Studia graeco-arabica

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Cover

Mašhad, Kitābḫāna-i Āsitān-i Quds-i Raḍawī 300, f. 1v
Paris, Bibliothèque nationale de France, *grec* 1853, f. 186v

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Tools for Research

The quest for 'Falsehood', or a survey of Tools for the Study of Greek-Syriac-Arabic translations.

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Abstract
This article surveys the tools available for those interested in the study of Greek-Syriac-Arabic translations of Greek scientific literature. Presenting both standard printed works and the available digital databases, it identifies the respective advantages and disadvantages of each. Thereafter, it sets out the work-in-progress of the ERC project Transmission of Classical Scientific and Philosophical Literature from Greek into Syriac and Arabic (HUNAYNNET). The remit of this project is to offer a new approach for research into translation techniques and into the history of the transmission of classical Greek literature in Late Antiquity and the Middle Ages, building upon the methods of digital philology and computational linguistics.

Philitas' Quest[1]

I. Available resources relating to Graeco-Arabic translation studies

The trilingual text corpus HUNAYNNET presents the first attempt to create an aligned Greek, Syriac and Arabic corpus. In order to assess its level of innovation, it is worth sketching the principal differences between HUNAYNNET and other relevant resources, currently four in number.[2]

1. *A Greek & Arabic Lexicon (GALex): Materials for a Dictionary of the Mediæval Translations from Greek into Arabic*.[3] The first systematic lexicographic investigation of the Graeco-Arabic translations and their vocabulary was launched by Gerhard Endress (Ruhr Universität Bochum) and Dimitri Gutas (Yale University, New Haven). The results of their (still on-going) research were published in the form of a printed analytical reference dictionary, arranged according to the alphabetical order of the Arabic roots. Each root is allocated separate paragraphs for the derivational verbal stems and the various nominal forms pertaining to that root, while each paragraph is again subdivided according to the different Greek words actually translated in the Arabic texts by the headword of the paragraph.

For example, an imaginary user (let us call him Philitas), in general terms interested in logical terminology and, more particularly, in the transmission of Aristotle's *Organon*, who would like to know in which texts the Arabic word *bāṭilun* and its adverbial derivative *bāṭilan* ('false, void, worthless') are used to render the concept of 'falsehood', will consult the dictionary at the last part of the root *B-Ṭ-L*. There he finds the relevant paragraph

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[1] The following examples draw on the provisional shape of the corpus as of 23 October 2019.

[2] It is not possible to do justice to the manifold advantages and valuable scientific contributions of these projects within these few pages. In what follows, we present only a very limited number of playfully selected illustrations as to how to make use of their results, in order to elaborate on the basis of these examples some innovative aspects of HUNAYNNET.

[3] G. Endress - D. Gutas (eds.), *A Greek and Arabic Lexicon (GALex). Materials for a Dictionary of the Mediaeval Translations from Greek into Arabic, Handbook of Oriental Studies. Section 1: The Near and Middle East, vol. 11*, Brill, Leiden [etc.] 1992–; *GALex*, Vol. I: ﺍ to ﺃﻱ. Vol. II: ﺏ to ﺑﻴﻦ.

stretching over eight pages,[4] listing in all 27 different Greek words translated as *bāṭilun/bāṭilan* alone or through compound expressions combined with other Arabic words. Each of these 27 correspondences is illustrated by citations of relevant passages from the Greek and Arabic texts (*Belegstellen*), the number and diversity of which naturally varies depending on the frequency of attestations recorded in the corpus on which the dictionary builds. Among other things, Philitas will understand from sections 2.2-2.4 of this paragraph that *bāṭilun/bāṭilan* was used in at least three different texts – namely the translations of Aristotle's *De Interpretatione* and *De Caelo*, and Themistius' commentary on Aristotle's *De Anima* – as an equivalent for the Greek ψεῦδος ('falsehood'), and additionally in two other texts in order to translate the adverb ψευδῶς ('falsely') (2.3), or the verb ψεύδομαι ('to lie') (2.4). The relevant page, *GALex* vol. II, p. 320, looks as follows (framing added):

بطل   [320]   *bṭl*

bāṭilun 829.10 ⊷ ἀνάγκη τὸ αὐτὸ ἀπειράκις νοεῖν, ψευδὴς ἄρα ἡ τοιαύτη ὑπόθεσις *Philop. In De an. 128.10* = fa-l-šayʾu l-wāḥidu taʿlamuhu <l-nafsu> mirāran kaṯīratan wa-hāḏa bāṭilun *199.13* ⊷ τότε τις σοφὸς ἀνὴρ ἐπέστησεν, ὡς δεῖ ψευδεῖ λόγῳ τυφλῶσαι τὴν ἀλήθειαν *Ps.-Plut. Placita 298a23* = qaṣada raǧulun ḥakīmun li-iṣlāḥi ḏālika bi-an ʿamiya (*sc.* al-nāsu) ʿani l-ḥaqqi bi-bāṭilin waḍaʿahū *13.4*; οἱ Στωικοὶ τὰς μὲν αἰσθήσεις ἀληθεῖς, τῶν δὲ φαντασιῶν τὰς μὲν ἀληθεῖς, τὰς δὲ ψευδεῖς. Ἐπίκουρος ... τῶν ... δοξῶν τὰς μὲν ἀληθεῖς, τὰς δὲ ψευδεῖς *396a5, 8* = ammā aṣḥābu l-riwāqi fa-yarawna anna l-ḥawāssa ḥaqqun wa-anna l-taḫayyulāti minhā ḥaqqun wa-minhā bāṭilun wa-ammā Abīqūrus fa-yarā anna ... mina l-ārāʾi mā huwa ḥaqqun wa-minhā mā huwa bāṭilun *53.20,22*.

