

INTRODUCING POLYLOGUE THEORY

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dedicated to the memory of Charles Hamblin

Polylogue generalises upon dialogue. A sitting of parliament is a polylogue, but would not normally be accounted a dialogue. A large dinner-party is also a polylogue, but would not usually be considered a dialogue when it involves several conversations. Dialogue suggests, for one thing, a central focus, a spotlight on one person, the speaker, at a time — limitations that polylogue can abandon. Dialogue is a conversation or discourse between two or more persons. No restriction to two persons is implied by the term *dialogue*, though a two party form is commonly suggested by use of the term. But a restriction to persons is normally presupposed.¹

Use of the term *polylogue* is designed to break all such presuppositions. In a polylogue the participants need not be persons; some or all may be computers, as in a parallel computing network. The folklore committee comprising three men and a dog furnishes a polylogue setting. Nor need there be any focus in a polylogue; a round-table setting with several different, and only occasionally intersecting, conversations going on at the same time, supplies a type of polylogue difficult to present satisfactorily in the usual forms that serve to represent spoken dialogue. Parallel activities such as computing, where tasks are divided up and only later coordinated again, provide other examples where for much of the polylogue process there is no central or common focus; the exchange is largely decentralised. Furthermore in a polylogue, participants may have comparatively little of the normal bases for dialogue or for communication in common. They may, for example, come from different cultures, and speak different languages, if any language at all. In what follows, allowance will be made for polylogues where the participants have different cultures or value frameworks or the like, and, as chief working example, where they conform to different logics. Finally, the sole participant in a polylogue may be an

eccentric hermit or an artificially isolated reasoner: polylogue includes monologue.

The 'communication' network which embraces the participants in a polylogue may be widely dispersed; for instance they may be in different countries linked by line. And communication between the participants may be both highly *restricted* — for instance, they can only communicate through a central coordinator or through translators or censors, if at all — *and* rather *poor*, for any of several reasons: the communication lines are faint or noisy, the participants do not share a common language or much overlap in languages, the participants have different cultures or ideologies. Many of these transmission problems in polylogue communication are familiar enough from multicultural conferences and committees (such as various United Nations forums). But such polylogues will be taken as they stand, in order as they stand, with sometimes inconsistent, and often poor or incomplete, communication. There is no need to invoke such assumptions as that the standard design and engineering problems of communication can be sufficiently solved by improved line technology, more or better translators and programmers, and so on. Inconsistent and incomplete communication and data are phenomena relevant logics are well equipped to handle (cf. Belnap and RLR).

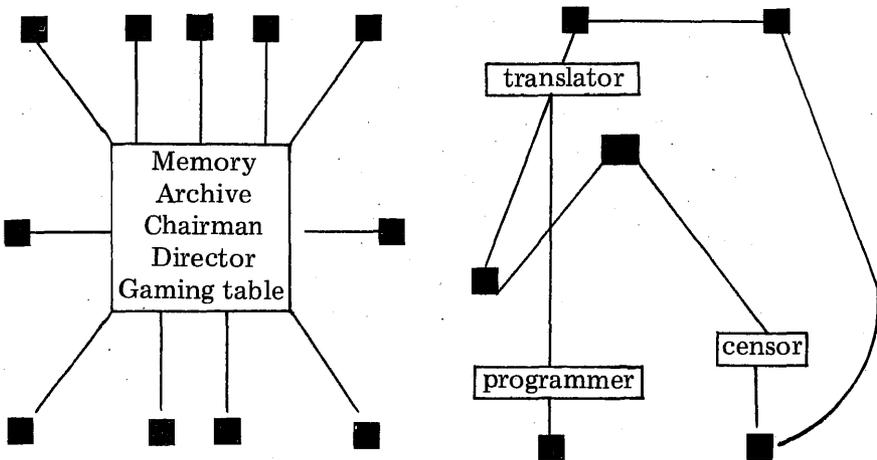
A polylogue is represented at base by a *system*, comprising *participants* related through a communications *network* and *facilitators* or filters — which perhaps, like the participants, change over the *duration* of the polylogue, new channels being added or old removed — together with a total *record*, minute minutes, which may be an interlaced tape giving the state of each participant and what it *says* (and perhaps, appropriately indicated, *experiences* or *thinks* or *does*) at each time interval for the duration the polylogue. What a novel recording a dialogue typically offers is a selection from such a total record; such a record is rather the sort of thing "intelligence" agencies would like to have on file. The remainder of a polylogue is given by *rules* applying to the system, mainly closure rules on the output.

