

Section A		
Institution: Durham University		
Unit of Assessment: 29 - Classics		
Title of case study: Open Access to Ancient Greek and Latin through <i>Diogenes</i>		
Period when the underpinning research was undertaken: Between 1 January 2000 and 31 December 2020		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s): Peter Heslin	Role(s) (e.g. job title): Professor of Classics and Ancient History	Period(s) employed by submitting HEI: 2000 – present
Period when the claimed impact occurred: Between 1 January 2014 and 31 December 2020		
Is this case study continued from a case study submitted in 2014? No		
Section B		
1. Summary of the impact		
<p><i>Diogenes</i> is free, open-source software which enables people around the world to access in digital form the totality of classical Greek and Latin literature, along with integrated morphology and lexica for language learners. <i>Diogenes</i> has transformed the ability of readers in many countries to encounter and engage with classical literature in the original languages. The mechanism for this impact comes via: (a) Version 3 of <i>Diogenes</i>, which remained in use during the present impact period; (b) Version 4 of <i>Diogenes</i>, a major rewrite released in September 2019; (c) a completely new webapp for phones and tablets, <i>DiogenesWeb</i> released in 2020.</p>		
2. Underpinning research		
<p>This is not a case study continued from REF2014 according to strict REF criteria, for it includes new types of impact and new beneficiaries; but Version 3 of <i>Diogenes</i> was submitted as an ICS to REF2014 and continued in use during the current period.</p>		
<p>a) Research on Latin poetry and its Greek sources. All versions of the <i>Diogenes</i> software have been entirely written by Heslin. As documented in the REF2014 impact case study, the genesis of <i>Diogenes</i> arose in the course of his research while writing the <i>Transvestite Achilles</i> [R1], when he realised that existing tools for searching the standard databases of Latin and Greek texts available at the time gave incomplete and erroneous results. Since then, the Packard Humanities Institute has made its corpus of Latin texts available via its website, but its search interface is primitive and insufficient for answering complex questions. The rewrite of <i>Diogenes</i> that led to the release of Version 4 happened in response to and in order to facilitate its continuing daily use by Heslin in the course of writing <i>Propertius, Greek Myth, and Virgil</i> [R2]. The substantial improvements made to the user interface of Version 4, listed below, arose from that work.</p>		
<p>b) <i>Diogenes</i> as Research. As noted in the REF2014 impact case study, <i>Diogenes</i> is simultaneously a research output itself (it was submitted as such to RAE2001, [R3]), and a mechanism for transmitting the impact of that research to its users. Decoding and reverse-engineering the metadata and formatting codes of the archaic databases, which remain in a largely undocumented binary format, was a massive research project, the result of which is embedded in the software and its documentation [R3]. Another output of that research effort is [R4]. The most important new feature in Version 4, which required very significant effort, is the ability to export all of that metadata and formatting information in the ubiquitous modern standard for textual representation, which is TEI-compliant XML. This will serve to future-proof the Latin and Greek text databases, which were created long ago at very great labour and cost, by translating the information encoded there into a format that will be legible long into the future. It opens entirely new horizons of possibility for these indispensable corpora. In more immediate terms, it permitted the development of the <i>DiogenesWeb</i> app for handheld devices, which takes that XML data and feeds it to a browser on a phone or tablet for conversion into HTML for display. Creating this XML output functionality required fresh investigation into the formatting codes of the archaic databases and how they relate to the</p>		

formatting conventions of scholarly editions. This is fundamentally a research question that requires experience and expert knowledge of all the conventions of printed works of classical scholarship as well as of best practices in digital markup. The result of this effort is embodied in the code (specifically the file xml-export.pl).

c) Dissemination of Research Insights. As referenced in the REF2014 impact case study, Heslin disseminated the research insights of his work on *Diogenes* in a series of publications. This has continued since 2014. An article, “The Dream of a Universal Variorum: Digitizing the Tradition” [R5], builds upon Heslin’s experience in developing *Diogenes* to envision a future successor that would weave together not only texts and lexica but also the historic commentary tradition.

