

Historical perspectives on forms of English dialogue

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*Reasoning, Rhetoric and Dialogue in Galileo's Mathematical Discourses**

by Elisabetta Lonati & Kim Grego

1. The reception of Galilean thought in (Early) Modern England

This study analyses the two English versions of Galileo Galilei's *Discorsi e Dimostrazioni Matematiche, intorno a due nuove scienze* (1638, henceforth *Discorsi*), issued in England in 1665 and in 1730 respectively. The first is a translation by Thomas Salusbury, Esq.; the second is by Thomas Weston, Master of the Academy of Greenwich. The topic, as reported in the title pages of both versions, is *Two New Sciences* concerning *Mechanicks and Local Motion* (1665/1730). The new ideas and approaches to reality expressed in this work were «more favourably received [...] by Englishmen than by men of any other nation outside Italy» (Drake 1999b: 236-237). It is no accident that, following the establishment of the Royal Society (1662), «many of Galileo's books were published [...] through the monumental labors of the mysterious Thomas Salusbury» (Drake 1999b: 247). Nor is it a coincidence that the two English translations preceded by far any other modern language version in Europe¹.

1.1. The source text

The original manuscript of Galileo's *Discorsi* was written some time between 1602 and 1637², during the life imprisonment following the Inquisi-

* Elisabetta Lonati is responsible for paragraphs § 1, 1.2., 1.4., 1.5, 1.5.2., 2., Kim Grego for paragraphs § 1.1., 1.3., 1.5.1, 3., 4.

1. For a detailed discussion on Galileo Galilei's works and language, with particular reference to the English translations, see Drake (1958, 1999a and 1999b); Gotti (2000); Zeitlin (1959).

2. Drake (1989: vii): «The only source of information about Galileo's experimental work

tion's condemnation of his 1632 *Dialogo* [...] *sopra i due Massimi Sistemi del Mondo* (henceforth *Dialogo*)³. From the scientist's Tuscan captivity, his *Discorsi* reached the more tolerant Leiden, where they were first printed in 1638 (Drake 1980/2001: 104). The last and «most demanding of Galileo's books» (Swerdlow & Levere, in Drake, 1999a: xiii) is now acknowledged as having paved the way for modern physics from Newton to Einstein⁴ by addressing key physical-philosophical topics such as motion, the classical matter-vs.-void antithesis and infinity.

There is no ultimate evidence that the two English translations derive from the same Italian edition, if only because the two translators lived in different historical periods and a great amount of Galileo's works in Italian had been circulating in London since the end of the 17th century⁵.

However, previous studies may suggest the opposite. For instance, a study carried out by Drake (1958: 26) on Salusbury's technique in his 1661 translation of Galileo's *Dialogo* (1632) highlights that «in his own edition Salusbury was meticulously faithful to his original, and never edited out or deliberately omitted a word of Galileo's text». The same approach to the original text of the *Dialogo* is also emphasised by Gotti (2000). He points out that Salusbury is extremely faithful in reproducing the source text at both the lexical and the morpho-syntactic levels:

the sentences are usually translated in a very similar form, and only minor alterations in word order or syntactic construction are made in order to satisfy specific rules which diverge in the two languages (Gotti 2000: 91).

Obviously enough, these remarks cannot be directly transferred to Galileo's *Mathematical Discourses and Demonstrations touching Two New Sciences* (1665, henceforth *Discourses*,) as analysed here. Nonetheless, they

is volume 72 of the Galilean manuscripts at the National Central Library of Florence. Into that volume were bound, in no discernible ordering, Galileo's working papers on motion from 1602 to 1637, the eve of publication of *Two New Sciences*».

3. *Dialogo di Galileo Galilei Linceo* [...] *Dove ne i congressi di Quattro giornate si discorre sopra due massimi sistemi del mondo Tolemaico, e Copernicano*; [...] In Firenze, 1632, translated by Thomas Salusbury and included in the first tome of his *Mathematical Collections* with the title *The Systeme of the World: in Four Dialogues. Wherein the Two Grand Systemes of Ptolomy and Copernicus are largely discoursed of* [...] by Galileus Galileus. London, 1661.

4. Hawking (1988/1989: 189-190): «Galileo, perhaps more than any single person, was responsible for the birth of modern science. [...] It was this work, referred to as *Two New Sciences*, even more than his support for Copernicus, that was to be the genesis of modern physics».

5. For an in-depth discussion on the reception, translation and publication of Galileo's works in England, and London in particular, see Drake (1999b).

can be useful in outlining Salusbury's adherence to the 1632 edition, which makes it very likely that the source edition he used was precisely the first Elzevier edition published in Leiden in 1638. The comparison of some examples⁶ supports this interpretation of Salusbury's methodology:

Elzevier ed. 1638

SALV. A questo rispose il S.Sagr. che pur si pagavano tutti i particolari Soldati con danari raccolti da imposizioni generali di soldi, e di quattrini, se bene un Million d'oro non bastava à pagar tutto l'esercito. (pp. 19-20)

Salusbury's transl. 1665

SALV. To this *Sagredus* answereth, That every particular Souldier is still paid with money collected by the general Impositions of Shillings and Pence, although a Million of Gold sufficeth not to pay the Whole Army. (p. 16)

Elzevier ed. 1638

SAGR. La speculazione mi par tanto gentile, e peregrina, che io quando ben potessi, non me gli vorrei opporre, che mi parrebbe un mezzo sacrilegio lacerar si bella struttura calpestandola con qualche pedantesco affronto; però per intera soddisfazione recateci pur la prova, che dite Geometrica [...]. (p. 30)

Salusbury's transl. 1665

SAGR. The Speculation is, in my esteem, so quaint and curious, that, for my part, though I could, yet would I not oppose it, for I take it for a piece of Sacrilege to deface so fine a Structure, by spurning at it with any pedantic contradiction; yet for our entire satisfaction, give us the proof (which you say is Geometrical) [...]. (p. 24)

Elzevier ed. 1638

SIMP. Io gusto del vostro trattar, come fate talora, con qualche piacevolezza; & al quesito vi rispondo, che la facilità mi parrebbe grande più che à bastanza, quando il risolverla in punti non fusse più laborioso, che in dividerla in mille parti. (p. 37)

Salusbury's transl. 1665

I am pleased with your way of arguing, as you now do mix it with some pleasantness: and to your question I reply, that the facility would seem more than sufficient, if the resolving it into Points were but as easie, as to divide it into a thousand parts. (p. 30)

Elzevier ed. 1638

SIMP. Io resto interamente appagato; e mi credano certo, che s'io havessi à ricominciare i miei studii, vorrei seguire il consiglio di Platone, e cominciarli dalle Matematiche, le quali veggo che procedono molto scrupolosamente, ne vogliono ammetter per sicuro fuor che quello, che concludentemente dimostrano. (p. 91)

Salusbury's transl. 1665

SIMP. I am wholly satisfied: and verily believe, that if I were to begin my Studies again, I should follow the Counsel of *Plato*, and enter my self first in the Mathematicks, which

6. More examples may be found in the Appendix.

I see to proceed very scrupulously, and refuse to admit anything for certain, save that which they necessarily demonstrate. (pp. 74-75)

In the preface to his 1730 translation of Galileo's *Discorsi* (titled *Mathematical Discourses concerning Two New Sciences*, henceforth *Discourses*₂), on the other hand, Thomas Weston indicates as the reason why a new translation was "much desired and promoted" the fact that Mr Salusbury's version had by that time "become very scarce" (*Discourses*₂, Translator's Preface, TP, v). 'Scarcity', here, is to be understood as 'rarity', since the Great Fire of 1666 had destroyed a great amount of books, including Salusbury's (Drake 1999b, p. 247). Therefore, he adds, "In Consequence whereof I now make publick a Second Translation (done from *Elzevir* Edition of the *Italian*)" (*ibidem*), that is to say the same first edition issued in Leiden in 1638 which Salusbury translated in 1665 (see previous examples and Appendix for the Italian version).