2.2 ψεῦδος (*falsehood*) **(a)** *abs.* : οἷον τὸ ἄνθρωπος ἢ λευκόν ... οὔτε γὰρ ψεῦδος οὔτε ἀληθές πω *Arist. Int. 1, 16a15* = miṯālu ḏālika qawlunā insānun aw bayāḍun ... fa-innahū laysa huwa baʿdu ḥaqqan wa-lā bāṭilan *100.4 / fol. 179a13*; τοῦτο δὲ ψεῦδος *13, 22b36* = wa-hāḏā ayḍan bāṭilun *128.5 / fol. 189b12*; *14, 23b4* = *130.18 / fol. 190b8*; *etc.* ⊷

οὐ γὰρ οἷόν τε πρὸς τὸ φανὲν ψεῦδος μὴ ἀνανεῦσαι *Them. In De an. 88.40* = fa-innahū laysa yumkinunā allā naǧḥada mā ẓahara lanā annahū bāṭilun *155.7*; ἐν οἷς οὔπω τὸ ἀληθὲς ἢ τὸ ψεῦδός ἐστι *109.7* = allatī lā yakūnu fīhā baʿdu lā l-ḥaqqu wa-lā l-bāṭilu *198.12*; ἔστι μέντοι καθάπερ τῇ αἰσθήσει τὸ ἡδὺ καὶ τὸ λυπηρόν, οὕτως αὖ πάλιν τῷ θεωρητικῷ τὸ ἀληθὲς καὶ τὸ ψεῦδος, τὸ ἀληθὲς μὲν ἀντὶ τοῦ ἀγαθοῦ, τὸ ψεῦδος δὲ ἀντὶ τοῦ κακοῦ *114.5-6* = wa-kamā li-l-ḥissi l-laḏīḏu wa-l-muʾḏī ka-ḏālika ayḍan li-l-naẓariyyi l-ḥaqqu wa-l-bāṭilu fa-l-ḥaqqu makāna l-ḫayri wa-l-bāṭilu makāna l-šarri *208.6-7*; *109.8* = *198.14*; *112.11-13* = *204.19-205.1*; *etc.* **(b)** *in hend.* kiḏbun bāṭilun : τοῦτο δ' ὅτι ψεῦδος, φανερόν *Arist. Cael. III 8, 307a18* = fa-hāḏā kiḏbun wa-bāṭilun *353.7 Badawī*.

2.3 ψευδῶς *adv.* (*falsely*) = *in hend.* kāḏibun wa-bāṭilun : ἀφροσύνης δέ ἐστι ... τὸ ψευδῶς δοξάζειν περὶ τῶν εἰς τὸν βίον ἀγαθῶν καὶ καλῶν *Ps.-Arist. Virt. 6, 1250b45* = wa-ammā afʿālu l-ǧahli fa-... an ... yataqallaba (*sc.* al-insānu) fī l-ahwāʾi l-kāḏibati wa-l-ārāʾi l-bāṭilati *versio Q 42.23*.

2.4 ψεύδομαι (*to be untrue, false*) : οὐδὲ λύειν ἅπαντα προσήκει, ἀλλ' ἢ ὅσα ἐκ τῶν ἀρχῶν τις ἐπιδεικνὺς ψεύδεται *Arist. Phys. I 2, 185a15* = fa-innahū laysa yanbaǧī an nanquḍa (*sic leg. pro* tunqaḍa *ed.*) kullahā bal innamā yanbaǧī an naqṣida bi-l-naqḍi minhā li-mā kāna bayānuhū mabniyyan ʿalā l-mabādiʾi illā annahū bāṭilun *8.12**.

Fig. 1. *GALex* entry for the Greek ψεῦδος

Philitas is happy with the reference to Aristotle's *De Interpretatione*, yet slightly disappointed to find nothing on the correspondence of ψεῦδος with *bāṭilun* in other texts of the Aristotelian *Organon*. He is also curious as to which other Arabic words were used to render ψεῦδος and looks up the 'Greek-Arabic Glossary' at the end of this dictionary, which refers him directly back to the section reproduced above:[5] tools available

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Ψ

ψαύω *c. gen.* : balaġa 1.10 [II, 551]

ψευδής : bāṭilan 2.1 [II, 319-320]

ψευδογραφέω : *sem. etym.*; rasama šaklan bāṭilan (bāṭilan 2.5) [II, 321]

ψεῦδος : bāṭilan (bāṭilan 2.2a) [II, 320]; *in hend.*; kaḏibun bāṭilun (bāṭilun 2.2b) [II, 320] ⊢ *adv.* ψευδῶς : *in hend.*; kāḏibun wa-bāṭilun (bāṭilun 2.3) [II, 320]
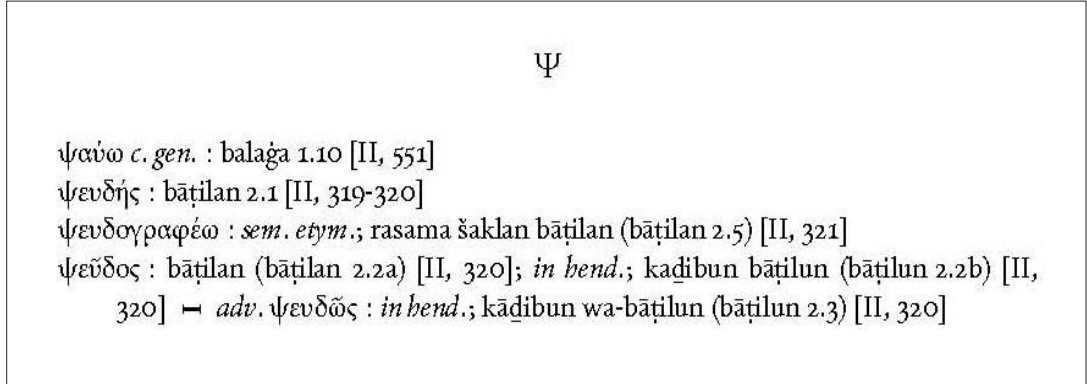