3. References to the research

[R1]. Peter Heslin, *The Transvestite Achilles: Gender and Genre in the Achilleid of Statius* (Cambridge University Press 2005). DOI: [10.1017/CBO9780511482236](https://doi.org/10.1017/CBO9780511482236)

[R2]. Peter Heslin, *Propertius, Greek Myth, and Virgil: Rivalry, Allegory, and Polemic* (Oxford University Press 2018). DOI: [10.1093/oso/9780199541577.001.0001](https://doi.org/10.1093/oso/9780199541577.001.0001)

[R3]. Peter Heslin, *Diogenes* (2000–2020). Full source-code with documentation is available on GitHub (<https://github.com/pjheslin/diogenes>). Direct link to the new XML export code: <https://github.com/pjheslin/diogenes/blob/master/server/xml-export.pl>

[R4]. Peter Heslin, Review article on Thesaurus Linguae Graecae, CD-ROM Disk E. Bryn Mawr Classical Review (2001.09.23): <http://bmcr.brynmawr.edu/2001/2001-09-23.html>.

[R5]. Peter Heslin, “The Dream of a Universal Variorum: Digitizing the Tradition” in *Classical Commentaries: Explorations in a Scholarly Genre*, C. S. Kraus and C. Stray (eds.), pp. 494-511 (Oxford University Press 2015). DOI: [10.1093/acprof:oso/9780199688982.001.0001](https://doi.org/10.1093/acprof:oso/9780199688982.001.0001)

Evidence of quality

[R1] and [R2] are both peer-reviewed monographs published by major academic presses, and have been recognised in published international reviews as research outputs of major significance. [R1] was submitted to RAE2008 and [R2] is being submitted to the current REF. An earlier version of [R3] was submitted as a research output to RAE2001. It was officially recommended for use by the American Philological Association in 2005. [R4] is a lengthy, peer-reviewed article commissioned by a leading review journal. [R5] was commissioned for a peer-reviewed collection of essays by significant international figures in the field, published by a major academic press.

4. Details of the impact

Summary.

There are several collections of Latin and Greek texts available on the Internet, and various tools to help read them, but none of them, apart from *Diogenes*, combines access to the full range of classical literature with sophisticated search functionality and tight integration of the best available morphological and lexicographical tools. This puts the totality of ancient literature along with the tools to engage fully with those texts at the fingertips of people with an interest in classical languages, from secondary students to pensioners, all over the world, especially in developing nations where access to printed resources is more limited; thus they can become better readers of the classics. The evidence for this international societal impact is both quantitative and qualitative. The quantitative evidence comes from webserver logs and the qualitative evidence comes from a recent survey of *Diogenes* users and from unsolicited correspondence from teachers, students and members of the general public [E1].

Chronology. Version 3 of *Diogenes*, which was submitted to REF2014 as an impact case study, had a browser-like front-end based upon a software component that was deprecated by the Mozilla project in 2015. Despite its destined obsolescence, Version 3 continued to be downloaded and remained in active use until late 2019. The present impact case study is primarily based, however, upon two subsequent developments: Version 4 of *Diogenes* and a new project, *DiogenesWeb*. Creating Version 4 of *Diogenes* entailed pulling the old Mozilla code out of Version 3 and replacing it with a new interface which is based upon Google Chrome; this should be supported for many years to come. Version 4 also brought a redesigned user interface and added a major new capability: exporting texts in a modern XML format. This permitted the creation of *DiogenesWeb*, a webapp that was designed to provide

the two features most commonly requested by users of *Diogenes* over the years: an app that would work on phones and tablets, and the ability to use it with other corpora of texts.

New benefits of Version 4.

Version 4 includes a redesigned, modern user interface, which reflects feedback from users of Version 3; the new interface is much cleaner, more intuitive and provides better hints, which help the user to frame requests for information about usage and collocations more accurately. It comes with many new capabilities beyond XML output, most of which were added at user request. A major new feature is close integration with the *Thesaurus Linguae Latinae*, the most authoritative lexicon of the Latin language; clicking on a Latin word in *Diogenes* then brings up the correct page of the correct volume of the *TLL*. Other significant new features include: quick searching through a single author; Greek text searches are now chronologically ordered; and it has corrected versions of the LSJ Greek lexicon and the Lewis and Short Latin lexicon.

New benefits of DiogenesWeb.

Diogenes users have long requested an app that will work on phones and tablets; the new XML export feature has finally made this possible. Now *Diogenes* users can upload either their favourite texts or the entire PHI/TLG corpora to their private cloud storage in XML format and read them on their handheld devices with the same links to morphological analysis and lexica as those provided by the desktop application. Another frequent request has been to extend the *Diogenes* interface to additional texts, and in response to that demand *DiogenesWeb* has added support for three open-access corpora: Perseus, The First Thousand Years of Greek, and DigiLibLT (late antique Latin).