Weston meant his second translation to

be (as I presume my Friends expect it should be) neater, and more agreeable to the present Taste, and less obscure than the former [...] The only Objection to our Author, as I have heard of, is, that he is too prolix (*Discourses*₂, TP, vi-vii).

The first translation's obscurity and Galileo's own 'prolixity' urged Weston to adopt a completely different approach to Salusbury's and to adapt the original Italian text to contemporary taste.

Weston's transl. 1730

SALV. To this *Sagredus* answers; Altho' a Million of Gold suffices not to pay a whole Army, that yet each single Soldier may be paid with Monies collected from the general Tax or Subsidy of Shillings and Pence. (p. 28)

SAGR. This Speculation seems to me so curious, that I would not contradict it, methinks, tho' I could; for I take it for a kind of Sacrilege to deface so fine a Structure, or to trace, pursue, or examine it with any pedantic Remarks. But, however, for entire Satisfaction, pray give us the Demonstration, which you say is Geometrical, [...]. (pp. 43-44)

SIMP. I can't say but I am pleas'd with the Method you talk of; and to your Question I reply, That I should think it more than sufficiently easy, if a Line could be as readily divided into Points, as into a thousand Parts. (p. 54)

SIMP. I am throughly satisfied, and, believe me, were I to begin my Studies again, I would follow *Plato's* advice, and begin with Mathematicks, which I see proceed with the utmost Caution, and refuse to admit any thing as certain but what they demonstrate. (p. 133)

All the above considerations lead us to believe that both the 1665 and the 1730 translations may be considered versions of the same 1638 first edi-

tion or, in other words, parallel versions of the same source text (though of course not necessarily of the same copy)⁷.

Therefore, the object of this analysis will be the 1665 and the 1730 English versions considered *as such*, that is to say, as independent English texts belonging to, expanding upon and ultimately shaping Modern English scientific discourse.

1.2. Dialogue and discourse

Despite being titled *Discorsi* [...] *Matematici* (1638) and *Mathematical Discourses* (1665 and 1730), Galileo's work is in fact structured as a series of four *dialogues*. For this reason, before proceeding with the textual analysis, it may be interesting to explain the meanings of the pairs *dialogo-dialogue* and *discorso-discourse* in the Italian and English lexicography of the time. A dictionary review can actually help clarify what these terms represented for Galileo and his Italian and English contemporaries.

The first and the second editions of the *Vocabolario della Crusca*, issued in 1612 and 1623 respectively, record the following meanings in two distinct entries:

DIALOGO. Scrittura in prosa, dove s'introducono più persone a discorrere, per via di domanda, e di risposta. [...]. (*Vocabolario*, 1612)

DISCORSO. Operazion dello 'ntelletto, con la quale si cerca d'intendere una cosa perfettamenteamente, per mezzo di conghietture, o di suo' principi noti. [...]. (*Vocabolario*, 1612)

and

DIALOGO. Discorso di più persone. [...]. (*Vocabolario*, 1623)

DISCORSO. Operazion dello 'ntelletto, colla quale si cerca d'intendere alcuna cosa perfettamenteamente, per mezzo di conghietture, o di suoi principj noti. [...]. (*Vocabolario*, 1623)

In a similar way, Early Modern English dictionaries record *dialogue* as a communication, reasoning or disputation between two parties or more, or a written Discourse, where such a Conference is set down. (Blount, *Glossographia*, 1656)

and

a written discourse wherein two parties are brought in talking together. (Phillips, *The New World of English Words*, 1658).

7. A similar approach may be found in a recent study by Pahta *et al.* (2011: 178-196), concerning medical texts. See Bibliographical references.

In Early Modern English lexicography, the term *discourse* is not yet attested as a separate entry. The issue dates of both the Italian and the English dictionaries shortly precede the publication of Galileo's *Discorsi* (1638) and Salusbury's translation (1665). The meanings are similar in the two languages, except for some slight difference highlighted in the lexicographic entries. On the one hand, Blount (1656) and Phillips (1658) do not list *discourse* as a separate entry, even though its meaning is included in the entry *dialogue*, and it is used in the two definitions as a quasi-equivalent. On the other hand, the Italian *Vocabolario* (1612 and 1623) treats *dialogo* and *discorso* as independent lexical items and thus as two separate entries. At any rate, both the partial overlapping of their meaning(s) and the quasi-equivalence of the two terms in this context support the rendering of the Italian title in English. Only later, in the first quarter of the 18th century, just before the publication of Weston's translation (1730), are *dialogue* and *discourse* treated separately in English dictionaries. Starting with Kersey (1702) and later Bailey (1721 and 1730), *discourse* is included in the lemmata with the following definitions:

A Discourse, *speech, or talk*. (Kersey, 1702)

and

DISCOURSE, [...] Reasoning, Speech, Talk. (Bailey, 1721)

DISCOURSE, [...] speech, talk, conversation, reasoning. (Bailey, 1730)

At the dawn of Weston's 1730 translation, *discourse* seems to focus on spoken interaction whereas *dialogue*, in the same dictionaries, highlights the structure of such interaction, especially as «a written discourse where two or more Parties are talking together» (Bailey 1721) or «a discourse in writing between two or more parties» (Bailey 1730)⁸.

1.3. Aims of the study

The analysis of the two English versions of Galileo's *Discorsi* aims at discussing the interaction between speech-related features and writing-related features of a scholarly conversation in dialogue form.

8. The core meaning of *dialogue*, as it was also attested in Early Modern English dictionaries, does not change in later works. However, it is worth noting a semantic narrowing since the beginning of the 18th century: «Dialogue, *a feigned discourse between several persons*» (Kersey 1702); «DIALOGUE, [...] a Conference or Discourse between two or more Parties; or a written Discourse where two or more Parties are talking together» (Bailey 1721); «DIALOGUE, [...] a conference or discourse between two or more parties; or a discourse in writing between two or more parties wherein they are represented as talking together» (Bailey 1730).

According to Culpeper and Kytö (2010: 17 *passim*), speech-related genres can be classified as *speech-like* (that is, containing «features that are speech-like», such as personal correspondence, prose fiction with speech presentation, but also plays and handbook in dialogue form, etc.); *speech-based* (that is, containing features based on “real-life” speech events, such as trial proceedings, witness depositions with direct speech presentation, but also parliamentary records, etc.); *speech-purposed* (that is, genres «designed to be articulated orally», such as sermons and proclamations which are «designed to produce monologue», but also handbooks in dialogue form, plays, etc. Plays, in particular, «are designed to produce real-time spoken interaction». On the contrary, *written-based* and *-purposed* features characterize scholarly writing and prose fiction with no speech presentation. Moreover, Culpeper and Kytö (2010: 17-18) also maintain that «there is no reason why a text could not be speech-like, speech-based and speech-purposed. The multi-faceted life of texts can only be properly understood on a case-by-case basis».

In the context of the present analysis, speech-related features are meant as those linguistic-rhetorical aspects characterizing speech presentation and spoken interaction when these appear in written dialogue form, such as in:

Salusbury's transl. 1665

SIMP. I can scarce refrain my laughter to see the great Antipathy that *Salviatus* hath to Antipathy, so that he will, not so much as name it, [...].

SALV. Now let this, for the sake of *Simplicius* be the solution of our scruple; and leaving the Digression, let us return to our purpose. [...]

