

Proof and Prayer:

A Characterization of Ritualized Persuasive Discourse

0. Abstract

In this paper, we introduce a class of discourse called Ritualized Persuasive Discourse, or RPD. This class covers a wide range of different genres, all of which involve an extensive tradition important to speakers in the genre and the need to persuade an audience to agree with the speaker. The combination of these influences produces a variety of intriguing linguistic features.

RPD covers a surprisingly diverse set of discourse types. For most concrete examples of the principles described in the paper, we take two of the most disparate members of the class: English-language mathematical proofs of the modern era, and prayers of petition from the Roman, Greek, and Christian traditions, along with Navajo holy chants (which fall intriguingly between the two).

Examining these based not on specific content but on linguistic structure and general relationship to content, we find a number of similarities that help to define the

nature of RPD. ‘Function’-based features include context, content, and purpose of the discourse, while ‘form’-based features deal more directly with the language used to express it and include organizational, syntactic, and lexical points.

By this comparison of examples of RPD and the resultant synthesis of their shared elements, we come to a better understanding of the boundaries of the class of RPD—what makes a specific instance of discourse RPD, what features to look for in such a text, and how to recognize those characteristics of the text stemming from its nature as RPD. We also examine RPD’s place with reference to the study of stylistics. Investigating the assorted members of the RPD class as related works reveals much about their individual natures and about how we work with formal language and argumentation.

1. Introduction

To start, we introduce a class of discourse called Ritualized Persuasive Discourse (RPD). RPD overlaps considerably with the more general ‘argumentative discourse,’ though some members of RPD come closer to supplication than argumentation and many fall somewhere in between. Generally speaking, the RPD class consists of instances of language that attempt to bring an audience around to a speaker’s point of view, respecting (and using) conventions of formal language appropriate to the genre. Members of the RPD class come from genres with extensive and highly valued traditions and tend to concern subjects that their authors consider serious and worthy of formal and much-

considered language. Though improvisation may have a place in some forms of RPD, the language and structures have their roots in established tradition.

RPD includes oral and written material from a range of subjects, and we will refer to ‘speakers’ as well as ‘texts’ and ‘authors’ throughout this paper. The overlap between situations calling for formal language and those requiring persuasion, unsurprisingly, contains a large portion of each of those sets. We run across RPD frequently—in legal language, business contracts, etiquette, and even academic writing—and it has cropped up throughout history in rhetoric, supplication, and countless rituals.

Among the many members of RPD we find two that seem at first entirely unrelated: mathematical proof and petitionary prayer. Yet both qualify as RPD, for they both rely on the use of formal language evolved from many previous works in the field and they both attempt to persuade an audience—proof to convince the reader of the truth of the author’s proposition, and prayer to convince the deity (and the listening worshipers) of the propriety of granting a request. (We concentrate on petitionary prayer, though other types of prayer exhibit many of the same linguistic features.) We draw most of our demonstrative examples from these two discourse types, for a number of reasons. First, we have a massive body of work in each discipline to examine, coming from a variety of time periods and cultures, from which we focus on modern English proof, Greek, Roman, and Christian prayer, and Navajo sacred chants. (Those not familiar with these types of texts may wish to consult Appendix A for an overview.) The lack of shared content between these simply prevents us from becoming distracted; we know that any commonalities we find must arise from the ritualized persuasive nature of the works

rather than from a specific shared topic. Accordingly we proceed not by examining each genre in turn, but by looking at their key features and the degree to which they coincide.

2. Characteristics of RPD

In this section, we discuss those features of RPD not specifically related to the language used to phrase it. These more ‘functional’ characteristics still, however, play a role in determining whether we can effectively analyze a text as RPD. We address issues of context, content, and purpose.

Context

RPD appears only in particular circumstances, oral or written, which include neither all situations that call for persuasion nor all those that call for ritual. For RPD to exist, the specific goal of the discourse need not have appeared before, but people must have previously attempted *similar* goals: one may use RPD to prove a new theorem, but the theorem must bear some resemblance to other mathematical theorems. Other situations involve tradition aplenty, but require no persuasive element—most prayers of thanksgiving, for example—and we do not class these as RPD either. One must desire something from the audience. RPD also seems much more likely to occur when the audience has higher status than the author.

The authorship of RPD, in fact, presents some interesting points. Because of the traditional nature of RPD and the extensive similarities between texts within a genre, one need not have extensive education or even full understanding of content to use RPD, merely some experience with the language. Indeed, the RPD in the Book of Common Prayer originally arose from a desire to give the non-Latin-speaking masses greater connection to church services: the ritualized nature of the language kept the prayers suitable for the formal context of religion, while those who spoke only the vernacular could now engage in petitions of their own. (Targoff 2001) The constraints on language introduced by RPD make it easier for lower-status or uneducated speakers to address those considered their superiors without causing offense.

Producing ‘customized’ RPD relating to new content, however, demands more from the author. He must now not only understand the behavior of the relevant type of RPD and recreate it, but also have a good grasp of his subject and how to express his desires within the confines of RPD. Depending on how extensively the genre provides closely defined formulas for insertion of one’s own concerns—in the Anglican Prayers of the People, quite thoroughly (for example, Form I’s optional petitions such as “For reasonable weather...” and “For those who travel on land, on water, or in the air [or through outer space]...” (Guilbert 1977)), in mathematics almost not at all—the author’s level of comfort and experience with the genre must rise accordingly. Though his status may remain below that of his audience, demonstrating this level of familiarity with RPD allows the author, in some cases, to assert a position of equal or nearly equal erudition and power with the audience. (In proofs, one might argue that the author asserts superiority to the audience, particularly in proof-like Navajo chants and in certain

mathematical documents given to labeling concepts ‘obvious.’ Still, the goal of the discourse remains to persuade the audience, and the author cannot afford to ignore its opinions.)

Content

One can apply the linguistic principles of RPD to anything, of course, but the result may or may not qualify as RPD: I may ‘prove’ in mathematical language that I want a bagel for breakfast, but neither context nor content suits RPD, particularly not the type I have chosen. This utterance then only dubiously qualifies as RPD at all, even if the request meets with greater success than it would have if phrased in ordinary language.