Fig. 2 *GALex* – Greek-Arabic Glossary entry for ψεῦδος

Since *GALex* so far covers only Arabic roots beginning with *Alif* and *Bāʾ*, the first two letters of the Arabic alphabet, the 'Greek-Arabic-Glossary' only contains references to words recorded in this part of the lexicon. In our case, all references for ψεῦδος go to *bāṭilun/bāṭilan* (i.e. expressions containing this word), whereas the Greek word may have been translated by means of other Arabic words not yet included in the dictionary. However, Philitas may now turn for further research to one of the following tools.

2. *Wörterbuch zu den griechisch-arabischen Übersetzungen des 9. Jahrhunderts (WGAÜ)*.[6] Another printed reference dictionary of the Graeco-Arabic translations was published by Manfred Ullmann (Eberhard Karls Universität Tübingen) in four volumes between 2002 and 2018. It differs from the *GALex* in five main respects: (a) it is based on another text corpus (in general more medical and fewer philosophical works, including also some non-scientific, e.g. religious texts); (b) its entries are arranged not according to Arabic roots and lexemes, but according to Greek headwords in the order of the Greek alphabet; (c) each headword is immediately followed by the relevant Greek and Arabic *Belegstellen*, in other words, it is up to the user to reconstruct from these which Arabic word actually corresponds to the Greek headword in question (by contrast, the correspondence is made explicit in each case in the *GALex*, often accompanied by information on the translation technique, e.g. paraphrastic style, the figure of hendiadys, etc.); (d) the arrangement according to the Greek lemmata means that that Arabic lexemes which can be reconstructed as equivalents of the Greek headwords pertain to roots from all over the Arabic alphabet (as opposed to the Arabic lemmata of the *GALex*, that are taken from Arabic roots beginning with *Alif* or *Bāʾ* only); (e) while the *GALex* additionally includes detailed analyses of Arabic conjunctions, prepositions and particles, the *WGAÜ* is rather cursory regarding these word classes.

Since this dictionary is composed of a main volume and a three-volume supplement, Philitas will need to look up ψεῦδος twice, with the following results (framing added):

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[5] *GALex* (above, n. 2), vol. II, p. 852.

[6] M. Ullmann, *Wörterbuch zu den griechisch-arabischen Übersetzungen des 9. Jahrhunderts (WGAÜ). Suppl. Band I: A–O, Supplement Band II: Π–Ω, Suppl. Band II: Zur Agronomie*, Harrassowitz, Wiesbaden 2006, 2007, 2018.

Fig. 3 *WGAÜ* entry for ψεῦδος (main volume)   Fig. 4 *WGAÜ* entry for ψεῦδος (supplement)

Instead of *bāṭilun*/*bāṭilan*, *WGAÜ* displays the noun *kaḏibun* and the adjective *kāḏibun* as equivalents of ψεῦδος. In addition, the references are taken from other texts, now from an Arabic translation of Pseudo-Menander's gnomic verses (*Monostichoi*) and the New Testament. As to Philitas' special interest in Aristotle's *Organon*, the *WGAÜ* does not help at all, as this group of works does not figure among the texts taken into consideration by Ullmann. Nevertheless, Philitas may again choose the opposite approach and look up *bāṭilun*/*bāṭilan* in the Arabic-Greek index at the end of *WGAÜ* and its supplements, where he encounters three further Greek equivalents not recorded in the *GALex*:

Fig. 5 *WGAÜ* index entry for *bāṭilun*/*bāṭilan* (main volume) Fig. 6 *WGAÜ* index entry for *bāṭilun*/*bāṭilan* (supplement)

Apart from these two printed reference dictionaries, there are also the following two digital tools at Philitas' disposal.

3. *The Glossarium Græco-Arabicum (GlossGA)*,[7] an open-access online database, was established at Ruhr Universität Bochum by Gerhard Endress, Rüdiger Arnzen and Yury Arzhanov with the support of Torsten Röder. From 1994 to 2006, it was supported by the German Research Foundation (Deutsche Forschungsgemeinschaft). Since 2010, it has been established as a research unit of the project *Greek into Arabic - Philosophical Concepts and Linguistic Bridges*,[8] funded by the European Research Council, and directed by Cristina D'Ancona (University of Pisa), Gerhard Endress (RUB Bochum) and Andrea Bozzi (ILC-CNR Pisa). This lexical database makes available digital representations of the file cards prepared for, though not yet processed in *GALex* (cf. above, § 1). It makes it possible to search for Greek and Arabic lexemes besides offering various combined search strategies (e.g. Arabic Root + Part of Speech [PoS], Greek/Arabic Lexeme + Selected Work[s], Truncation, etc.). A simple search for *bāṭilun* generates the following result:

Fig. 7 *GlossGA* search results for *bāṭilun*

Since the *GlossGA* aims at providing the materials not yet covered in the *GALex*, the results for the Arabic root B-Ṭ-L, already treated in the *GALex* vol. II, are as might be expected rather limited. Nonetheless, our imaginary user Philitas can gather from the above list that the correspondence *bāṭilun* = ψεῦδος is also attested twice in the Arabic translation of Aristotle's *Physics*. A mouse-click on these correspondences will provide Philitas with detailed information about the exact place of its occurrence, the part of speech of the Greek and Arabic lexemes, the Arabic root, as well as brief quotations from the context (pericopes) as in the following example (framing added):[9]

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7   http://telota.bbaw.de/glossga (retrieved on 23 October 2019).
8   ERC Advanced Grant 249431. Cf. http://www.greekintoarabic.eu/ (retrieved on 23 October 2019).
9   *GlossGA*, retrieved on 23 October 2019: http://telota.bbaw.de/glossga/glossary.php?id=210986.