SIMP. This is a bold speech, *Salviatus*, I shall never believe that in *Vacuity* it self, if so be one should allow Motion in it, a lock of Wool would move as swiftly as a piece of Lead. (p. 59)

Weston's transl. 1730

SIMP. I can't help laughing to see the great Antipathy *Salviatus* has to Antipathy; that he does not think it worth naming, [...].

SALV. Well, for your Sake, *Simplicius*, let this solve our Doubt, and leaving this Digression, let us return to our purpose. [...]

SIMP. How, *Salviatus*! You'll never get me to believe, I think, that a Lock of Wool, and a Piece of Lead, would, even in a *Vacuum*, fall with the same Celerity. (pp. 106-107)⁹

9. SIMP. Mi vien quasi da ridere nel veder la grande antipatia, che hà il Sig. Salv. Con l'antipatia, che nè pur vuol nominarla, [...].

SALV. Hor sia questa in grazia del S. Simp. la soluzione del nostro dubbio; e lasciato il digredire torniamo al nostro proposito. [...]

SIMP. Gran detto è questo S. Salv. Io non crederò mai, che nell'istesso vacuo, se pur' vi si desse il moto, un fiocco di lana si movesse così veloce come un' pezzo di piombo. (*Discorsi*, pp. 72-73)

Whereas, writing-related features are meant as the linguistic-rhetorical aspects which characterize scholarly writing, such as:

Salusbury's transl. 1665

SALV. In regard I see, that you are so well pleased with these Geometrical Demonstrations [...] I will give you the fellow to this, which satisfieth to a very curious Question. [...]

PROPOSITION,

Upon Cylinders, the Superficies of which the Bases being subtracted are equal, have the same proportion to one another as their heights Reciprocally taken

Let the Superficies of the two Cylinders AE and CF be equal; but the height of this CD greater than the height of the other AB. I say, that the Cylinder AE hath the same proportion to the Cylinder CF, that the height CD hath to AB. Because therefore the Superficies CF is equal to the superficies AE, the Cylinder CF shall be lesse than AE: [...]. (pp. 45-46)

Weston's transl. 1730

SALV. Since I see you are so well pleased with Geometrical Demonstrations [...] I will give you the Fellow of this, which will answer a very curious Question often ask'd. [...]

PROPOSITION,

Upright Cylinders, whose Surfaces, omitting the Bases, are equal, are in reciprocal Proportion to their Heights: Let the Surfaces of the two Cylinders AE and CF be equal, but let the Height of the one CD be greater than the Height of the other AC: I say the Cylinder AE has the same Proportion to the Cylinder CF, as the Height CD has to the Height AB: For since the Surface CF is = the Surface AE, the Cylinder CF will be less than the Cylinder AE: [...]. (p. 82)¹⁰

Accordingly, the discussion will also verify whether there is a "shifting relationship" or, rather, a "shifting proportion" in the use of speech-related features and writing-related features in the two versions.

1.4. The structure of Galileo's *Discorsi*

The characters involved are Salviati, Galileo's voice, theorizing the new science and putting forward the new approach to reality; Sagredo, the new sci-

10. SALV. Già che veggio, che gustate tanto di queste Geometriche dimostrazioni [...] vi dirò la compagna di questa, che sodisfà ad un quesito curioso assai. [...]

I Cilindri retti, le superficie de i quali trattone le basi siano eguali, hanno frà di loro la medesima proporzione che le loro altezze contrariamente prese.

Siano eguali le superficie de i due Cilindri AE, CF, mà l'altezza di questo CD maggiore dell'altezza dell'altro AB. Dico il Cilindro AE al Cilindro CF haver la medesima proporzione, che l'altezza CD alla AB. Perche dunque la superficie CF è eguale alla superficie AE, sarà il Cilindro CF minore dell'AE, [...]. (*Discorsi*, p. 56).

entist, curious and imaginative, deeply interested in new hypotheses and experiments; and Simplicio, representing Aristotle and the Peripatetics but open to further debate, i.e. a figure representing a traditional scholar who, despite his name, is «for most of the time a respectable opponent [...] He is therefore the antithesis of Galileo-Salviati» (Frova and Marenzana 2006: 52-53).

The *Discorsi* is arranged as four dialogues taking place over four distinct days each comprising a series of discussions on different topics. The general structure sees the alternation of the three characters with the personality of Salviati clearly emerging as the leading one¹¹.

1.5. Methodology and materials

The present study follows a qualitative approach in the analysis of the opening dialogue («Concerning the Resistance of SOLIDS, against FRACTION»)¹² in both *Discourses*, and *Discourses*₂.

Due to the complex and multilayered nature of Galileo's *Discorsi*, different theoretical tools and notions from pragmatics have been useful in supporting the analysis.

In the following sections the terminology adopted in this discussion is briefly defined.

1.5.1. Genre

The concept of genre is as old as western culture, coming down straight from Platonic archetypes and Aristotelic categories, and has acquired various specifications, connotations and formulations over the centuries. In modern times, categories were reviewed by Kant in *Critique of pure reason* (1781), Wittgenstein changed his view of categories into prototypes as "family resemblances" (1953), Derrida supported the thought that all texts belong to one or more certain (textual) genres (Derrida and Ronell 1980). Contemporary linguistics developed the notion further to cater for specialized communication, for instance Bhatia (1993: 13) defining it

11. For a detailed discussion on the roles and tasks in conversation, as well as the distribution of interactional features, see Itakura (2001) and section 1.5 *Methodology and materials*.

12. This is title for the first dialogue in the 1730 Weston's translation, and it corresponds to the Italian «Scientia nuova prima, intorno alla resistenza dei corpi solidi all'essere spezzati. *Giornata prima*». Salusbury's first dialogue is not titled.

a recognizable communicative event characterized by a set of communicative purpose(s) identified and mutually understood by the members of the professional or academic community in which it regularly occurs. Most often it is highly structured and conventionalised with constraints on allowable contributions in terms of their intent, positioning, form and functional values,

and Swales (1990: 58), specifying that

exemplars of a genre exhibit various patterns of similarity in terms of structure, style, content and intended audience. If all high probability expectations are realized, the exemplar will be viewed as prototypical by the parent discourse community.

The genre considered here is somewhat closer to the earlier concept of literary genre or, in Fairclough's words, **pre-genres** are:

highly abstract 'pre-genres' such as Narrative or Report which generalize over many different forms of narrative or report at a more concrete level.

Here, though, Swales's more specific view of pre-genre will be adopted, in which "conversation" is a precursor of all genres written and spoken, and as such it «represents a pre-genre for dialogue» (Cramer 2011: 57).

1.5.2. Conversation analysis

That is the study of conversation, simply put. In more detail, it is the discipline established starting from and owing to Schegloff *et al.* (1974) article on turn-taking in conversation. The tools it employs derive from various other fields of study apart from linguistics, including psychology and ethnology. Within linguistics, the focus is definitely pragmatic, and – as intended here – it is not limited to turn-taking alone, but extends to sociolinguistic and discursive considerations, like that of repair.

1.5.3. Repair

The general notion of repair is taken from Conversation Analysis and means a kind of "correction" of some portion of text to avoid ambiguity and misunderstanding in the «sequential organization of conversation, specifically in turn-taking system» (Schegloff *et al.* 1977: 362). Actually, the notion of repair is more articulated and complex than that of «replacement of an 'error' [...] by what is 'correct'» (Schegloff *et al.* 1977: 363), because repair may include not only replacing but also repeating, recycling,

substituting, adding, inserting, etc. words, phrases and clauses, and «can describe more than one type depending on the component that it affects» (Rieger 2003: 50). The repair procedure partially overlaps with the notion of reformulation. However, reformulation here refers to single turns considered in isolation, so it is no specific conversational feature. Repair, on the other hand, as speech activity, focuses on interaction across subsequent turns and is explicitly elicited by interlocutors requesting repair. The notion, here, does not obviously apply to spontaneous interaction but to fictional scholarly conversation and written discourse¹³.