Relevance of content plays a major role; using the wrong genre of RPD for a given purpose has little effect. Though different genres of RPD do use many of the same linguistic techniques, each one has its own vocabulary and set of emphasized features, making a mismatch between genre and content immediately and often comically apparent. One might find elements of the repeated chorus in both a mathematical proof touching on several related points and in the Prayers of the People intercession in

Anglicanism:

Prayers of the People (Form IV)
(After each petition)
Celebrant: Lord, in your mercy
People: Hear our prayer.
 (Guilbert 1977)

Mathematics
(After proving each case of a theorem)
 ...as desired.
 (Sagan 2001)

But switching the content of these—for example, ending the demonstration of each sub-point of the theorem with “Hear our proof”—would hardly remain effective composition.

Of course the distinctions between types of RPD have a somewhat arbitrary nature, and one might find some culture with identical phrases for a communal petition response and a conclusion of a proof point; but where varieties of RPD do differ, one must not interchange them.

Aside from the correct choice of discourse type, the importance of inherent validity of argument varies with context and with subject, as does the definition of a valid argument. In proof, which we can reduce to logical formalism—a pure argumentative construction—we can define validity quite narrowly and concretely. Either a statement qualifies as demonstrably true, based on the points already made within the text or other facts assumed known, or it does not. Most other genres, lacking a completely objective underpinning, must focus more on plausibility. Within an ancient Greek context, such plausibility would lie in asking a deity for a gift within his or her power and inclination to grant, rather than demanding that the war god Ares make one's crops grow or, as the Trojan women do in the *Iliad*, imploring the goddess Athena to protect a city under attack by Athena's own favorite mortals.¹

Note that the very act of producing RPD, and the skill with which one does so, can affect the validity of the content in these non-concrete situations: in the *Odyssey*, Odysseus addresses local nymphs with *nun d'euchōlēis aganēise/ chairet'* ("Now rejoice in my friendly prayers": *Odyssey* 13.357-8). (Pulley 1997) Many classical hymns make a similar assumption that the act of prayer pleases the deity, and since the prayer serves as a demonstration of piety it strengthens the speaker's argument that the deity should favor him. In other cases, however, the application of RPD may simply make the

¹ Ovid's *Amores* 1.1 provides a humorous depiction of chaos—Apollo fighting, Mars playing the lyre, Venus wandering around in the woods, Minerva lighting wedding processions—that depicts the necessity in the ancient mind of each deity sticking to his or her own domain.

objective validity of the content less relevant: asking for something unreasonable may well sound more acceptable when couched in persuasive and familiar phrasing.

Purpose

RPD does not function purely based on validity of argument and content (discussed above)—whence the term *persuasive* discourse. As a demonstration, we may observe the differences between a ‘valid’ proof and a ‘good’ proof. Any merely logically sound proof technically qualifies as valid. A ‘good’ and fully effective proof, however, leaves the reader convinced of the truth of the statement and, preferably, with an understanding of the underlying concepts; it should also read easily and have some degree of ‘elegance.’ (Mathematicians disagree to some extent on what constitutes elegance, predictably enough given the subjective aesthetic nature of the term, but most ascribe elegance to briefer, simpler proofs and those that reveal some useful or interesting insight into the underlying principles. Elegance also relies on clear and reasonably concise expression of the proof.) We focus on ‘good’ proofs, rather than purely correct ones, for the flexibility of their language (in comparison to formal logic proofs, at any rate) and their focus on persuasion.

Indeed, some proofs can persuade at least the casual reader *without* logical validity, such as classic false proofs demonstrating that $1 + 1 = 3$ and the like:

$$\begin{aligned} \text{Let } a &= b. \\ \text{Then } a^2 &= ab, \\ a^2 + a^2 &= a^2 + ab, \\ 2a^2 &= a^2 + ab, \\ 2a^2 - 2ab &= a^2 + ab - 2ab, \\ \text{and } 2a^2 - 2ab &= a^2 - ab. \end{aligned}$$

Then $2(a^2 - ab) = 1(a^2 - ab)$,
 so that, canceling $(a^2 - ab)$ from both sides, we have $1 = 2$;
 thus, by substitution $1 + 1 = 1 + 2 = 3$. (Spencer 1998)

Such samples qualify as effective RPD only to a point, since higher-level readers will immediately notice logical flaws—false basic-algebra proofs such as ‘ $1 + 1 = 3$ ’ frequently rely on dividing by zero in some non-obvious way, as this one does. Yet these proofs may still use the linguistic principles of RPD to perfection, and may thereby convince the casual or inexperienced reader. False proofs with convincing language and less blatant logical transgressions may go completely undetected for years. In other genres, we again have additional criteria for effectiveness, of varying degrees of subjectivity, that more or less map onto the quality of ‘elegance.’ Along with using reasonable and relevant content, indeed sometimes more importantly, one must please the taste of the audience. Here we use ‘taste’ to refer to those often, but not always, subjective preferences peculiar to the genre—in some cases perhaps a rhetorical aesthetic, in some a particular feeling about oneself, in some a sense of justice, and so on. Thus we now investigate the formal tactics that RPD uses to achieve these various goals.

3. Linguistic Principles of RPD

We now turn to an examination of the ‘form’ of RPD. In this section we analyze some of the linguistic behaviors characteristic of RPD, including its organization and peculiar uses of language, both lexical and non-lexical.

Organization and structure

We begin this section by describing some specific structures used in proofs and petitionary prayer. With this evidence in mind, we can proceed to describe some of the conclusions we draw about the organizational characteristics of RPD in general.

Some organizational types of proofs

Examples from (Sagan 2001)

*Synthesis*²: Statement of theorem as ‘givens’ or conditions (*if..., let..., for...*) followed by conclusion (*then...*), proof through sequence of conclusions citing previous conclusions from within and outside the proof, summary showing that argument proves initial theorem.

Proposition 1.1.1 *If $\lambda = (1^{m_1}, 2^{m_2}, \dots, n^{m_n})$ and $g \in S_n$ has type λ , then $|Z_g|$ depends only on λ and*

$$z_\lambda \equiv |Z_g| = 1^{m_1} m_1! 2^{m_2} m_2! \dots n^{m_n} m_n!$$

Proof. Any $h \in Z_g$ can either permute the cycles of length i among themselves or perform a cyclic rotation on each of the individual cycles (or both). Since there are $m_i!$ ways to do the former operation and i^{m_i} ways to do the latter, we are done. ■

Synthesis-analysis: States theorem, gives intermediate conclusion and demonstrates that intermediate conclusion implies final conclusion (*we need only show that...because...*), proves intermediate conclusion.