Fig. 8 *GlossGA* entry for the correspondence ψεῦδος/*bāṭilun*

Furthermore, the rubric 'Cumulative Views' on the lower right of the screen interface provides a facility for displaying a brief comparative overview of the two corresponding lexemes. Selecting 'ψεῦδος | باطل' (cf. frame above) produces the following table, the left side of which notes the Greek lexemes rendered by *bāṭilun* and the sources of attestation (as are hitherto recorded in the *GlossGA*), while the right column contains conversely the different Arabic roots used for the translation of ψεῦδος, together with information on the part of speech and the sources of attestation:

Fig. 9 *GlossGA* view of the correspondece ψεῦδος/*bāṭilun*

Philitas understands from this overview that the nominal and adjectival derivatives of the root *K-Ḏ-B*, which he has encountered already in the *WGAÜ* as equivalents of ψεῦδος in non-scientific texts, are additionally attested in this function in three texts pertaining to the Aristotelian *Organon* (in the *De Interpretatione*, as well as in the *Categories* and *Analytica priora*). Besides the *GlossGA*, Philitas will find an additional tool for his research in the *G2A Web Application*,[10] a text database created by the team of A. Bozzi in Pisa as part of the above-mentioned ERC project *Greek into Arabic - Philosophical Concepts and Linguistic Bridges*. The database contains the Arabic adaptations of Plotinus' *Enneads* – namely, the pseudo-*Theology of Aristotle* (*Kitāb Uṯūlūǧiyā*), the *Epistle on the Divine Science* (*Risāla fī l-ʿIlm al-ilāhī*), and the *Sayings of the Greek Sage* (*al-Šayḫ al-Yūnānī*) –, as well as part of the Arabic version of Aristotle's *Metaphysics* (*Kitāb Mā baʿd al-ṭabīʿat*). The *G2A Web Application* offers the possibility to search 1) for an Arabic lexeme, 2) for a Greek lexeme, 3) for both Greek and Arabic lexemes present in the parallel pericopes. A simple search for باطل in the text of the *Theology of Aristotle* brings the following results:

Fig. 9a Search results for باطل in the *G2A Web Application*

Given a rather paraphrastic nature of the pseudo-*Theology of Aristotle*, Philitas is nevertheless thrilled to find out that Arabic *bāṭilun* could be used to render Greek μάτην ('in vain, idly').

4. *A Digital Corpus for Graeco-Arabic Studies (DCGAS).*[11] Unlike the three above-mentioned tools, the *DCGAS* provides actual texts rather than dictionary-like lexicographical entries. Initiated and maintained by Mark J. Schiefsky (Harvard University, Cambridge, MA), Gregory R. Crane (Universität Leipzig) and Uwe Vagelpohl (University of Warwick), this open-access corpus contains not only works preserved in Greek and Arabic versions, but also Greek texts for which no Arabic translation is extant, as well as others that were originally composed in Arabic. Of the total of 230 Greek and Arabic works accessible at *DCGAS*, 36 works

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[10] http://www.g2a.ilc.cnr.it (retrieved on 23 October 2019).
[11] https://www.graeco-arabic-studies.org (retrieved on 23 October 2019).

can be viewed in both versions in parallel columns. Like the corpora taken into consideration in the *GALex* and *GlossGA*, this bilingual corpus consists mainly of medical, mathematical, and philosophical writings. The bibliographical list of sources informs the user about the editions utilised in generating]the digital corpus.[12] Conspicuously, the creators of the corpus chose – possibly for reasons of copyright – often old, outdated editions, e.g. I. Bekker for the Aristotelian corpus and É. Littré's edition of Hippocrates' works, though more reliable recent editions are available.

Checking the bibliography for Aristotle's *De Interpretatione*, Philitas learns here that he can view the Greek text as edited by I. Bekker and published in 1837 in Oxford, and the Arabic translation either in the edition of I. Pollak (Leipzig, 1913) or of ʿA. Badawī (Cairo, 1948).

The parallel reading interface of the *DCGAS* always provides pairs of texts, either a Greek and an Arabic edition aligned at the level of chapters or – in cases where various editions of the same text have been digitised – either two Greek or two Arabic editions (it is not possible to display simultaneously two Arabic editions or translations next to the translated Greek text). On selecting Badawī's 1948 edition, the opening page of Aristotle's *De Interpretatione* appears with Greek and Arabic versions side by side, as follows:

Fig. 10 *DCGAS* parallel reading interface

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[12] *DCGAS*, retrieved on 23 October 2019: https://www.graeco-arabic-studies.org/texts.html.