Reformulation is a linguistic strategy used to rewrite an expression or a longer portion of text in order to clarify and explain its original (theoretical) contents. In other words, it is a simplified version of difficult passages for a non-expert – or a less expert – readership. The explanation may also be associated and expanded with anecdotes from real life experience (see *Ex. 1*).

Conversational dominance refers to the asymmetry characterizing the exchange structure, the development of turn-taking and the alternation of assigned roles in conversation (such as expert vs. non-expert). In other words, conversational dominance refers to «a multi-dimensional construct» (Itakura 2001: 1862) in which one speaker controls other participants both from a sequential and quantitative viewpoint. Sequential means «the tendency for one speaker to control the direction of an interaction» (Itakura 2001: 1864), whereas quantitative refers to the space «each speaker [...] occupies in the sequence» (Itakura 2001: 1870), both as regards the average turn length and the number of words spoken (*ibidem*)¹⁴.

2. Galileo's conversational strategies

2.1. Reformulation and repair

Galileo's scientific exposition follows a meta-linguistic approach characterized by a great variety of rhetorical and stylistic strategies. These aim at

13. The expansion of the repair notion «to handle all discourse» draws on Roberta Piazza's analysis of play discourse (1999: 1006 ff.). Both «the structure of the exchange – [...] the canonical types of requests for repair of the literature on conversational analysis – and the pragmatics of conversation» have been considered (Piazza 1999: 1006). In her opinion «any conversational move [...] can be sequentially implicated with the preceding and the following turns and thus can function as a trigger for repair work. Thus both in natural conversation and in dramatic discourse an infinite variety of signals exists which determine self-correction» (*ibidem*).

14. For a general discussion on this topic see also Trosborg (1994).

asserting «the possibility of discoursing in everyday language about problems that traditionally had always been dealt with by recourse to technical jargon» (Drake, 1999a: 51). Science, however, cannot be generically reduced to everyday experience, but in exposing science the world of experience and shared knowledge may help «avoid [...] a mere world on paper» e.g. «the artificial vocabulary of philosophers» (Drake, 1999a: 51). The world of experience and the world on paper alternate in Galileo's scientific exposition through his use of reformulation. The following excerpts exemplify the approach in the two English versions under scrutiny here¹⁵. The two interlocutors are Salviati, representing Galileo's voice and Sagredo, the curious and imaginative scholar:

Example 1 – Scientific exposition by reformulation

Salusbury 1665
(pp. 8-9)

Weston 1730
(p. 13 ff.)

SALV. [...] and let AB and CD be two **Cylinders** (1), and between them let there be **distended** (3) the **thread** (1) EF, which for greater plainness I will represent to be a small **Cord** (1): there is no doubt but that the two **Cylinders** (1) **being pressed** (2-3) hard one against the other, the **Cord** (1) EF **pulled by** (2-3) the end F will Resist no small force before it will **slip** (6) from between the two **Solids** (1) **compressing** it (2): but if we **remove** (6) one of them, though the **Cord** (1) continue touching the **other** (1), yet shall it not by such contact be **hindered** (3) from **slipping** (2) away. But if holding (2) it fast, though but gently in the point A, towards the top of the **Cylinder** (1), we **wind** (6), or **belay** (6) it about the same (1) **spirally** (1) in AFLOTR, and **pull** (6) it by the end R: it is manifest, that it will begin to **presse** (2) the **Cylinder** (1), and if the **windings** (1) and **wreaths** (1) be many, it shall in its effectual drawing always **presse** (6) it so much the straiter about the **Cylinder** (1): and by **multiplying** (2) the **wreaths** (1) if you **make** (6) the contact longer, and consequently more invincible, the more difficult still shall it be to with

SALV. [...] Let AB and CD be two **Cylinders** (1), and between them, let there be **extended** (3) a **Thread** (1), which, for greater Plainness, we'll represent by the small **Cord** (1) EF. Now there's no doubt but these two **Cylinders** (1) **being press'd** (2-3) hard against one another, the **Cord** (1) EF, **pulled by** (2-3) the End F, has a great Force to resist, before it can be **drawn** (3) from between the two **Solids** (1) which **compress** (5-6) it. But if one of these **Cylinders** (1) be removed (3), though the **Cord** (1) still touches the **other** (1), yet shall it not, by such Contact, be **hinder'd** (3) from **slipping** (2) away; but if at the Top of the **Cylinder** (1) at A, the **Cord** (1) be **held** (3) but lightly, and then **wound about** (3) the same (1) in a **spiral Manner** (1), as AGLOTR, and if you **pull** (6) it by the End R, 'tis manifest, that it will begin to **press** (2) the **Cylinder** (1), and if there were more **Turnings** (1) or **Windings** (1) about, the harder 'tis **pull'd** (3), the closer it will adhere to, or **press** the **Cylinder** (1). And if, by **multiplying** (2) the **Wreaths** (1), the Contact be **made** (3) longer, and consequently more inseparable, the more difficult it

15. It is worth remembering that Salusbury's translation/version is extremely faithful to the original Italian text, issued in 1638.

draw (2) the **Cord** (1), and make it yield to the **force** (1) that pulls it.

Now who sees not, that the same **Resistance** (1) is in the **threads** (1), which with many thousand such **twinnings** (1) spin the thick **Cord** (1)? [...]

SAGR. Your (4) Discourse hath removed (5-6) the wonder out of my mind at **two effects** (1), [...]. the **other** (1) is at a plain, but cunning Instrument found out (2-3) by a young Kinsman of mine (4), by which with a **Cord** (1) he could let (5-6) himself (4) down from a window without much **gauling** (2) the palms of his (4) hands, as to his (4) great smart not long before he (4) had done (5-6). For the better understanding whereof **take** (5-6) this Scheme:

About such a **Cylinder** (1) [...], two Inches thick, and six or eight Inches long, he (4) **cut** (5-6) a hollow notch spirally, for one turn and a half and no more, and of *widenesse fit for the Cord* (1) he (4) would use (5-6); which he (4) **made** (5-6) to enter (2) through the notch [...], **incircling** (2) afterwards the **Cylinder** (1) in a barrel or socket of Wood, or rather Tin, but **divided** (2-3) lengthwaies, and **made** (2-3) with Claspes or Hinges to open and shut (2) at pleasure: and then **grasping** (2) and **holding** (2) the said *Barrel* or *Case* with both his (4) hands, the **rope** (1) **being made** (2-3) fast above, he (4) **hung** (5-6) by his (4) arms; and such was the compression of the **Cord** (1) between the *moving Socket* and the **Cylinder** (1), that at pleasure **gripping** (2) his (4) hands closer he (4) could stay (5-6) himself (4) without descending (2), and **slacking** (2) his (4) hold a little, he (4) could let (5-6) himself (4) down as he (4) pleased (5-6).

SALV. An ingenious invention verily, [...].

will be to **withdraw** (2) the **Cord** (1), and make it give Way to the **Force** (1) that pulls it. Now, I say, who does not see that the same **Resistance** (1) is in the **Threads** (1), which, with a thousand and a thousand such **Twinnings** (1), twist or spin the thick **Rope** (1)? [...]