[In showing that a certain W is a submodule] To check that W is closed under the action of S_n , it suffices to show that $\pi \mathbf{w} \in W$ for all \mathbf{w} in some

² I have developed these terms for classifying proof structure types, based in part on observations in Fetisov, A. I. (1963). Proof in Geometry. Boston, D. C. Heath and Company.

basis of W and all $\pi \in S_n$. (Why?) Thus we need to verify only that $\pi(\mathbf{1} + \mathbf{2} + \dots + \mathbf{n}) \in W$ for each $\pi \in S_n$. [Proof of this fact follows.]

Indirect: Assumes the negative of the conclusion, begins sequence of conclusions from this assumption, reaches a final demonstrably false conclusion (one that contradicts givens or previously proven results).

[In a discussion of Maschke's theorem] However, we can *not* drop the finiteness assumption on G , as the following example shows. Let \mathbf{R}^+ be the positive real numbers, which are a group under multiplication. [Standard synthesis-type reasoning follows, relying on Maschke's theorem working for \mathbf{R}^+ , an infinite G .] But then

$$X(r) = T^{-1} \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} T = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

for all $r \in \mathbf{R}^+$, which is absurd.

Motivated: Begins with reasons for setting the givens or a demonstration of the usefulness of the result if proven.

It is now an easy matter to prove Schur's lemma, which characterizes homomorphisms of irreducible modules. This result plays a crucial role when we discuss the commutant algebra in the next section. [Standard synthesis proof follows.]

Corollary: Places reasoning first, then states theorem.

It is interesting to note that Schur's lemma continues to be valid over arbitrary fields and for infinite groups. In fact, the proof we just gave still works. The matrix version is also true in this more general setting. [Statement of "matrix version" of general form of theorem follows.]

Some organizational types of prayers

Greek petitions: Invocation, optional *pars epica* or 'argument' listing reasons for granting the request (including list of previous service to the deity), request.

*Zeū pater, ē ra tin' ēdē hupermeneōn basilēōn
tēid' atēi aasas kai min mega kudos apēuras?
ou men dē pote phēmi teon perikallea bōmon
nēi poluklēidi parelthemen enthade errōn,
all' epī pasi boōn dēmon kai mēri' ekēa,
iemenos Troiēn euteixeon exelapaxai.
Alla, Zeu, tode per moi epikrēēnon eeldōr;
autous dē per eason hupekphugeein kai aluxai,
mēd' outō Trōessin ea damnasthai Achaious. (Iliad 8.242)*

Father Zeus, was there ever a mighty king whom you blinded with a blindness like this, robbing him of great glory? I tell you that I have never passed by a beautiful altar of yours as I came to this wretched place on my many-oared ship, without burning the fat and thighs of oxen on them all, keen as I was to lay waste Troy of the beautiful walls. Come now, then, Zeus, grant this wish for me. Allow us to flee and escape and do not allow the Achaeans to be beaten thus by the Trojans. (Pulleyn 1997)

Roman petitions: Invocation with specification of deity through epithets if needed, possible persuasive reference to sacrifice, expression of intent to make a request, list of desired favors, request for general divine goodwill. Can contain *pars epica* but less commonly and extensively than in Greek.

Vos, Ceres mater ac Proserpina, precor, ceteri superi infernique di, qui hanc urbem, hos sacratos lacus lucosque colitis, ut ita nobis volentes propitii adsitis, si vitandae, non inferendae fraudis causa hoc consilii capimus. (Livy 24.38.8, L. Pinarius to his troops) (Hickson 1993)

"You, Mother Ceres and Proserpina, and all ye deities, celestial and infernal, who have your dwelling in this city and these sacred lakes and groves-I pray and beseech you to be gracious and merciful to us if we are indeed purposing to do this deed not that we may inflict but that we may escape treachery and murder." (Etext 2005)

Christian Collects (from the Book of Common Prayer): invocation of God, petition, support (*through Jesus Christ...*), optional glorification of God. (Brook 1965)

(Collect for Vocation in Daily Work) Almighty God our heavenly Father, who declarest thy glory and showest forth thy handiwork in the heavens and in the earth: Deliver us, we beseech thee, in our several occupations from the service of self alone, that we may do the work which thou givest us to do, in truth and beauty and for the common good; for the sake of him who came among us as one that serveth, thy Son Jesus Christ our Lord, who liveth and reigneth with thee and the Holy Spirit, one God, for ever and ever. *Amen.* (Guilbert 1977)

Navajo 'prayers': Series of unchangeable fixed elements (including catalogues and myths), sometimes linked by sections that the singer may adapt to the problem at hand. Note that Navajo holy songs, unlike what we may think of as prayers, do not exactly importune anyone for help; by their proper utterance they accomplish a purpose. In this they come, in fact, closer to proofs. We can still argue for the 'persuasive' aspect of RPD as they must reassure the patient as well as fulfilling their function, and they do include opportunities for the practitioner to modify and expand the text, which he must do in accordance with the style and language of the prayer as a whole. (Reichard 1944)

We observe specific comparable elements in proofs and prayers, many of which prove plausible for other discourse types to use as well. These elements of course do not have the same content since the different genres tend to treat entirely different subjects, but they may serve matching purposes. We can also draw parallels based on position within the text, necessity (or lack thereof) of including the element, usual amount of the discourse taken up by that element, and flexibility of placement. For example, we find an 'invocation' in all our examined discourses: in prayer it appears straightforwardly as an address to the deity, but in mathematics the introductory reasoning of a motivated proof

serves the same purpose of attracting the attention of the desired audience and providing a general hint as to the direction the argument will take. Other such common elements include partial recaps at the end of a section and concluding summaries of the entire piece. We also frequently see the drawing in of authorities or support external to the passage itself, as shown in this proof:

Since the irreducible characters are orthonormal with respect to the bilinear form $\langle \cdot, \cdot \rangle$ on $R(G)$ (Theorem 1.9.3), they are linearly independent. But part 3 of Proposition 1.10.1 and equation (1.18) show that we have $\dim R(G)$ such characters. Thus they are a basis. (Sagan 2001)

We also notice a phenomenon of discourse-specific substructures (such as mathematical induction or the listing of epithets) that appear with some frequency and always in their entirety, but not necessarily in all examples of the genre. These ‘tropes’ do not completely determine the organization of the text and can serve with multiple overall structures, but the way that they function within the larger organization of the text and the freedom of their movement within a piece depends on the specific substructure and genre.