Quantitative Evidence of Impact

Version 3. Version 3.1.6 has been downloaded 24,325 times since 2014. Version 3.2, which was released in October 2014, was downloaded 18,405 times from the Durham website between January 2018 and April 2019 [E3]. The top countries in terms of downloads of 3.2 were: **China, USA, Italy, Greece** and **Germany**, showing the international reach of the impact. The nature of the impact of Version 3 on its beneficiaries is documented in the REF2014 ICS, and that impact continued into the current period until it was superseded by Version 4.

Version 4. The new *Diogenes* website has been expressly designed to capture information regarding whether the identity of its users qualify its impact for REF. The website asks people before downloading Version 4 of the desktop application or using *DiogenesWeb* to self-identify as academics or research postgraduates on the one hand, or as students or members of the general public on the other. Through the end of 2020, 9,616 people had downloaded Version 4 of *Diogenes*, of which 4,401, or 46% were non-academics. Among those users, the top countries represented are (as inferred from IP geolocation): **Germany, USA, UK, Brazil** and **Japan** [E4].

DiogenesWeb. In the first year that *DiogenesWeb* has been operating, between 23 December 2019 and 31 December 2020, users have downloaded 22,745 Latin and Greek texts, of which 13,178 or 58% were read by users who did not identify as academics or postgraduates. In that same period, users looked up 305,811 words, of which 205,447 or 67% of the queries were by non-researchers. The geographical spread of usage is similar to that for Version 4, but slightly different: **USA, Germany** and the **UK, Brazil** and **Ireland** [E5]. The new, impact-specific question asked by the new website, a feature not available for REF2014, provides firm quantitative evidence that, in addition to researchers in Classics, a very large number students and non-academic users around the world also use *Diogenes*. Note that for reasons of privacy users are not otherwise tracked, which limits the nature of the quantitative data that can be collected.

Qualitative Evidence of Impact

Written feedback shows that beneficiaries value the following features of *Diogenes*: flexibility and power in searching; unified, portable access to large textual corpora and large lexica; convenience; speed; a well-designed user interface; and that it is free.

Diogenes is used by secondary and undergraduate students the world over, particularly in developing nations. **Mexico**: “I would describe *Diogenes*’ role in my academic life as substantial. It has had a very positive impact in my life.” **Mexico**: “Before I used to consult the university’s library for some works, but they do not have all authors we need ... And now I live far away from the university ... I hope it continues to exist, cause this is a big help to students from countries like Mexico, where we have less access to the classics.” **Turkey**: “I’m ... an undergraduate classical philology student at Istanbul University ... when I updated *Diogenes* [to Version 4], I simply gasped. It is very obvious that you ... worked very hard for this ... Layout is very glamorous ..., search options are responding much faster and efficient..., the beautiful LSJ not hanging up at the top but *going along with the text* ... I sincerely thank you for this beautiful tool and making it available for all.” **Brazil**: “Nunc possum multo celerius et commodius non modo legere textus Latinos atque Graecos, sed etiam eos vertere in Lusitanicum sermonem” (Now I can more quickly and accurately not only read Latin and Greek texts, but also translate them into Portuguese) [E1].

British and **European** students agree. “I wanted to thank you for your amazing software, *Diogenes*. It helped me throughout secondary school in Spain and I use it daily for my University course. I also wanted to say that the new 4.0 version is great...!”; “Much faster, easier to manoeuvre and more accessible anywhere (don’t have to carry a big book around)”; “It has made my work smoother”; “Much quicker, easier, more efficient”. For some students *Diogenes* is their primary means to access classical texts and lexica while in Covid-19 lockdown: “because the access to ancient texts in *Diogenes* is so easy, my students read through them more eagerly (especially now, when using the library is impossible)” [E1]. *Diogenes* is used not only by students, but also used by professionals in the cultural sector: “Although not a classicist by trade (I’m a translator), I use this tool every single day. It has made my life richer and fuller, giving me unprecedented access to so many ancient works, not to mention the ease of consulting LSJ or Lewis and Short with a single click. It truly is in a league of its own”. Another writes: “The usefulness of *Diogenes* when translating became especially evident with the integration of *OLD* and *TLL* ... I’m currently translating Cicero’s *De natura deorum* into Estonian [E1].

A **Chinese** correspondent highlights that, in contrast to most online tools, the desktop application is entirely self-contained and does not require an Internet connection for any of its functionality: “I am writing to express my gratitude for your writing the *Diogenes* desktop application, which helped me a great deal in my mostly solitary study and the search environment you provide is a godsend for an independent scholar who cannot always afford *TLG* online access I can speak from experience from my visits to my native China, where there are many, many students and scholars interested in western Classical languages ... yet the government tries to make access to the outside Internet as slow and high-latency as they could ... This means that projects like *Diogenes* Desktop application ... [are] extremely useful for scholars, a kind of Samizdat for Classics for people behind the Great Firewall.” [E1].