SAGR. Your (4) Discourse has made (5-6) me (4) cease wondering (2) at **two Effects**, [...]. The **other Effect** (1) I (4) wonder'd at (6), was that of a simple, but clever, Instrument, **invented** (2-3) by a young Kinsman of mine (4), by which, and by Help of a **Cord** (1), he (4) could let (5-6) himself (4) down from a Window, without **hurting** (2) or **gawling** (2) his Hands, as he (4), not long before, had done (5-6) to his (4) great Pain. And that you (4) may (5-6) the better understand (2) this, **take** (5-6) the following Scheme. About a **Cylinder** (1), [...] about two Inches thick, and eight or ten long, he (4) **cut** (5-6) a Notch spirally, of one turn and half, and no more, *big enough to receive* (2) the **Cord** (1) he (4) **design'd** (5-6) to use (2), and which he (4) **put into** (5-6) the Notch [...]: Afterwards he (4) **inclos'd** (5-6) that **Cylinder** (1) and **Cord** (1) in a Wooden, or rather a Tin Tube, **made** (2-3) with Clasps or Hinges, to open or shut (2) lengthways at Pleasure. Then **having made** (2-3) fast the **Rope** (1) above, **grasping** (2) of the said *Tin Case* with both his (4) Hands, he (4) **hung** (5-6) by his (4) Arms, whence, such was the Compression of the **Cord** (1) between the *ambient Tube* and the **Cylinder** (1), that, at Pleasure, by **clinch-ing** (2) his (4) Hands closer, he (4) could stop (5-6) himself (4), and by a little loosening (2) his (4) Hold, he (4) could let (5-6) himself (4) down gently as he (4) pleas'd (5-6).

SALV. An ingenious invention truly [...].

Before analysing reformulation, in Sagredo's turn, it is worth looking at Salviati's preceding argumentation. Salviati expounds his scientific theory focusing on the experiment reported. The steps of the process described are clearly and discursively highlighted, avoiding rhetorical ornaments. Salviati's exposition is characterized by textual cohesion and depersonalization, expressed through linguistic features such as lexical repetitions (1), non-finite verbs (2), the passive voice (3).

Sagredo formally follows Salviati's turn, but he actually introduces his own independent discourse, that is his reformulation (Sagr., *Ex. 1*). Sagredo aims at popularizing the topic of the ongoing discussion: the incipit of this turn could actually be reduced to the linking formula «in other words», introducing the reformulated version for a non-expert readership. The recourse to Sagredo's personal experience is a clear strategy – mostly used throughout the dialogue – to transform the world on paper into the sensible world of shared knowledge, understandable by the layman. The popularization starts at «For the better understanding whereof take this Schemae» (*Discourses*₁), «And that you may the better understand this, take the following Scheme» (*Discourses*₂), Sagredo, *Ex. 1* above. The attention is now focused on «a young Kinsman of mine» (*Discourses*_{1,2}), and not strictly on the (scientific) process as in the preceding turn. The shift from a written-related dimension to a speech-related one emerges from both the preference for linguistic features typical of personalization, like personal deixis (4), finite verbs (5), the active voice (6), and the frequency of their use.

If Sagredo is the supporter of Salviati-Galileo's thought, his formal turn may also be considered as a kind of repair triggered by Salviati's explicit request «who sees not, that the same Resistance is in the threads [...]?» (*Discourses*₁), «who does not see that the same Resistance is in the Threads [...]?» (*Discourses*₂), structurally placed at the end of his turn. Sagredo's repair starts with «a plain, but cunning Instrument found out by a young Kinsman of mine?» (*Discourses*₁), «a simple, but clever, Instrument, invented by a young Kinsman of mine» (*Discourses*₂), and it is later emphasised by a more formal «For the better understanding whereof» (*Discourses*₁), «And that you may the better understand this» (*Discourses*₂), clearly replying to Salviati's trigger-query, see *Ex. 1*. Galileo does double himself, putting forward two different fictional characters: Galileo's thought – i.e. his outlook on reality and his scientific knowledge – is structurally transformed into two *dramatis personae* with partially overlapping functions.

The Salviati-Sagredo repair strategy corresponds to the alternation between scholarly and popularizing exposition, indeed, as Piazza (1999) states

«what really characterizes dramatic and fictional discourse in general is that, while apparently focusing on the interpersonal plane, it actually aims at conveying a specific meaning and message». This is obviously the case with Galileo's ideas as exposed in his *Discorsi*.

Also consider the following example:

Example 2 – Conversational repair

Salisbury 1665
(pp. 31-32)

SALV. [...] And whilst that breaking a Solid into many pieces, and pursuing to reduce it into very small powder, it were resolved into its infinite Atomes, admitting no farther division, **why may we not say (7)** that it is returned into one sole *Continuum*, but perhaps fluid, as the Water, or Quicksilver, or other Metall melted? **And do we not see (7)** Stones liquefied into Glass, and Glass it self with much Fire to become more fluid than Water?

SAGR. **Should we therefore think (7)** Fluids to be so called, because they are resolved into their first, infinite, indivisible compounding parts?

SALV. I know not how to find a better answer to resolve certain sensible appearances, amongst which this is one: **When I take a hard Body (7)**, be it either Stone, or Metal, and with a Hammer, very fine File, endeavour to divide it, as much as is possible, into its most minute and impalpable powder; it is very clear, that least Atomes, albeit for their smallness they are imperceptible, one by one, to our light and touch; yet they are quantitative, figured, and numerable: [...].

Weston 1730
(p. 59-60)

SALV. [...] whilst we breaking any Solid to Pieces, and endeavouring to reduce it into the smallest Dust, when it is resolv'd into Particles admitting farther Division; **why may we not say (7)**, that it is return'd into one *Continuum*, but perhaps fluid, as Water is, or Mercury, or melted Metal? **And do we not see (7)** Stones liquefied into Glass, as also Glass itself, with a vast Heat, to become as fluid as Water?

SAGR. **Must we then believe (7)** Fluids to be so call'd, because they are resolv'd into their first infinite, indivisible, composing Parts?

SALV. I don't know how better to account for many sensible Appearances, of which this is one. **When I take any hard Body (7)**, for Example, a Stone, or Piece of Metal, and, with a Hammer, or very fine File, divide it, as much as possible, into the finest and most impalpable Powder, 'tis manifest that its most minute Particles, altho' they are singly so small as to escape our Sight, yet are they quantitative, figured, and numerable: [...].

Conversational repair, in *Ex. 2*, may be seen in the flow of the argumentation conducted through a trigger-repair structure (7). At the end of his turn, Salviati formulates two questions to verify the effects of his exposition on his interlocutors «why may we not say [...] And do we not see [...]?» (*Discourses*_{1,2}). Sagredo answers both by making clear that he has understood Salviati's argumentation and, at the same time, by formulating a new request «Should we therefore think Fluids to be so called, because [...]?» (*Discourses*₁), and «Must

we then believe Fluids to be so call'd, because [...]» (*Discourses*₂). Salviati's repair starts at «I know not how to find a better answer» (*Discourses*₁), and «I don't know how better to account for» (*Discourses*₂) and introduces further developments in the discussion: «When I take a hard Body [...]» (*Discourses*_{1,2}).

Both in *Ex. 1* and *Ex. 2* the flow of the argumentation is triggered by explicit requests of repair. In *Ex. 1*, though, these give rise to reformulation, whereas in *Ex. 2* they produce expansions (7) by which the argumentation progresses.

2.2. Control dominance

Another interesting key point to discuss is *control dominance* in conversation. In the case of the Galileo's dialogue control dominance focuses on turn-taking development.

In particular, as the dialogue progresses, the different roles assigned to the participants define themselves, along with the functions and the goals of the three interlocutors. This often implies asymmetrical relationships.