Indeed it seems that some genres favor the existence of these blocks more than others. Some, such as Navajo chants, rely on total organization in which every component has a precise position in the sequence. (Reichard 1944) Others use a block-based organization strategy, similar to the mathematical concept of a partial ordering. In this approach, certain groups of elements must appear together and in a particular order, but the order of the groups themselves may shift depending on the author’s preference, emphasis, or perception of flow. Most mathematical proofs have some degree of block-based organization, as we see from synthesis-analysis proofs—essentially a reordering of blocks of logic within a synthesis proof. Other instances of RPD may fix certain key

elements relative to one another but allow variation in organization between and within them. Lists of epithets in classical prayer, which generally appear at a fixed point near the beginning of the prayer but in which the epithets themselves may appear in any order convenient to meter and poetry, follow this pattern. Likewise, using mathematical induction requires an author to address a ‘basis case’ and an ‘inductive step’ (as well as, in a thorough proof, recapping why the use of induction proves the desired proposition), within each of which he may proceed as he sees fit.

We can thus see that each genre takes, to some extent, its own approach to the specifics of organization. For that matter, how closely and how essentially one must follow the ideal organization also varies from type to type, and even between examples within types. Essentially, some types of RPD lend themselves better to customization than others. RPD in general, though, does rely on organization. In most cases one may only customize to a certain extent; there exist rules about where one may insert one’s own ideas and in what form. For example, when one produces a proof in mathematics the content necessarily changes between each proof, but one would conventionally use a certain structure given the type of proposition, or prove certain concepts leading up to one’s result in a certain way. Velleman offers a multitude of generalizations, including:

To prove a conclusion of the form $P \rightarrow Q$:

Assume P is true and then prove Q .

or Assume Q is false and prove that P is false.

To use a given of the form $P \rightarrow Q$:

If you are also given P , or if you can prove that P is true, then you can use this given to conclude that Q is true. Since it is equivalent to $\sim Q \rightarrow \sim P$, if you can prove that Q is false, you can use this given to conclude that P is false.

To prove a goal of the form $\forall x P(x)$:

Let x stand for an arbitrary object and prove $P(x)$.

To prove a goal of the form $\exists x P(x)$:

Try to find a value of x for which you think $P(x)$ will be true.

or Introduce a new variable x_0 into the proof to stand for an object for which $P(x_0)$ is true.

To prove a goal of the form $P \wedge Q$:

Prove P and Q separately.

To use a given of the form $P \vee Q$:

Break your proof into cases. (Velleman 2006)

In other genres even content may have restrictions: observe the Prayers of the People, where one must pray for the given parties and results except at those clearly marked points where one may add one's own petitions, denoted by such instructive phrases as:

Members of the congregation may ask the prayers or the thanksgiving of those present

I ask your prayers for _____.

I ask your thanksgiving for _____. (Guilbert 1977)

We must simply determine for each genre which organizational rules qualify as 'laws' and which as merely 'guidelines.'

'Syntactic' features

RPD has many non-lexical features that help distinguish it from ordinary language. These may include specifically unique or merely unusual constructions, as well as increases in flexibility of expression. These quirks seem to arise from two main impulses, the archaic and the artistic.

Because of the ritualized and tradition-focused context in which RPD generally appears, one often has specific instances of RPD long outlasting their contemporary dialects. Possibly because of the influence of these examples (which naturally tend to hold great importance to the field, arise often, or have 'pattern' status as examples to imitate in creating one's own texts—explaining why they endure for such a long time),

even newly created instances of RPD will use items fallen into disuse in the everyday language. Note that archaism may arise from deliberate imitation of previous examples so as to produce ‘correct’ text, from respect for tradition in general, or from an appreciation for archaic linguistic behaviors as belonging more fully and solely to the realm of the relevant RPD (though this may merge into a simple separation of usage between RPD and everyday language, albeit one that arose from retaining an originally shared item).

Archaisms abound in religious spheres, where a particularly strong reverence for tradition sometimes combines with a fear that changing even the smallest part of the traditional language will give negative results. In Greek, the word *kluthi* (‘hear’) appears in that form, the singular imperative, only when addressing gods; the plural imperative occasionally appears with mortals (increasingly so in later work), but seems to do so in serious situations when the religious gravitas associated with the word would not feel out of place. The imperative in *-thi*, a very old morphological formation and Indo-European remnant, appears with only a few verbs, several of which also appear mainly in religious contexts (*hilēthi* ‘be propitious,’ *phanēthi* ‘appear’). (Pulley 1997) Traditional sects of Christianity frequently retain archaic pronoun and verb morphology—most classically,

*Our Father Who art in Heaven,
Hallowed be Thy name...*

but in a wide range of other cases as well.

The artistic category includes features whose existence we cannot easily explain by tracing them back to a time when they had the same usage in normal speech and RPD. We must assume in these cases that RPD has absorbed them for other reasons, whether a particular need or simply an aesthetic preference for them. Freedom of word order seems to fall into this category—observe *mercifully to hear us*, from the Christian Collects.

(Guilbert 1977) We also observe the use of a number of passive and impersonal features in proof language—where subjects and actors tend toward the scarce—that we do not generally use: *let X...*, *X is defined as...*, *X is determined by...*, *with X being...*, *it is obvious that*, and so on. The tendency to use the plural first person *we* in mathematics (and other formal academic writing) even when only one person creates the discourse seems to combine aesthetics with a desire to reflect the impersonality of the proof. Similar blends of aesthetics and consideration of function appear in the treatment of verb tenses in Greek and Navajo sacred texts: Greek does not use the imperatival infinitive with deities, apparently in part because it sets a tone of inappropriate confidence in one's own instructions, while by contrast Navajo uses perfective and future tenses in its prayers to reflect that, by the fact of the performance of the prayer, the desired result will come to pass—indeed *has* come to pass by the end of the performance: *Beyond it danger will pass by me./Beyond it danger has passed by me.*" (Reichard 1944; Luckert 1977; Pulleyn 1997)

Vocabulary and phrases

RPD almost invariably relies on an array of specialized vocabulary. The purposes these specialized terms serve, and the frequency with which they appear, vary between genres, but we may make the general observation that they tend to apply to the most central and important concepts of the discourse.

