for another project, so it was relatively easy to start using it for this collaboration too.
Sharing research and outputs	Twitter	text, like, retweet, hashtag	Individual team members who have Twitter accounts tweet about their research, both while it is in progress and when research outputs are shared publicly, using the hashtag #DataCreatives. This allows members of the research collaboration to connect with the broader research and creative arts community, discuss ideas as they are developing, and generate data feedback loops, as well as feeding the results of the research back to the wider research and arts communities.	Number of retweets; Text from comments; Location of tweets (kind of)	Mastodon. The creative and research audience for this collaboration use the Twitter platform.
Sharing research and outputs	Mozilla Hubs	3D experience	We are planning to use this as a space for sharing and exploring the 3D data visualisations created in Unity.		