A number of important changes can be wrung on the presentation. For example, by allowing for sleeping or empty participants and non-operational communications lines at given stages of the polylogue, a "static" formulation, with fixed lists of participants (a "total cast") and networks, can be given. Further, facilitators can be seen as special participants. Thus a polylogue setting can be viewed as a

simple time-dependent relational structure on individuals (thus describable by a first order theory, with time parameter). The output, represented by records thereof, can also be given simplified canonical form, as will appear.

Polylogue systems may thus be explained, perhaps more perspicuously, in terms of two main components, each of which admits of easy graphic representation: namely, polylogue settings at given times, and polylogue outputs.

The (physical) *polylogue settings*, at any given time during the polylogue, may be shown in a diagram, such as the following, adapted from schemes for parallel computers (Goldschlager and Lister, p. 104) :



In this diagram, small black boxes indicate participants, lines communication lines. (The lines can always be decomposed to binary relations, where the channels are only for communication.) The larger boxes show various facilitators or controllers or focusses. The setting may change over time, as in that splendid polylogue, the Mad Hatters' tea party (for looked at one way, the Alice books each consist of a series of logically interesting polylogues).

The *polylogue output*, the record of the communication, may also be depicted, as for instance in the following section of an inter-communication running unsuccessfully and at cross purposes :

	Particip- ant 1	Particip- ant 2	3	1, to 2	3	1, to 3	
...	Bah-bah BAH !	Your tail is still hurting you ?	all its utter- ances are false	Bah-bah Bah-Bah Bah	All commu- nications in this poly- logue are false !	Bah (through inter- preter) Oh can it ! Bah-bah	...
TIME AXIS 							

What is entered in a single communication box may be quite extensive. For instance, it could be the contents (the finite sequence of symbols) of the tape of a Turing machine at any stage in a complex calculation; and, for that matter, the output could be the sequence of Turing machine tapes involved in the calculation.

Even where there are several interchanges proceeding at the one stage, for instance different conversations at different corners of the room, these can be packed onto a single linear tape, or into a standard record book; and provided they are adequately coded the separate interchanges can be unscrambled. For such purposes a time indicator alone is not sufficient (though time will afford a partial ordering of locutions), but further contextual indicators will serve, in the example given such indicators as, in the east corner. Because of the intertangling of communication, it becomes relevant who is addressing whom, who is sending and who is receiving (or intended to, given that success or not being written in).

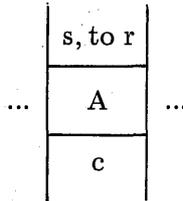
These considerations help determine the form of each item of polylogue output. Starting with the linguistically predominant element, it takes such forms as :

Locution A is directed by participant s at audience r
in context c (1)

Here s represents the speaker or sender, r the audience or receiver; the context c will include a time indicator and commonly spatial and other setting indicators. Direction can be interpreted in this sort of way: s prepares A (e.g. draws it from an appropriate state and codes

it for transmission) and transmits on communication lines to r. The correlated reception relation, A is received by t from s in c, can be interpreted similarly; for instance, t intercepts A on a line from s (and decodes and stores it). Direction, which amounts to attempted communication, may fail to get through; successful communication is a matter of both direction and reception.

The output form can be given various pictorial and symbolic representations. It can be shown, as before, as a slide or stage or an annotated tape, thus :



Or it can be simply condensed to the symbolic form

$$D(A,s,r,c) \tag{2}$$

and the linguistic connotations (the restriction to directed *locutions*) removed from the interpretation. Thus relation D can alternatively be interpreted in terms of relation C of successful communication or in non-linguistic terms (e.g. of thought or experience A). Where the reception relation D^0 is supplied, C can be defined; $C(A,s,t,c) =_{Df} (D(A,s,t,c) \ \& \ D^0(A,t,s,c))$, given a suitably tight context notion. Such symbolic forms can do a rich variety of jobs, three of which are important in making connections, as well as for what follows :

- 1) $D(A,s,r,c)$ can represent the set-theoretic structure $\langle c,s,r,A \rangle$.