Here Philitas can easily compare the Greek and Arabic versions, some advantages of which immediately leap out. The textual or terminological comparison is not restricted to the *Belegstelle* or pericope quoted in the lexicographical resources, but may take into consideration on a larger contextual scale all kinds of doctrinal, logical and other corollaries for the whole chapter. The alignment provided by the editors of the corpus, makes it much easier to locate and compare parallel text units (in this case chapters) in both languages than by having the two relevant printed editions side by side. On the other hand, doing exactly this reveals a number of serious disparities between a text-based corpus such as the *DCGAS* and the use of printed editions. This becomes clear if we look at the same section of Aristotelian work displayed in Fig. 11 in the printed editions by L. Minio-Paluello[13] and Badawī[14] (framing added):

Fig. 11: Greek (left) and Arabic (right) printed editions of *De Interpretatione*

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[13] Arist., *De Int.*, p. 49 Minio-Paluello (cf. Aristotelis *Categoriae et Liber de interpretatione*, ed. L. Minio-Paluello, Clarendon Press, Oxford 1949).

[14] ʻA. Badawī, *Manṭiq Arisṭū*, vol. 1, Dār al-Kutūb al-Miṣriyya, al-Qāhira 1948.

Three sets of important data contained in the printed Greek edition (marked here by frames) are not visible in its digital counterpart. These are, in a clockwise direction: (i) the so-called Bekker numbering (the conventional standard for references to page, column and line of all Aristotelian works); (ii) the page numbers of Minio-Paluello's edition; and (iii) the critical apparatus, which indicates disparities between manuscripts, variant readings, etc. Likewise, the printed version of Badawī's edition contains additional information not reproduced in the *DCGAS*: (i) page numbers; (ii) the folio number + *recto/verso* of the only extant Arabic manuscript used by Badawī; and (iii) the footnotes which, on some pages, also contain critical notes on difficult readings, alternative readings in the margins of the manuscript, etc. Some of this data is crucial for a careful comparison of the two versions, while some is essential for the reader's orientation and for exact references to particular places in either text. For example, Philitas – taking advantage of the *DCGAS* for his research on the concept of 'falsehood' in Aristotle's Organon – encounters in the first chapter of the *De Interpretatione* the correspondence *bāṭilun* = ψεῦδος. The corresponding Greek and Arabic clauses in question, framed in Fig. 12, are exactly the same as those quoted as *Belegstelle* in the *GALex* (cf. above, Fig. 2):

Aristotle, *De Interpretatione* 1, 16a14-16:

οἷον τὸ ἄνθρωπος ἢ λευκόν … οὔτε γὰρ ψεῦδος οὔτε ἀληθές πω

مثال ذلك قولنا إنسان أو بياض … فإنّه ليس هو بعدُ حقًّا ولا باطلاً

However, while *GALex* gives both Bekker numbers for the Greek text and folio as well as page and line numbers for the Arabic text, Philitas will not be able to figure out the precise place of his finding in the *DCGAS* without having recourse to the printed editions. Since the critical apparatus is not displayed in the *DCGAS*, he is further kept from the following important information provided there by Minio-Paluello (cf. Fig. 11, left hand side, penultimate line): '15-16 ἀληθὲς … ψεῦδός ΣΛΓ'. This note tells the reader that the testimonies ΣΛΓ read in lines 15-16 οὔτε γὰρ ἀληθὲς οὔτε ψεῦδός instead of οὔτε γὰρ ψεῦδος οὔτε ἀληθές. Σ and Γ are sigla for two Syriac translations of Aristotle's *De Interpretatione*, and Λ stands for the Latin translation by Boethius. This information is deeply interesting not only for the reconstruction of the Greek text, but also because the inversion of the word order is perfectly mirrored in the Arabic translation confronting the *DCGAS*-user, which has not been taken into consideration by Minio-Paluello.

Another useful tool of the *DCGAS* is the search interface that provides the possibility of searching all the texts in the corpus. A query leads to positive results only if it is entered in the exact inflected form in which a particular Greek or Arabic word occurs in the texts (e.g. the query 'باطل' finds this identical form, but not the forms باطلاً or الباطل). Alternatively, the search can be filtered by choosing a specific period of time, works by a particular author, a particular 'domain' (e.g. astronomy), or a text type (e.g. translation or commentary). Thus, Philitas in search of 'falsehood' in Aristotle's *Organon* may launch a query for 'باطل' with filters 'Aristotle' under the rubric 'Author', 'Logic' as domain, and 'Translation' [as text type], achieving the following result:

Fig. 12 Results of search for باطل in Aristotle's *Organon* in *DGAS*

In this way Philitas finds four more attestations of the lexeme in the 10th-century Arabic translation of Aristotle's *Topica* not recorded in the previous three tools, as well as three references to the *De Interpretatione*. However, a closer look at the sections of 3-4 lines displayed in the list of results reveals that none of them contains the word searched for.

The reason for this is that the results list does not display the proper context of the queried lexeme, but only the first lines of the page on which it occurs. In other words, Philitas has to take the further step of selecting one of the headers in this list, in order to view in a new window the entire page where at some place or other (no highlighting or other emphasis) he may spot the word he is searching for. The corresponding section of the Greek text is not shown in this window, and nor does Philitas receive any information about the relevant chapter number or the Bekker numbers of the Greek text relating to the Arabic text in front of him.

Having learned from Minio-Paluello's edition of *De Interpretatione* of the existence of the Syriac versions, Philitas may well find it worthwhile turning his attention to the available resources for the Graeco-Syriac translations. Regrettably, the situation in that field is dramatically poorer than in Graeco-Arabic studies, with no reference tools at hand besides the glossaries for individual texts.[15] This hypothetical survey shows that there are evident limitations of the available resources for the study of Syriac and Arabic translations from Greek:

1. discrepancies between the printed editions and the online presentations of the texts;
2. a lack of tools for the comparative study of Syriac and Arabic translations from Greek;
3. difficulties in combining philological and computational approaches to the texts.