In the following dialogue, control is attained through *sequential dominance* (control on the direction of interaction) and *quantitative dominance* (space each interlocutor occupies in the sequence), see § 1.5. Both are emphasised in the text as (8)-*sequential* and (9_{short})/(9_{long})-*quantitative*. However, *sequential dominance* is also marked by personal deixis, especially I (8_a) vs. you (8_b); whereas we (8_c) refers to scholars/human beings and is mostly used to narrow the gap between interlocutors. Here, Salviati and Simplicio discuss infinity and indivisibility:

Example 3 – Control dominance

Salisbury 1665
(pp. 25-26)

SALV. You (8_b) shall have some of my (8_a) particular thoughts thereon (8): first repeating what but even now I (8_a) told you (8_b), namely, that (8) Infinity alone, as also Indivisibility, are things incomprehensible to us (8_c): now think how they will be conjoined together: (8) [...] (9_{long}) [here a long and articulate discussion on infinity and indivisibility starts; at the end of which Simplicius introduces his doubt and makes the the conversation/debate progress]

Weston 1730
(pp. 45-48)

SALV. I (8) will give you (8_b) my particular Sentiments of that too (8): but let me (8) repeat what I (8) just now told you (8_b), namely, that (8) Infinity, as also Indivisibility, from their very Nature, are Things incomprehensible to us (8_c): What must they be then when join'd together? (8) [...] (9_{long}) [here a long and articulate discussion on infinity and indivisibility starts; at the end of which Simplicius introduces his doubt and makes the the conversation/debate progress]

SIMP. Here already riseth a doubt, which I (8) think unresolvable; and it is, that we (8_c) being certain to find Lines one bigger than another, although both contain infinite Points, we (8_c) must of necessity confess, that we (8_c) have found in the same Species a thing bigger than infinite; [...]. Now this assigning of an Infinite bigger than an Infinite is, in my (8) opinion, a conceit that can never by any means be apprehended.

SALV. These are some of those difficulties, which result from the Discourses that our finite Judgements make about Infinites, giving them those attributes which we (8_c) give to things finite and terminate; which I (8) think is inconvenient (8); [...]: for proof of which there cometh to my (8) mind a Discourse, which, the better to explain, I (8) will propound by way of Interrogatories to Simplicius that started the question (8). I (8) suppose that you (8_b) very well understand which are Square Numbers, and which not Square. (8) (9_{long})

SIMP. I (8) know very well, that the Square Number is [...]. (9_{short})

SALV. Very well: And you (8_b) know also, that (8) as the Products are called Squares: the Produsors [...] are called Sides, or Roots; and the others [...] are not Squares. So that if I (8) should say (8), all Numbers comprehending the Square, and the not Square Numbers, are more than the Square alone, I (8) should speak a most unquestionable truth: Is it not so? (9_{long})

SIMP. It cannot be denied. (9_{short})

SALV. Farther questioning, if I (8) ask you (8_b) how many are the Numbers Square, you (8_b) can answer me (8) truly, that (8) they be as many, as are their proper Roots; since every Square hath its Root, and every Root its Square, nor hath any Square more than one sole Root, or any Root more than one sole Square.

SIMP. True. (9_{short})

SALV. But if I (8) shall demand how many Roots there be, you (8_b) cannot deny but that (8) they be as many as all Numbers, since there is no Number that is not the Root of some Square: And this being granted, it is requisite to affirm (8), [...]. (9_{long})

SIMP. Here already arises a Doubt which I (8) think is not to be resolv'd; and that is this: Since 'tis plain that one Line is given greater than another, and since both contain infinite Points, we (8_c) must surely necessarily infer, that we (8_c) have found in the same Species something greater than Infinite, [...]. But now, to assign an Infinite greater than an Infinite, is what I (8) can't possibly conceive.

SALV. These are some of those Difficulties which arise from Discourses which our finite Understanding makes about Infinites, by ascribing to them Attributes which we (8_c) give to Things finite and terminate, which I (8) think most improper (8), [...]. For Proof whereof I (8) have something come into my (8) Head, which (that I (8) may be the better understood) I (8) will propose by way of Interrogatories to Simplicius, who started the Difficulty (8). To begin then, I (8) suppose you (8_b) know which are Square Numbers, and which not? (8) (9_{long})

SIMP. I (8) know very well that a square Number is [...]. (9_{short})

SALV. Very well: And you (8_b) also know, that (8) as the Products are call'd Squares, the Factors are call'd Roots; and that the other Numbers, [...] are not Squares. Whence taking in all Numbers, both Squares and Not Squares, if I (8) should should [sic] say, that (8) the Not Squares are more than the Squares, should not I (8) be in the right? (9_{long})

SIMP. Most certainly. (9_{short})

SALV. If I (8) go on with you (8) then, and ask you (8_b), How many squar'd Numbers there are? You (8_b) may truly answer, That (8) there are as many as are their proper Roots, since every Square has its own Root, and every Root its own Square, and since no Square has more than one Root, nor any Root more than one Square.

SIMP. Very true. (9_{short})

SALV. But now, if I (8) should ask how many Roots there are, you (8_b) can't deny but (8) there are as many as there are Numbers, since there's no Number but what the Root to some Square. And

The alternation of the two characters shows, on the one hand, the approach used by Salviati to deliver his knowledge: «by way of Interrogatories to *Simplicius* that started the question [...] Farther questioning, if I» (*Discourses*₁) and «by way of Interrogatories to *Simplicius*, who started the Difficulty [...] If I go on with you» (*Discourses*₂). On the other hand, his questioning and explanatory techniques also highlight *Simplicio*'s reasoning process and appreciation for the new method and results, as clearly expressed in subsequent turns: «Here already riseth a doubt [...] → I know very well, that [...] → It cannot be denied [...] → True» (*Discourses*₁) and «Here already arises a Doubt [...] → I know very well that [...] → Most certainly [...] → Very true» (*Discourses*₂). The conclusion of the argumentation, reinforcing the validity of the process and the results thus obtained, is summed up in Salviati's words «And this being granted, it is requisite to affirm» (*Discourses*₁) and «And this being granted, we may likewise affirm» (*Discourses*₂).

In the *Discorsi*, Salviati is undoubtedly the advocate of Galileo's thought and the final arbiter of his communicative strategy. As a matter of fact, at «the level of the exchange, one speaker [*Salviati*] may ask a question while the other [*Simplicio*] answers. In each case, the asymmetry consists in one speaker's control over the interactional contribution of the other», Itakura (2001, p. 1862).

However, meanings and contents are the results of interaction, not the outcome of imposition, since the control dominance device functions only, and only if, a mutual agreement is established and maintained between participants, whichever their role(s) and task(s): «the development of the conversation [...] is actualised or *successful* only when it is accepted by the other speaker through a *complying action* that is constrained by the previous speaker's action» (Itakura, 2001, p. 1862). Hence, Salviati-Galileo's thought may be guaranteed by both *Simplicio*'s own discourse and his (inter)personal – but also (inter)actional, conversational and intellectual – disposition to compromise.

3. The shift towards speech-related features

Scientific exposition – as seen – is certainly one key aspect defining these texts' rhetoric, although it is not the only one, or not one that can be discussed without also considering other rhetorically relevant features. Thus, moving away from the expository and deeper into the dialogic, the follow-

ing analysis will take into account what strategies are employed to initiate, unfold and develop argumentations, between the constructed and the spontaneous.

3.1. Cohesive interplay

In the excerpt from Ex. 4 below, there are three subsequent conversational turns. It is interesting to look at how each ends and how the argumentation continues and is brought forward into the next turn.