In examining vocabulary, we must make a distinction between jargon and unofficial adaptation of elements of everyday language. Any discourse on issues not

usually part of life will, by nature of its content, have to include words that do not appear in other spheres. This type of language arises simply as a way of describing specialized objects. We also, however, find words never formally defined to have an atypical meaning but that function in an atypical way. This distinction becomes especially important in mathematics, where we can define a term to have any meaning (though preferably, in the interests of elegance, one reasonably consistent with its usual sense), but where we also tacitly assign specialized mathematical, logical, and rhetorical meanings to function words and the like.

Just as we see the prevalence of archaic syntactic features, we find vocabulary terms whose meanings have changed (or that have fallen into disuse) in ordinary speech but retain other uses within RPD. Sometimes this meaning mismatch stems not from one-sided evolution, but from evolution in different directions in RPD and everyday speech, or from evolution within RPD alone due to extensive usage or the need to express a particular concept. Words such as *vouchsafe* in Christianity and *veneror* ('worship') in Roman religion serve as examples of this tendency toward archaism. (Hickson 1993)

Expansion of meaning seems to occur less often than other types of meaning alteration (which phenomenon makes a certain amount of sense, since RPD generally arises in limited contexts where more specific and narrow word meanings become both more useful and more likely). Indeed the everyday language usually retains the ability to use a word in its RPD sense, if only metaphorically or with special explanatory emphasis ('He's a saint—no, seriously, he's actually a Saint'), so that usually RPD meaning becomes a subset of everyday meaning. In some cases, however, RPD clearly remains the source of the particular usage.

We may take as an example the Latin *colere*, with the basic meaning ‘inhabit.’ In ordinary Latin speech, *colere* generally means ‘till’ and often appears in descriptions of farming. It also, however, has a more figurative meaning: ‘protect, cherish.’ Common in Livy and poetic prayers, *colere* often appears in a relative clause of the structure *qui...colis* (‘[you] who protect ___’) identifying the deity addressed. To use *colere* in this abstract sense outside of prayer, one must have the idea of a protective deity in mind; essentially, one must import the context of religion into the conversation. When it lacks this association with divinity, *colere* simply refers to physical attention. (Hickson 1993)

Much more commonly, we see restriction of words’ meanings within RPD—reasonably enough, since we may expect specializing discourse to result in specialization of words. We generally find two major types of restriction: ‘loss of sense’ and ‘demanding definition.’

‘Loss of sense’ describes those situations in which a word takes on a reduced number of meanings in the context of RPD. Most words in language have a wide variety of literal and metaphorical senses, but the common desire in RPD for precisely appropriate words leads to an avoidance of peripheral definitions in favor of clearly and unambiguously addressing one central concept. In mathematics, the most dramatic example concerns the connective *or*. In English, *or* can act either inclusively or exclusively: *A or B* with inclusive *or* holds true if *A*, if *B*, and if *A* and *B*, while with exclusive *or* does not hold if *A* and *B*. We may thus say ‘Would you like something to eat or to drink?’ and then provide both, but we may also say ‘Would you like the fish or the vegetarian option?’ and allow the choice of only one item. Ordinary speech usually glosses over this ambiguity; the context of *A or B* generally makes it clear whether *A and*

B constitutes a possibility, and at times we may use tone of voice or emphasis to disambiguate more fully (as in ‘Now, Timmy, you can have cake *or* ice cream’). In mathematics, however, the exclusive meaning of *or* simply does not exist, regardless of pragmatics or context. (Formal logic explicitly defines the ‘or’ operator, as a term, in a purely inclusive sense. Most mathematical texts, however, do not include a discussion of formal logic, and many readers have little acquaintance with the subject as such; rather, the reader recognizes the non-exclusivity of *or* merely through familiarity with the discourse.) If we say ‘Let x be a multiple of 3 or a multiple of 2,’ then x may perfectly well equal 6. Mathematicians may use *or* in situations where both options cannot simultaneously hold true (‘Let x be a prime or a multiple of 6’), but their mutual exclusivity never stems from the use of the word *or*. (Morash 1991)

Another common technique in mathematics, ‘demanding definition,’ involves reducing the meaning of a word by creating different, and usually more specific, requirements for the items it may describe. Mathematical texts overflow with formal definitions of terms, stating all the relevant features of the object under discussion. Often these definitions appear set off from the main text, labeled, and even numbered for future reference. The term defined usually receives some sort of special emphasis, to clarify which term will take on the meaning described.

Definition. Let A be open in \mathbf{R}^n . Let $g : A \rightarrow \mathbf{R}^n$ be a one-to-one function of class C^r , such that $\det Dg(x) \neq 0$ for $x \in A$. Then g is called a **change of variables** in \mathbf{R}^n . (Munkres 1991)

In prayer, ‘demanding definition’ of this explicit type appears frequently in direct address. When the speaker wishes to ensure that the prayer reaches the ears of a particular deity, or an entity likely to take responsibility for the issue at hand, he may opt to include

a definition of his addressee in these terms. In Christianity we find the phrase *who takest away the sins of the world* to describe Christ, in connection with a prayer for mercy; in Roman prayer we find phrases such as *cuius in tutela Argi sunt* (“who are in charge of Argos”) in a prayer for Argos’ safety. (Guilbert 1977; Hickson 1993)

Authors do not always, however, make their definitions so overt. They may simply rely on the RPD context to supply the associations they need, without specifically saying that they intend to use a word in a context-specific manner. In mathematics, for example, the word *line* applies to far fewer objects than in ordinary speech; a long, curved mark might qualify as a line in general English, but not in mathematical terms. Though some elementary mathematical texts do define *line* (as a particular type of infinite one-dimensional manifold), most proofs mentioning lines simply assume that the reader knows the appropriate definition of *line* and will recognize it as used in the discourse-specific sense rather than the general one. In doing so, they rely on the reader’s previous knowledge of mathematics and his familiarity not with any specific statement of the definition but with the conventional usage of *line* throughout the subject. Words used at all levels of mathematics—*surface*, *intersection*, *continuous*, *compact*, *field*, *add*, even *prove*—apply invariably only to particular objects or situations, though within a given text they usually do not come accompanied by formal definitions.