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[15] A recently launched Digital Syriac Corpus (https://syriaccorpus.org/, retrieved on 23 October 2019) contains for the most part texts originally composed in Syriac. In the case of translations, they are not associated with their originals.

II. Philitas' Quest Improved

1. Using HUNAYNNET[16]

The Project HUNAYNNET aims to bring together in the form of an aligned text corpus the texts that have so far largely remained detached from each other in the preceding projects.[17] Hence, Philitas finds it felicitous that among the major novelties of HUNAYNNET is the inclusion of Syriac and Arabic translations in such a way that the original Greek texts and their Syriac and Arabic translations can be displayed in aligned parallel columns and thereby studied together in all three languages.

At the time of writing, Aristotle's *Categoriae*, *De Interpretatione* and *Analytica priora*, as well as the *De mundo*, Porphyry's *Isagoge* and a part of Galen's *Ars medica* (*Ars parva*) in all their available Syriac and Arabic versions have been completed. Thus, Philitas may retrieve Aristotle's *De Interpretatione* in Greek, Syriac and Arabic as follows:[18]
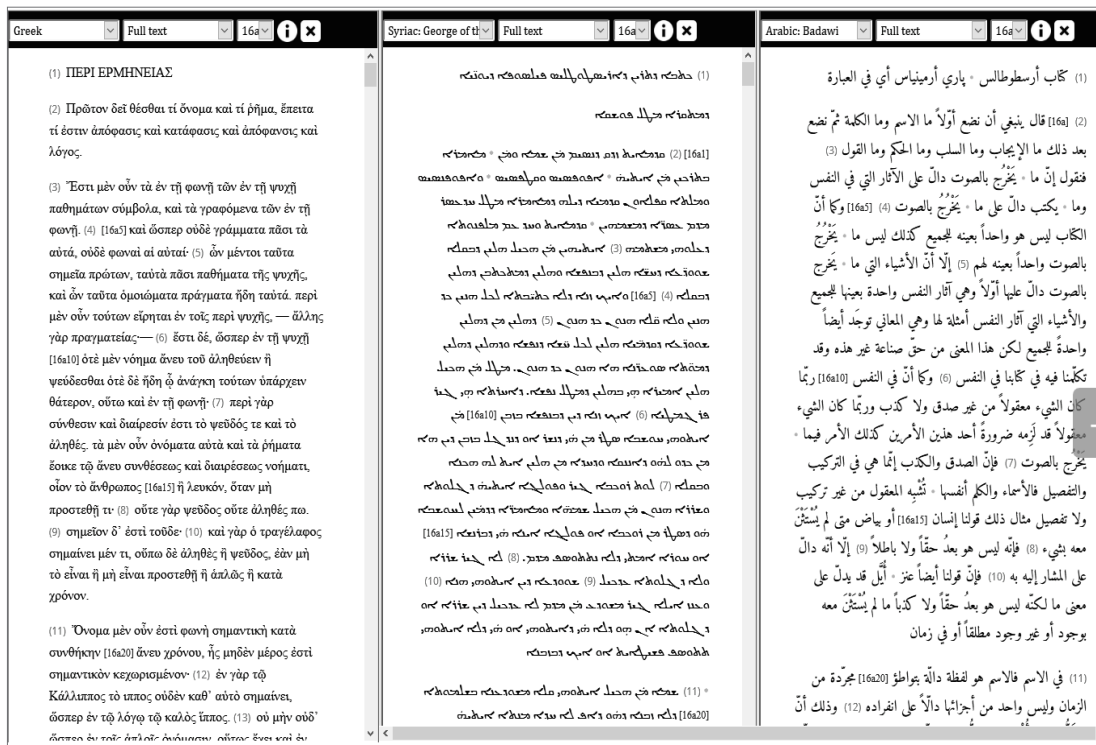

Fig. 13 Aristotle's *De Interpretatione* in the reading interface

As this particular work is extant not only in a single Syriac and a single Arabic translation, but rather in two versions each, Philitas may actually view and compare all five versions by means of 'add parallel version' at the upper right corner, opening a window for selecting the Syriac and Arabic versions to be displayed. Unlike the *DCGAS*, the Greek text is taken from the OCT edition by Minio-Paluello; as for the Syriac and Arabic, all texts have been normalized (abbreviations resolved, homographs disambiguated; *shadda*s, *hamza*s and other

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[16] <https://hunaynnet.oeaw.ac.at/> (retrieved on 23 October 2019).

[17] For a more detailed description of the project see: R. Arnzen - Y. Arzhanov - N. Bamballi - S. Čéplö - G. Kessel, "Coding and Encoding: Towards a New Approach to the Study of Syriac and Arabic Translations of Greek Scientific and Philosophical Texts", *Comparative Oriental Manuscript Studies Bulletin* 4 (2018), pp. 205-13.

[18] <https://hunaynnet.oeaw.ac.at/de_interpretatione.html> (retrieved on 23 October 2019).

orthographic features of Arabic supplied; all *seyame* in Syriac included, etc.) in order to allow a more accurate and at the same time user-friendly reading of the texts.