A **German** teacher of Classics also highlights the self-contained nature of the desktop application, but for different reasons, as it means that he can take *Diogenes* anywhere, even on class trips to southern Italy: “For anyone dealing with ancient Greek or Latin texts *Diogenes* is of great use, but especially for students and those teaching students. You can’t do with a textbook or a mere digitized ‘online text’, what one can do (or demonstrate) with *Diogenes*: (1) preparing texts by analysing grammar ... (2) studying semantic fields ... not a long time ago this would have taken months and even years of reading, what now can be accomplished in minutes; (3) studying historical linguistics by observing how Greek or Latin word meanings and grammar changed over time ... (4) deconstructing literary and intertextual codes in Greek and Roman poetry ..., military and sexual vocabulary, etc. ...; (5)

it's 'portable' and it's 'all there': all the corpora ... on a single computational device locally installed - now it's possible even with handhelds/mobiles! No rocket science needed. My students use it (installed on an old tiny laptop) all the time during our trips to the south of Italy while deciphering (mural) inscriptions in Pompeii and Herculaneum...." [E1].

Teachers who have used *Diogenes* for many years were relieved when Version 4 came out, ensuring its continued viability. A retired teacher from **Australia** writes: "I taught Latin and ancient Greek for many years and during that time made pretty heavy use of *Diogenes* ... I was worried that it might be on the point of becoming obsolete. So I was relieved to see that a new version is out. I think it's very important that *Diogenes* be properly supported. For a lot of us involved in Classical Studies *TLG* and *PHI* transformed the way we interact with ancient texts—they made it much, much easier to follow leads and lines of interest out into other texts. *Diogenes* has been simply the best available tool in this endeavour." [E1].

A teacher from the **USA** notes the benefits of *DiogenesWeb* for students who may not go to the trouble of installing the desktop application: "None of my students, so far as I know, has their own personal ... *TLG* or *PHI* corpus on their computers, so the development of the *DiogenesWeb* app has been a very good thing ... I use *Diogenes* ... to search various words and phrases across corpora so as to introduce comparative instances in the classroom ... both to demonstrate the above kinds of inquiries and to answer 'live' questions in the classroom as they occur ... I noticed that students in my Greek Prose Composition class ... who self-reported their own use of *Diogenes* tended to do much better on the assignments." [E1].

This latter observation that students who are encouraged to use *Diogenes* become better readers of Latin and Greek through being challenged to engage with the full spectrum of linguistic usage is echoed by other teachers. **Netherlands**: "I teach full-time in University (undergraduate) and in school (gymnasium), and occasionally in teacher training ... I consistently recommend using *Diogenes* in this way to prospective teachers and TAs. Based on targeted assignment results, I am quite happy to vouch that using *Diogenes* makes students, at any level of study, better classicists: more independent, versatile, self-reliant, resourceful and critical." **USA**: "I use *Diogenes* in class all the time ... Sometimes I project this on a screen for all to see; other times I have some individual student do the searching/looking up and then report back ... All of this really helps sharpen our collective understanding of a text: we don't have to guess, we can directly consult all the evidence ... [It's] an amazing way to check our intuitions and sharpen our understanding of Greek/Latin. My students often rely on *Diogenes* in writing their final papers, and I'd say that it allows them to reach a standard of knowledge that would otherwise take them far longer. *Diogenes* helps students achieve the results that would take a professional scholar with an enormous memory a lifetime of reading -- and helps them achieve those results in a manageable amount of time. This is remarkable." [E1].

5. Sources to corroborate the impact

[E1]. *Diogenes* 4 user survey.

A spreadsheet showing responses to a survey of users of Version 4 of *Diogenes*, which was conducted in March 2020 and advertised over email, Twitter and other social media; and email correspondence with users.

[E2]. Download figures for Version 3.1.6.

Download figures for Version 3.1.6 from the old *Diogenes* download website.

[E3]. Download figures for Version 3.2

University of Durham web server logs for the old *Diogenes* website showing downloads of Version 3.2 for 2018–19 and the code used to generate the statistics.

[E4]. Download figures for Version 4.

Web server logs for the new *Diogenes* website and the code used to generate the statistics.

[E5]. Access figures for *DiogenesWeb*.

Web server logs for *DiogenesWeb* and the code used to generate the statistics.