Other words, meanwhile, appear with more or less the same definition as in everyday language, but have become the default ways to express a given concept and appear far more frequently relative to their synonyms than one would expect. Thus, in mathematics, the word *unique* takes on a demanding definition compared to its typical one (‘the unique X that Ys’ means that there exists precisely one entity Z such that Z Ys,

and $Z = X$ —it does not, as it would in ordinary English, describe an X that happens to Y and in some respect, not necessarily that one, differs from all other entities). It also takes on extremely heavy usage, and mathematicians use it almost exclusively for a concept they could convey by *single, only, precisely one*, and so on. A word generally gets this heavy usage only in one sense, even if it may still appear in other senses.

4. Samples

In this section we examine specific passages from each of our major sources of RPD, pointing out instantiations of the principles described above.

Proof (from representation theory) (Sagan 2001)

Proposition 1.7.6¹ *The center of Mat_d is*

$$Z_{Mat_d} = \{cI_d : c \in \mathbb{C}\}.$$
²

Proof. Suppose that $C \in Z_{Mat_d}$. Then, in particular³,

$$CE_{i,i} = E_{i,i}C \tag{1.15}$$

for all i . But $CE_{i,i}$ (respectively, $E_{i,i}C$)⁴ is all zeros except for the i th column⁵ (respectively, row), which is the same as C 's. Thus (1.15) implies⁶ that all off-diagonal elements of C must be 0. Similarly⁷, if $i \neq j$, then

$$C(E_{i,j} + E_{j,i}) = (E_{i,j} + E_{j,i})C,$$

where the left (respectively, right) multiplication exchanges columns (respectively, rows)⁸ i and j of C . It follows that all the diagonal elements must be equal and so $C = cI_d$ for some $c \in \mathbb{C}$. Finally, all these matrices clearly commute with any other matrix, so we are done⁹. ■¹⁰

1. **Proposition 1.7.6:** Clearly sets off beginning of proof using terminology specific to discourse
2. States theorem. This proof does not explicitly state givens as it relies on definitions of the relevant objects previously established in the text.
3. *in particular:* Ritualized vocabulary that comes to mean ‘in one specific case,’ without the normal English dimension of ‘especially’

4. (*respectively, E_{ij}C*): Unusual syntax with odd word order and dropping of extraneous words
5. *column*: Example of ‘demanding definition’: in mathematics *column* cannot refer to a building element or the like, only a specific part of a matrix
6. (1.15) *implies*: Using facts from earlier within the passage
7. *Similarly*: Disproportionately used vocabulary
8. (*respectively, rows*): Phrase (*respectively, _____*) taking on feel of repeated chorus from the repeated use of the identical structure throughout the proof
9. *so we are done*: Concluding phrase reaffirming that we have accomplished the proof we set for ourselves
10. ■: ‘Vocabulary’ symbol only used in mathematics; rarely if ever explicitly defined, but has the meaning of ‘End of the proof.’ Commonly called ‘tombstone.’

Hail Mary (Catholic) (Benedict XVI 2005)

Hail¹, Mary, full of grace²,
 the Lord is with thee³.
 Blessed art thou⁴ among women
 and blessed is the fruit of thy womb⁵, Jesus.
 Holy Mary, Mother of God⁶,
 pray for us⁷ sinners,
 now and at the hour of our death.
 Amen.⁸

1. *Hail, Mary*: Invocation of deity addressed
2. *grace*: RPD-specific vocabulary, involving loss of usual (physical) senses in favor of a demanding definition (*grace* as divine compassion)
3. *thee*: Archaic vocabulary
4. *blessed art thou*: Archaic verb conjugation and vocabulary; artistic word order
5. *fruit of thy womb*: Formulaic vocabulary little used outside of RPD
6. *Mother of God*: Reminder of superior status of audience, typical of RPD
7. *pray for us*: Central request of petition
8. *Amen*: Ritualized conclusion

Aeneid 4.607-621 (Dido’s curse of Aeneas prior to her suicide) (Hickson 1993)

Sol, qui¹ terrarum flammis opera omnia lustras,
 tuque harum interpres curarum et conscia Iuno,
 norturnisque Hecae triviis ululata per urbes
 et Dirae ultrices et di morientes Elissae²
 accipite haec, meritumque malis advertite numen

et nostras³ audite preces⁴. si tangere portus
 infandum caput ac terris adnare necesse est,
 et sic fata Iovis poscunt, hic terminus haeret,
 at bello audacis populi vexatus et armis
 finibus extorris, complexu avulsus Iuli
 auxilium imploret videatque indigna suorum
 funera; nec, cum se sub leges pacis iniquae
 tradiderit, regno aut optata luce fruatur,
 sed cadat ante diem mediaque inhumatus harena.
 haec precor⁵, hanc vocem extremam cum sanguine fundo⁶.

Translation (A. S. Kline)

O Sun¹, you who illuminate all the works of this world,
 and you Juno, interpreter and knower of all my pain,
 and Hecate howled to, in cities, at midnight crossroads,
 you, avenging Furies, and you, gods of dying Elissa²,
 acknowledge this, direct your righteous will to my troubles,
 and hear my³ prayer⁴. If it must be that the accursed one
 should reach the harbour, and sail to the shore:
 if Jove's destiny for him requires it, there his goal:
 still, troubled in war by the armies of a proud race,
 exiled from his territories, torn from Iulus's embrace,
 let him beg help, and watch the shameful death of his people:
 then, when he has surrendered, to a peace without justice,
 may he not enjoy his kingdom or the days he longed for,
 but let him die before his time, and lie unburied on the sand.
 This I pray⁵, these last words I pour out with my blood⁶.