The Syriac and Arabic versions contain in addition to the chapter numbers (in the column header) the Bekker numbers (provided every fifth line in blue characters in square brackets) to facilitate orientation and referencing. Another major advantage of HUNAYNNET lies in the fact that the aligned sections (consecutively numbered in magenta characters) are limited to smaller units of meaning, i.e. (sub- or co-ordinate) clauses or sentences, similar to the *Belegstellen* provided in the above-mentioned dictionaries *GALex* and *WGAÜ*. Thus, Philitas, spotting one of the words *bāṭilun* or ψεῦδος in the Arabic or Greek texts in front of him, may move the cursor to the relevant aligned section in any desired version, in order to generate automatic highlighting of the parallel sections in all versions and languages. The result for unit (8) in the text displayed in Fig. 14, which contains once again the clause dealt with above in the *GALex* and *DCGAS* (cf. Fig. 1, 10), will look like this:

Fig. 14 An example of sync unit highlight in the reading interface

As compared with the previous tools, in addition to the Greek and Arabic pericopes also made available is the corresponding section of the Syriac translation by George, Bishop of the Arabs (d. 724), referred to in the critical apparatus of Minio-Paluello under the siglum Γ. As just mentioned, the reading interface of HUNAYNNET provides the opportunity also to display the second, anonymous Syriac version (Σ) taken into consideration by Minio-Paluello, which has for ψεῦδος the same Syriac word (ܕܓܠܘܬܐ) as the translation by George. Likewise, if Philitas uses this method to check the terminology in the second (fragmentary) Arabic version, he shall immediately see that its author preferred for the translation of ψεῦδος the root *K-D̲-B* (using another root again for the antonym ἀληθής), which we have already encountered – though in other works – in the *WGAÜ* (cf. Fig. 3-4) and *GlossGA* (cf. Fig. 9):
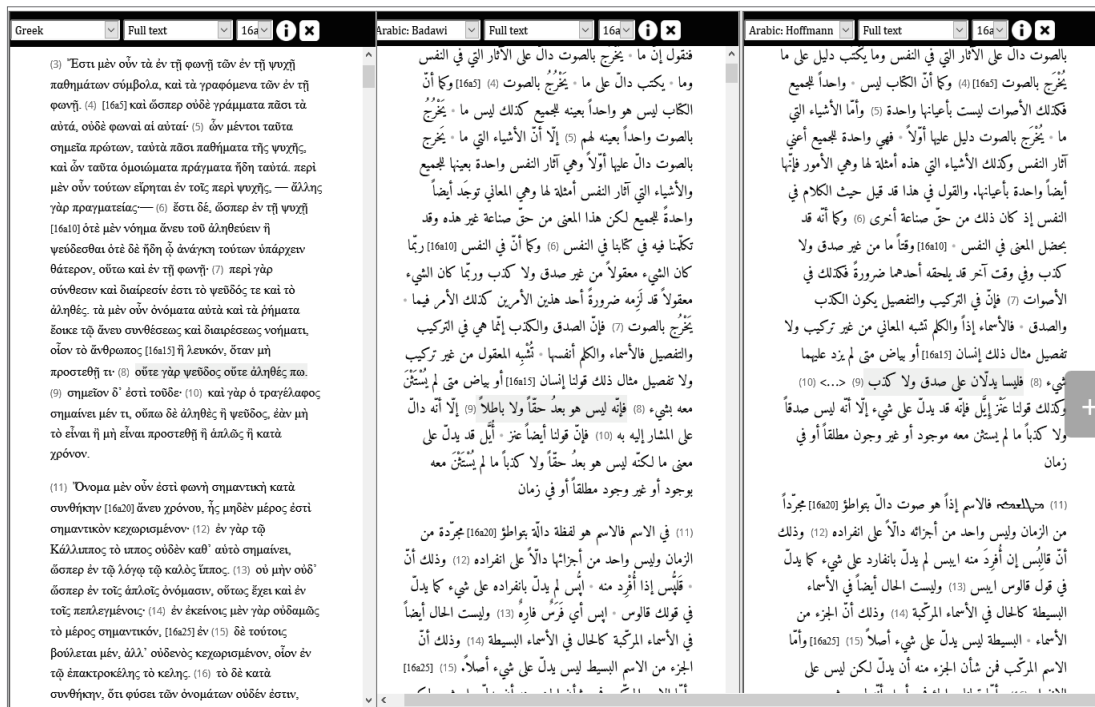
Fig. 15: Comparison of two Arabic translations in the reading interface

Furthermore, Philitas can infer from a comparison of the highlighted sections that both Arabic versions agree with the two Syriac versions in inverting the order of ψεῦδος … ἀληθές, as indicated in the Greek apparatus. Another important improvement concerns the apparatus added by the editors of the Syriac and Arabic texts. Such notes are not visible in the reading interface of the *DCGAS* (cf. Fig. 10). In HUNAYNNET they are accessible and provide text-critical information in relation to the text, for instance, about modifications introduced by the editor, as well as variant readings.

As for the lexicographic study of the text corpus, it has been noted above that HUNAYNNET essentially provides two different options. One involves simply double-clicking on any chosen word in any language, thus triggering different morphological and part-of-speech analyzers, such as the Greek Word Study Tool by Perseus, the Syriac Electronic Data Research Archive (SEDRA) and ElixirFM for Modern Standard Arabic. The results achieved by this method provide the user with tokenization, part-of-speech assignment and a basic analysis of morphology, together with information on the meaning of the word in question (albeit derived from corpora and periods other than the scientific works translated and the translator's own). Once the entire Greek-Syriac-Arabic corpus has been prepared for HUNAYNNET, it should be able to offer more appropriate analyses for the Syriac and Arabic words, which to a great extent will be done manually. For the time being, Philitas can apply the above-mentioned morphological analyzers to his study of 'falsehood' in unit (8) of the *De Interpretatione* (cf. Fig. 15).