Example 4 – Cohesive interplay

Galileo 1638 (p. 6-ff.)	Salisbury 1665 (pp. 5-ff.)	Weston 1730 (pp. 7-ff.)
SAGR. [...] l'uno più grosso il doppio dell'altro, quello non reggerà non solamente doppio peso di questo, mà triplo, e quadruplo.	SAGR. [...] the one twice as thick as the other, that shall bear a weight not only double to this, but triple, and quadruple.	SAGR. [...] the one twice as thick as the other, that shall bear a Weight, not only double, but triple, nay quadruple of this.
SALV. Dite pur'ottuplo, nè direte lontano dal vero: nè questo effetto contraria à quello, ancor che in sembiante apparisca così diverso.	SALV. You may say octuple [...] though in appearance it seemeth so different.	SALV. You may say octuple [...] at first Appearance, it seems so Difficult.
SAGR. Adunque Sig. Salviati spianateci questi scogli, e dichiarateci queste oscurità, se ne havete il modo [...] e se vi contentate, che questo sia il soggetto dei nostri ragionamenti di oggi, à me, e credo, al Sig. Simp. Sarà gratissimo.	SAGR. Therefore, Salviatus, explain unto us these Riddles, and level us these Rocks [...] if you be content that this be the subject of our this-daies discourse, it will be to me, and I believe to Simplicius, very acceptable.	SAGR. Therefore, Salviatus, remove these Doubts, and explain to us these Difficulties [...] And if you please to let this be the subject of To-Day's Discourse, you'll much oblige us both.
SALV. Non posso mancar di servirle [...]	SALV. I cannot refuse to serve you [...]	SALV. With all my Heart [...]

The topic being discussed (important when evaluating scientific exposition), when focusing on cohesion, is actually irrelevant: even without knowing it, it is plain, just from the highlighted words, how the interplay progresses. Sagredo concludes the first turn-taking by saying «double», «triple», «quadruple». Salviati immediately resumes it by adding: «octuple». Here the cohesion is provided through a logical

reasoning sequence, expressed through basic but specific mathematical lexicon.

In the second turn-taking, the cohesive interplay is lexico-semantic. The key words closing the second turn are «different» (*Discourses*₁) and «difficult» (*Discourses*₂) already pointing to two dissimilar concepts. However, the ones opening the third turn are «riddles» and «rocks» (*Discourses*₁), and «doubts» and «difficulties» (*Discourses*₂). The lexical connection is not apparent in *Discourses*₁, where the “difference” develops into «riddles» (which may relate to *Discourses*₂ “difficulty” but hardly to *Discourses*₁ “difference”) and «rocks», unless the reasoning refers to how “different” «riddles» and «rocks» are. However, this is not the case, and a look at the coherence or logical connection between turns confirms that. In *Discourses*₁, on the other hand, the connection is there at both the cohesive and the coherent level, since «difficult» points openly to «doubts» and «difficulties», and the already plain link is made even plainer – obvious, even – by the repetition, with morphological variation, of the same word («difficult» / «difficulties»). Also to be noted is the alliteration that is offered in the *Discourses*₁ («riddles» and «rocks»), and kept and even expanded to include the element in the previous turn in *Discourses*₂ («difficult» / «doubts» and «difficulties»), thus reinforcing the interplay at the cohesive level. However, it is significant that the metaphorical meaning (the mysteries and asperities hidden in «riddles» and «rocks») is lost, however, in the second version. It appears to be a clear indication that in 1730 science is no longer to be expressed through (opaque) metaphors i.e. literarily, but in plain, crystal-clear (if bare) English.

Finally, the passage between the third and the fourth turns considered is signposted by the request made to Salviati to explain the “different” *Discourses*₁ / “difficult” *Discourses*₂ concept, which he gladly meets. All this is realized through conversational expressions («it will be to me, and I believe to Simplicius, very acceptable», *Discourses*₁ / «you’ll much oblige us both», *Discourses*₂) creating an implicit question-and-answer interplay. This is, however, very different from the plain, classical question-and-answer (Di Martino 1993 and Trosborg 1994) structure of earlier didactic manuals¹⁶. What differs between the two texts are the syntactic structures expressing the interplay, more articulated in *Discourses*₁, more concise in *Discourses*₂: «if you be content» (stative verb + adjective, description of state, written-related) vs. «And if you please» (action verb, active participation, speech-

16. See the didactic works featured in the *Corpus of English Dialogues 1560-1760* compiled by Culpeper and Kytö (2006).

related); «I cannot refuse to serve you» (sentence, written-related) vs. «With all my Heart» (utterance, speech-related).

Other dialogic passages highlighting a shift from more obviously written-related features to speech-related ones are reported in Ex. 5 below.

Example 5 – From written-based related to speech-related mimesis

1. Galileo 1638 (p. 21)	Salisbury 1665 (p. 17)	Weston 1730 (p. 30)
SAGR. Nò, quando quel metallo fusse una mole infinita: altrimenti.	SAGR. Not if the Mettal were of an infinite masse; otherwise –	SAGR. Not if the Mass of Metal was infinite: But otherwise –
2. Galileo p. 31	Salisbury 1665 (p. 25)	Weston 1730 (p. 45)
SALV. Havrò qualche mio pensiero particolare,	SALV. You shall have some of my particular thoughts thereon;	SALV. I will give you my particular Sentiments of that too;
3. Galileo p. 89	Salisbury 1665 (p. 109)	Weston 1730 (p. 130)
SALV. Risolverò congiuntamente tutto quello che opponete.	SALV. I will resolve all that which you object in one word.	SALV. I’ll answer all your Objections at once.
4. Galileo p. 38	Salisbury 1665 (p. 30)	Weston 1730 (p. 55)
SIMPL.: Io non capisco bene, come si deva intender questo negozio.	SIMPL. I do not apprehend very well, how this business should be understood.	SIMPL. I don’t understand this.
5. Galileo p. 89	Salisbury 1665 (p. 111)	Weston 1730 (p. 131)
SALV.: E questo confermo io,	SALV. And this I confirm;	SALV. Right;

In particular, Ex. 5.1, apart from losing the third-person singular subjunctive form «were» in favour of «was», anticipates the specification from the predicate to the subject, thus creating a loaded thematic element that is followed by a lighter – i.e. more incisive – rheme. Ex. 5.2 mimics speech by exchanging subject and object so as to have «I» (as expected in speech) as the subject; «will» substitutes «shall» as a deontic. Ex. 5.3 shows some dramatic syntactic simplification, with the deletion of the relative nexus, the nominalization of «to object» into «objection», the three-word prepositional phrase substituted by a two-word adverbial, the choice of the Germanic

«answer» instead of the Latinate «resolve», and the contraction of «will». All these features signal a trend towards the use of core strategies proper of English making *Discourses*₂ more of a rewriting than a translation, and thus more accessible from the contemporary public. A similar operation is performed in Ex. 5.4, where the second clause, the indirect question («how this business should be understood»), is furthermore completely deleted as useless to the economy of the reasoning. The mimetic process reaches a peak in Ex. 5.5, where the articulate O-S-V sentence «And this I confirm» is replaced *tout court* by a brisk but no less polite «Right».

The examples discussed show how, in the relevant time span between the two translations, the rendering of the Galilean dialogue follows a trend toward more modern structures, in which sentences give way to utterances in the contemporary pragmatic sense.¹⁷ It starts shifting away from the writing-related towards the speech-related, in its sounding plainer and thus closer to modern conversational English. In other words, dialogic interplay at the lexical, syntactic and discursive levels is present in both the versions, but whereas in *Discourses*₁ it lies mostly in its being logically coherent, in *Discourses*₂ it becomes *structurally* coherent too. Sentences then start to resemble utterances, and the realistic starts to get closer to the real: the reduction of the “constructed” in favour of the “natural”(-sounding) is itself a construction but a more subtle and an in-built one.