1. *Sol, qui (sun, who)*: Invocation with specification of deity through epithets (continuing through various appropriate deities: Juno, Hecate, the Furies)
2. *di morientes Elissae (gods of dying Elissa)*: A sort of reference to sacrifice; Elissa (another name for Dido herself) provides herself as a sacrifice
3. *nostras (our)*: Example of ritualistic syntactic oddity in using plural with singular speaker
4. *audite preces (hear [our] prayers)*: Expression of intent to make a request, followed by list of horrible things to happen to Aeneas
5. *precor (I pray)*: Use of vocabulary specific to RPD
6. *hanc vocem extremam cum sanguine fundo (these last words I pour out with [my] blood)*: Conclusion, with summary reminder of self-sacrifice

5. RPD and Stylistics

In this section we briefly discuss RPD in relation to previous work in discourse theory and stylistics. The elements of RPD correspond approximately to what M. M. Bakhtin calls *speech genres*, each of which consists of a set of forms and linguistic features; Bakhtin considers them almost equivalent to syntax in their control over newly produced utterances. (Bakhtin 1986) The speaker selects a speech genre based on situational, semantic, personal, and other considerations—and, Bakhtin argues, at that point has exhausted his choices and must speak as the genre dictates. We have used the term *genre* in a slightly broader and less strictly defined sense, to refer to a particular type of RPD (for example, mathematical proofs or Greek sacrificial petitions).³

M. A. K. Halliday describes a difference between *dialect*, as a variation “according to the user,” and *register*, a variation “according to the use.” (Halliday 1978) Bakhtin draws a similar distinction between *language forms*, “stable and compulsory for the user,” and *generic forms*, “more flexible, plastic, and free.” (Bakhtin 1986) RPD, of course, can exist in any dialect, though some dialects have a greater wealth of examples than others. The concept of register holds more interest. Halliday considers registers as defined by *field*, *tenor* (originally given the vague and overworked name *style*), and *mode*—or, as he defines the terms, “first, what is actually taking place; secondly, who is taking part; and thirdly, what part the language is playing.” (Halliday 1978)

The field of discourse refers to the subject under discussion, whether the religious well-being of a congregation, the physical well-being of a patient, or the mathematical well-ordering of a set. Field, of course, affects the vocabulary used in the text, and may

³ Some authors have also used *genre* as a superset of *register* (see next paragraph), so that for example ‘job interview questions about previous experience’ might serve as a register with ‘interview questions’ as the genre. This disagreement, along with the general overuse of the term, leads us to refrain from using *genre* with a strict definition. Wales, K. (1990). A Dictionary of Stylistics. Harlow, England, Longman.

lead to different frequencies of syntactic features as well. To determine the field we must naturally examine the situation in which the speaker or speakers find themselves. RPD can, theoretically, exist given any field, and as a class it clearly includes members from many different fields, mathematics and religion only two among them. We have noted that certain fields have more extensive use of RPD than others, with a more robust body of traditions from which to form new utterances—weightier contexts encouraging more ritualization, for example, and of course some situations providing more occasion or need for persuasion—but we do not define the RPD class with regard to field. Any given sample of RPD, though, must take field into account; as we have seen, using the particular linguistic features associated with RPD in one field while discussing a different one produces comical results at best (as with the “Hear our proof” example).

The context again becomes important in determining tenor, a function of the identities of the speaker and hearer and, more importantly, their relationship. Tenor provides a more precise way of describing ‘formal’ or ‘informal’ discourse—for example, ‘between candidate and interviewer’ or ‘between two roommates.’ Indeed Spencer and Gregory see tenor as purely a measurement of “the degree of formality in the situation,” though Pearce mentions other dimensions including “degree of emotional charge.” (Spencer 1964; Doughty 1971) Both consider the relationship between parties the determining factor. We must note, however, that this relationship does *not* entirely depend on, as Halliday puts it, “who is taking part.” The same two men, discussing the same subject, may adopt entirely an entirely different tenor as strangers in neighboring seats at a baseball game than as job candidate and interviewer. We need more context to determine tenor, including an indication not only of the relationship between speaker and

audience but also of the purpose and use of the discourse. RPD, while it seems more likely to occur when the speaker has a somewhat deferential relationship to the hearer, concerns itself more with this extended, purpose-based sense of tenor. For an utterance to qualify as RPD it must by definition contain an element of persuasion, dictating its purpose (at least in part).

Finally, the mode of the discourse corresponds roughly to the method of communication. Conventionally the primary distinction lies between oral and written discourse, but these classes do not necessarily correspond to the medium in which the discourse finally appears. A speaker may use language suitable for a written mode while giving dictation, or an author may imitate an oral mode in writing to create convincing dialogue or if he hopes to transmit his work orally (as in a play or poem).⁴ Our examples show that RPD can occur in any mode, including speech, writing, and discourse written for oral performance, such as the Book of Common Prayer. Transmitting RPD in written form helps preserve the ritual elements more precisely, and of course the examples given here all appear in written form, but many cultures disseminate ritual elements orally—particularly in religious spheres. For example, many Navajo consider it inappropriate or sacrilegious, if not downright dangerous, to make any record, written or audio-based, of a Navajo religious chant. We must also observe that, while language may typically fall into written and oral forms (with roughly analogous categories for sign languages), the discourse may require some non-verbal elements. Many examples of RPD—again,

⁴ He will, in general, do so imperfectly. Spencer and Gregory note that “characters in plays and novels never talk quite like people do in life; were they to do so they would be intolerable.” The author can adopt only certain significant features of the oral mode, indicating a less clear-cut distinction between oral and written discourse than some might like. Spencer, J., and Michael Gregory (1964). *An approach to the study of style. Linguistics and Style*. J. Spencer. London, Oxford University Press.

especially religious ones—cannot occur without accompanying rituals. The written-oral axis of mode seems to account inadequately for this characteristic, but as the RPD class does not depend on mode we leave the question of expanding the mode definition an open one.

It seems a natural development to ask whether, and how, RPD forms a class based on the values of these three components. The ‘persuasive’ element clearly draws on the tenor of the discourse, or at any rate on the purpose-related aspect of tenor. But the ‘ritualized’ marker appears harder to define. Bakhtin discusses certain types of discourse in which “the speech will is usually limited...to a choice of a particular genre,” and links this restriction to “high and official” types. (Bakhtin 1986) But Bakhtin’s view does not account for the ability to alter some ritualized discourse—one may pray for different results, prove a theorem in multiple ways, or use different orderings of Navajo chant components. And, indeed, ritualized discourse does not necessarily correspond to the most “high and official” discourse: consider saying grace before a meal in the home. Thus we cannot define ritualization simply as one extreme of the formality axis included in tenor. Nor can we predict ritualization based on field or mode, since while some fields and modes may have higher frequencies of ritualized utterances, any given field or mode generally includes both ritualized and non-ritualized examples. Further research might investigate whether we can define ritualization as a function of field, tenor, and mode, or whether we must take the more drastic step of introducing another axis describing the degree of dependence on traditional ideals.