The other option available for users is the Linguistic Corpus, created on the basis of NoSketchEngine (NoSkE),[19] which is an open-source corpus management tool designed especially for the linguistic study of text corpora. With this tool, Philitas can for instance generate complete word lists for each of the texts contained in HUNAYNNET (including frequency data etc.), every item of which might be turned by a simple mouse-click into a document displaying the appropriate pericopes of all occurrences of the word in question. Or he may launch truncated queries such as *باطل*, in what NoSkE refers to as a "phrase" query

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[19] Cf. <https://nlp.fi.muni.cz/trac/noske> (retrieved on 23 October 2019).

(which finds *bāṭil* with and without the definite article as well as with and without case or gender ending), or even search for the lemma باطل (using the "lemma" query in NoSkE) in combination with the option to generate a complete concordance of aligned sections. Using the latter option, the result for Aristotle's *De Interpretatione* will look as follows:

Fig. 16 Search results for باطل in NoSkE

Again, this and other query types, as well as the modes of displaying the results, are still in need of further refinement. However, they already provide even in their current provisional state powerful instruments for the lexicological and philological investigation of scientific translations from Greek into Syriac and Arabic.

Philitas then has a moment of realization: بل only appears in Isḥāq ibn Ḥunayn's translation after synchronization unit 102, i.e. in chapters 8-14, while for the portion of the text for which we have two Arabic versions (chapters 1-7), this conjunction is never used. As Philitas' query above shows, the conjunction بل is attested 27 times and by bringing up the number in the 'frequency' column and studying the results, Philitas can pose the conjecture that بل is the term used to translate the Greek conjunction ἀλλά. This hypothesis can be quickly checked using the parallel query interface of NoSkE: Philitas runs a query searching in HUNAYNNET_ara1 for بل, at the same time looking at only those aligned units in Greek which do not contain /ἀλλ./ (a regular expression where the dot stands for any character, so that both ἀλλά and ἀλλ' in crasis are covered):

Fig. 19 Parallel corpus search in NoSkE

Now, naturally Philitas is aware that this query will not provide him with the answer to the question as to which Arabic word translates which Greek word (for such an insight is not contained in the data, but rather must be gleaned from it). It will only show which Arabic synchronization units containing بل correspond to Greek synchronization units not containing ἀλλ. As it turns out, even this approximation is sufficient to

confirm his observation, as there are only two instances out of 27 (one in chapter 11 and one in chapter 14) where the Arabic text has بل, but the corresponding Greek text does not feature ἀλλ.:

Query بل, ἀλλ. 2 > Filter by aligned corpus 2 (263.50 per million) ⓘ	
HUNAYNNET_ara1	**HUNAYNNET_gre**
Chapter 11,216 1	بل نقول إنّه متى وجد ذلك فيه فهو أبداً غير صادق ومتى `<s>` Chapter 11,216 `<s>` ἢ ὅταν μὲν ἐνυπάρχῃ, ἀεὶ οὐκ ἀληθές, ὅταν `</s>` لم يوجد فليس أبداً يصدق δὲ μὴ ἐνυπάρχῃ, οὐκ ἀεὶ ἀληθές · `</s>`
Chapter 14,325 2	وذلك أنّ الاعتقاد فى خير أنّه خير والاعتقاد فى شرّ أنّه `<s>` Chapter 14,325 `<s>` τοῦ γὰρ ἀγαθοῦ ὅτι ἀγαθὸν καὶ τοῦ κακοῦ شرّ خليق أن يكون واحداً بعينه بل هو حقّ واحداً كان أو أكثر ὅτι κακὸν ἡ αὐτὴ ἴσως καὶ ἀληθής, εἴτε πλείους `</s>` من واحد εἴτε μία ἐστίν · `</s>`

Fig. 20 Results of the above query

But wait, thinks Philitas, there surely must be instances of ἀλλ. in chapter 1-7 where the Arabic translation does not feature بل ! Off he goes to find some and – sure enough – he finds 19 occurrences in chapters 1-7, none of which are translated by بل, arriving at this surprising insight:

	بل co-ocurs with ἀλλ.	بل does not co-occur with ἀλλ.
Chapter 1-7	0	19
Chapter 8-14	25	2

Being statistically inclined, Philitas can conduct a classic chi-squared independence test which will confirm that this finding is statistically significant. All this may suggest to Philitas that his finding is not a pure coincidence but reflects a relationship between the two Arabic versions. To be more precise, it is now possible to formulate a working hypothesis that the version of Isḥāq ibn Ḥunayn depends on the anonymous Arabic version. Moreover, even based only on the achieved results, Philitas might argue the following: first, that the anonymous Arabic version was never complete (or at least not in the complete form available to later users); and, second, that the anonymous version preceded the version attributed to Isḥāq ibn Ḥunayn. We do not know if Philitas is going to conduct a further analysis in order to prove this hypothesis or not. Without the corpus tools made available to him through the HUNAYNNET project, Philitas may have never been able to arrive at these insights, but now he feels that he can make interesting findings on a daily basis.

We hope to have illustrated how HUNAYNNET allows its users to approach the Syriac and Arabic translations in a way that has never been available before. The tools that HUNAYNNET is going to offer will help to verify many widely accepted assumptions about translations' authorship and possible Syriac intermediary versions, as well as to propose new interpretations. Moreover, it should be possible to study systematically the translation techniques of a particular translation or of a particular translator, and to survey the development of translation methods. And last but not least, one of the practical applications of corpus-based analysis is its assistance in the establishment of critical texts by means of contrastive analysis of given words and expressions. We hope that a corpus-based approach will offer a solid foundation for in-depth analysis of such questions, and thereby bring the study of the Syriac and Arabic translations to a qualitatively new level.