4. Final remarks

The dialogue has always been a relevant tool in discussing the most different topics in any domain. Galileo’s approach to reality and, particularly, his scientific thought are thus outlined and conveyed by this versatile and articulated device: a useful discursive strategy to transform the “world on paper” into concrete evidence and shared experience that the educated non-expert interlocutor(s) could actually understand. The conversational strategies (reformulation, repair, conversational dominance) are integrated with the rhetorical features belonging to the form and function of traditional dialogue (cohesive interplay, written-related vs. speech-related features). In other words, the speech-related conversational scaffolding expands to include written-based genres such as the scientific treatise, along with popularizing sections.

17. Bakhtin (1986: 68, emphasis added): «Any understanding of live speech, a live *utterance*».

These popularizing section-turns, usually delivered by Sagredo, parallel Salviati’s exposition and balance the underlying difficulty of scholarly writing.

Sagredo’s main function is to reformulate Salviati’s turns: he adapts written-based features to speech-related needs, as well as to the layman’s cognitive skills (reformulation and conversational repair).

The alternation between Salviati (obviously displaying control dominance), Sagredo and Simplicio corresponds to a popularization need. The speech-related utterances such as «An ingenious invention *verily*» *Discourses*₁ and «An ingenious invention *truly*» *Discourses*₂ (Salv. Ex. 1), seem to reinforce the conversational aspect.

The comparison between the *Discourses*₁ and *Discourses*₂ was the occasion for further reflections on the changing aspects of language. The analysis of compared examples from the *Discourses*₁ and the *Discourses*₂ highlights a probable shift in lexicon, syntax, textual and rhetorical organization mirroring the evolution of English scientific discourse between 1665 and 1730 as attested in the two texts.

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Appendix: The 1638 Italian text

5.1. On the resistance of solids (Ex. 1)

SALV. [...] e questi AB, CD siano due Cilindri, e tra essi disteso il filo EF, che per maggior chiarezza lo figureremo essere una cordicella: non è dubbio che premendo gagliardamente i due Cilindri l'uno contro l'altro, la corda FE tirata dall'estremità F resisterà a non piccola violenza prima che scorrere trà i due solidi comprimentila: mà se rimuoveremo uno di loro, la corda benche continui di toccar l'altro, non però da tal toccoamento sarà ritenuta, che liberamente non scorra. Mà se ritenendola benche debolmente attaccata verso la sommità del Cilindro A l'avvolgeremo intorno a quello a foggia di spira AFLOTR,

e dal capo R la tireremo: è manifesto, che ella comincerà à stringere il Cilindro, e se le spire, e volute saranno molte, sempre più nel validamente tirare si comprimerà la corda addosso al Cilindro: e facendosi con la moltiplicazione delle spire più lungo il tocco, & in conseguenza men superabile, difficile si farà sempre più lo scorrere della corda, e l'acconsentir alla traente forza. Hor chi non vede, che tale è la resistenza delle filamenta, che con mille, e mille simili avvolgimenti il grosso canapo contessono? [...] SAGR. Cessa per il vostro discorso nella mia mente la meraviglia di due effetti, [...]. L'altro è d'un semplice mà arguto ordigno trovato da un giovane mio parente per poter con una corda calarsi da una finestra senza scorticarsi crudelmente le palme delle mani, come poco tempo avanti gli era intervenuto con sua grandissima offesa. Ne farò per facile intelligenza un piccolo schizzo. Intorno à un simil Cilindro [...] grosso, come una canna, e lungo circa un palmo incavò un canaletto in forma di spira di una voluta, e mezo, e non più, e di larghezza capace della corda, che voleva adoprarne; e questa fecè entrare per il canale [...], circondando poi tal Cilindro, e corda con un cannone pur di legno, ovvero anco di latta ma diviso per lungo, & ingangherato, si che liberamente potesse aprirsi, e chiudersi: & abbracciando poi, e stringendo con ambe le mani esso cannone, raccomandata la corda à un fermo ritegno di sopra, si sospese su le braccia, e riuscì tale la compressione della corda tra'l cannone ambiente, e'l Cilindro, che ad arbitrio suo stringendo fortemente le mani poteva sostenersi senza calare, & allentandole un poco si calava lentamente à suo piacimento.

SALV. Ingegnosa veramente invenzione, [...]. (pp. 9-11)

5.2. *Conversational repair (Ex. 2)*

SALV. [...] E mentre che rompendo un solido in molte parti, e seguitando di ridurlo in minutissima polvere, risoluto che si fusse negl'infiniti suoi atomi non più divisibili, perche non potremmo dire quello esser ritornato in un solo continuo, mà forte fluido, come l'acqua, o'l mercurio, o'l medesimo metallo liquefatto? E non vediamo noi le pietre liquefarsi in vetro, & il vetro medesimo co'l molto fuoco farsi fluido più che l'acqua?

SAGR. Doviamo dunque credere i fluidi esser tali, perche sono risolti ne i primi infiniti, indivisibili suoi componenti?

SALV. Io non so trovar miglior ripiego per risolver' alcune sensate apparenze, tra le quali una è questa. Mentre io piglio un corpo duro ò sia pietra, ò metallo, e che con martello, ò sottilissima lima lo vò al possibile dividendo in minutissima, & impalpabile polvere, chiara cosa è che i suoi minimi ancor che per la lor piccolezza siano impercettibili a uno a uno dalla nostra vista, e dal tatto: tuttavia son'eglino ancor quanti, figurati, e numerabili; [...]. (pp. 40-41)

5.3. *Conversational dominance (Ex. 3)*

SALV. Havrò qualche mio pensiero particolare, replicando prima quel che poco fa dissi, cioè, che l'infinito è per se solo da noi incomprendibile, come anco gl'indivisibili: or pensate quel che saranno congiunti insieme: [...].

SIMP. Qui nasce subito il dubbio, che mi pare insolubile; & è che sendo noi sicuri trovarsi linee una maggior dell'altra, tutta volta che amendue contenghino punti infiniti bisogna confessare trovarsi nel medesimo genere una cosa maggior dell'infinito; perché la infinità de i punti della linea maggiore eccederà l'infinità de i punti della minore. Ora questo darsi un infinito maggior dell'infinito mi par concetto da non poter'esser capito in verun modo.

SALV. Queste son di quelle difficoltà, che derivano dal discorr che noi facciamo col nostro intelletto finito intorno agl'infiniti, dandogli quelli attributi, che noi diamo alle cose finite, e terminate; il che penso, che sia inconveniente; [...]; per prova di che già mi sovvenne un si fatto discorso, il quale per più chiara esplicazione proporrò per interrogazioni al S.Simp. che hà mossa la difficoltà.

SIMP. So benissimo, che il numero quadrato è quello, che nasce dalla moltiplicazione d'un altro numero in se medesimo, e così il quattro, il nove, son numeri quadrati nascendo quello dal dua, e questo dal trè in se medesimi moltiplicati.

SALV. Benissimo; E sapete ancora, che si come i prodotti si dimandano quadrati, i producesti, cioè, quelli che si moltiplicano, si chiamano lati, ò radici, gli altri poi [...] non sono altrimenti quadrati. Onde se io dirò, i numeri tutti comprendono i quadrati, e i non quadrati esser più che i quadrati soli, dirò proposizione verissima; non è così?

SIMP. Non si può dir altrimenti.

SALV. Interrogando io di poi, quanti siano i numeri quadrati, si può con verità rispondere, loro esser tanti, quante sono le proprie radici, avvenga che ogni quadrato hà la sua radice, ogni radice il suo quadrato, nè quadrato alcuno hà più d'una sola radice, nè radice alcuna più d'un quadrato solo.

SIMP. Così stà.

SALV. Mà se io domanderò, quante siano le radici, non si può negare, che elle non siano, quante tutte i numeri, poiche non vi è numero alcuno che non sia radice di qualche quadrato: E state questo converrà dire, [...]. (pp. 31-33)