6. Conclusion

By examining varied instances of RPD and generalizing from our observations, we have determined a number of key principles of RPD. We know that while RPD does not entirely rely on its content, one must have content compatible with one's genre and context. More than argumentation, though, RPD focuses on persuasion, and the presentation of the content has as much to do with efficacy as the content itself. Because of the weight of tradition behind each instance, and usually because of the serious nature of the context, RPD must take into account highly traditional and formal language. The text as a whole must follow an organizational scheme, and the language itself may exhibit an assortment of archaic and artistic behaviors, lexical or otherwise.

The similarities between proofs and prayers that arise from this analysis certainly hold great interest, but perhaps an equally intriguing concept is the interplay between ritualization and persuasive effectiveness—one must depart from the standard in order to adapt an utterance to one's own persuasive purposes, but at the same time remain within the confines of the ideal formal language for the genre. And while persuasion fits into the field-tenor-mode conception of discourse types, ritualization seems less predictable by those methods.

Our examples span widely varied fields. Yet we can see, even before in-depth analysis, similar tendencies in other spheres, including secular supplication and legal language. Considering the extent to which RPD appears in some of the most important parts of our lives, it seems both interesting and useful to develop an understanding of its

workings, as well as how to recognize it, analyze its message and methods, and reproduce it in our turn.

Appendix A. Overview of discourse types

Proof

For our purposes, ‘proof’ refers to a careful demonstration of the truth of a given mathematical statement. We concern ourselves with English-language proofs, excluding both other natural languages and proofs consisting purely of formal logic. A typical proof might look something like this:

Theorem 1. Let (A, \leq) be a poset and $X \subseteq A$. If X has a greatest (respectively, least) element, then that element is unique.

Proof. To prove uniqueness, we proceed, as in Section 5.3, by letting u_1 and u_2 be greatest elements of X . We claim that $u_1 = u_2$. Since u_1 is an upper bound for X and $u_2 \in X$, then $u_2 \leq u_1$. Reversing the roles of u_1 and u_2 , we deduce $u_1 \leq u_2$. By antisymmetry, we conclude $u_1 = u_2$, as desired. The proof of uniqueness for least elements is analogous. (Morash 1991)

Greek prayer

Greek religion centered on the worship of several major deities (including the well-known twelve Olympians) along with various minor or local deities, demigods, and heroes. In looking at Greek prayer, we consider “articulate requests directed towards the gods.” These might arise to accompany sacrifices or rituals, or as impromptu petitions, curses, and so on. Our sources include epigraphs and examples recorded in philosophical, dramatic, and poetic documents, among them the works of Homer and the tragedians.

Demosthenes offers this example during a speech:

prōton men, o andres Athenaioi, tois theois euchomai pasi kai pasais, hosēn eunoian echōn egō diatelō tēi te polei kai pasin humin, tosautēn huparxai moi par’ humōn eis toutoni ton agōna.

First of all, men of Athens, I pray to the gods that whatever goodwill I have always had towards all of you and the city, I shall continue to be granted the same from you in this present trial. (Pulleyn 1997)

Roman prayer

Roman religion had many similarities to the Greek—including the characters, and occasionally the names, of most major deities. A practitioner would both include prayer in the performance of any religious ritual and engage in prayer on its own, sometimes spontaneously. As above, we focus on petitionary prayer, in the forms of general requests as well as the more specific curses, vows, blessings, and oaths. We find examples of these in sources ranging from Virgil to histories to graffiti to curses scrawled on bits of lead and dropped down wells. Livy supplies this description (a propitiatory *supplicatio* spoken prior to a war with Philip, 31.8.2), among many others:

Supplicatio inde a consultibus in triduum ex senatus consulto indicta est, obsecratique circa omnia pulvinaria di ut quod bellum cum Philippo populus iussisset, id bene ac feliciter eveniret....

Thereupon, the consuls, acting on a resolution of the senate, ordered special prayers and supplications for three days, and at all the shrines intercessions were offered up that the war which the Roman people had ordered against Philip might have a happy and prosperous issue. (Hickson 1993; Etext 2005)

Christian prayer

Several Christian traditions supply a formal liturgy for their practitioners to use during worship. We draw on some Catholic sources and from The Book of Common Prayer, a collection of liturgical texts used in the Episcopal Church. Within this book, we note especially the Collects, short prayers spoken at the beginning of a church service, usually requesting that the congregants become more spiritually good or better prepared to worship, as for example:

(Collect for the Second Sunday of Advent) Merciful God, who sent thy messengers the prophets to preach repentance and prepare the way for our

salvation: Give us grace to heed their warning and forsake our sins, that we may greet with joy the coming of Jesus Christ our Redeemer; who liveth and reigneth with thee and the Holy Spirit, one God, now and for ever. *Amen.* (Guilbert 1977)

We also note the Prayers of the People (in their several forms), a formal template for petition and intercession on behalf of the congregation and their concerns. Typically a deacon or other member of the congregation leads these prayers, giving a list of petitions to each of which the congregation responds in unison. These responses may vary to match each petition, as in Form III:

Father, we pray for your holy Catholic Church;
That we all may be one.

Grant that every member of the Church may truly and humbly serve you;
That your Name may be glorified by all people.

Or they may consist of a single repeated phrase, as in Form V:

Here and after every petition the People respond

Kyrie eleison or Lord, have mercy.

Most forms contain some prescribed opportunity for customized prayer, as in Form V:

For those in positions of public trust [especially _____], that they may serve justice, and promote the dignity and freedom of every person, we pray to you, O Lord.

For _____, we pray to you, O Lord. (Guilbert 1977)

Navajo sacred chants

Navajo sacred chants have a number of different purposes, usually related to restoring balance to the life or body of the subject of the prayer. Typically, a trained singer speaks or chants a line, echoed by the patient with a slight overlap. These chants often address or concern Holy People, semi-divine ancient beings, but do not beseech

them as all-powerful gods. Rather, the skill of the singer and the power contained in the words of the song (and any accompanying rituals and sacrifices) bring the desired result to pass in and of themselves; one rather compels the ‘gods’ than implores them. We see this respect for the power of the prayer itself in the highly poetic and repetitive forms of the chants and in their frequent use of future and perfective tenses:

“Evil is passing me by.

Evil will pass me by.

Evil has passed me by.

Evil has repeatedly passed me by.” (Reichard 1944; Gill 1987)

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