As such the output element directly generalises on the dialogue elements of what may be called the *Australian* approach to dialogue (initiated by Hamblin and continued by his former students, especially McKenzie). The dialogue elements, or *locution-events*, of this approach take the reduced form $\langle t,s,A \rangle$ where the first time component is simply given by a numeral representing the place of the element in the sequence. The audience can be omitted from the elements because in this approach it is assumed to be the set P of all participants in a dialogue :

The participants in a dialogue are assumed to be always all present and fully participating in it, in the sense that a locution of any participant is directed to all the others participating in this dialogue and is heard and understood by them all (Hamblin 71, p. 131).

Thus $\langle t,s,A \rangle$ amounts to $\langle t,s,P,A \rangle$.

But the *generalised* Australian approach indicated is required because Hamblin's conditions are unduly restrictive. For instance, a Platonic dialogue does not end or begin because some young man in the audience enters or leaves. And in the more general polylogue framework where several exchanges or processes may be going on simultaneously it is important to be able to indicate other elements of context than temporal or ordinal placement of locution-events.

On the other hand, the generalisation can simply take over, without further ado, the technical work accomplished under the Australian approach. In particular, it can absorb all the working examples of Hamblin (especially in 71) and of McKenzie, thus providing a solid background in detailed examples for the theory, and incorporating, in Hamblin's fashion (of 70), a theory of fallacies.

However there are grounds for being less than fully satisfied with the set-theoretical representation of this approach, generalised or not. In part this is because of the way the representation buries the crucial locutionary parts (such as A) within the set-theoretical apparatus — something avoided in novels, Hansard reports², and so on, where the locutions are exposed, but ancillary material, such as to whom a statement was directed, may be bracketed. Part of the problem lies, however, with the set-theoretical representation itself, the fact that it provides an *object*, of the wrong sort for statemental operations, such as implication and conjunction, and an unduly inflexible one at that.³ Alternative representations of form 2) escape some of these problems.

2) $D(A,s,r,c)$ takes relational form $d(s,r,|c|,\S A)$,

where \S is the *that* operator, or other appropriate subject-forming operator (such as a quotation corner), and $|c|$ is an appropriately individualised context term (such as a time parameter or mereological sum of such parameters). The point of the fancy footwork — which can be dispensed with by those who (rightly) do not mind mixing types — is to get the expression into an appropriate first order form, so that it can be simply plugged into quantificational

logic, and that logic applied to deliver a logic of dialogue as an application. This representation gives then the *standard Anglo-American* approach to such matters as the "logic" of dialogue. It is simply another applied logic, and not a very interesting one, since the special axioms for relation d are very weak (to the point of vanishing).

Some of the shortcomings of this approach can be avoided by removing the unnecessary first order (or order) restrictions, and considering the mixed relational form $d(s,r,c,A)$ in an appropriate *intensional* logic. It is bound to be intensional because $A \equiv B$ is no guarantee at all that $d(s,r,c,A) = d(s,r,c,B)$. Indeed the logic will not be modal either, because strict equivalence is no insurance of intersubstitutivity; the logic will be rather highly intensional. Nonetheless the format still buries locutions, making logical operations upon them indirect and more difficult than need be.⁴

3) $D(A,s,r,c)$ is given relativised sentential form $A(c,s,r)$.

The great advantage of this form is that it can be immediately plugged into the framework of context logic (as developed in Goddard and Routley). Moreover, it affords immediate access to the critical, now exposed, sentential or symbolic components, to which the main logical work (the making of inferences or computations, determination of fallacies, etc.) is directed. And it facilitates imitation of features of natural language flexibility, such as the contraction of context to relevant components only — so $A(c,s,r)$ can often be contracted to $A(c)$ — and the shunting of many features of context from the syntactical format into the semantical evaluation — so we can often make a retreat to familiar sentential logics (where much of the real logical work we presently know about takes place).

Although 3) gives our preferred representation, nothing confines us to it, and we shall make use of all the representations, especially of the theory already elaborated under representation 1).

Because a polylogue output amounts to a sequence of dialogue elements, and there are various ways of restructuring the sequence, the output can be transferred into various canonical forms. Thus we can assume a single speaker, and could often assume a singleton audience, reducing elementary transactions to binary ones. Most important, we can suppose without loss of generality that the locutions in sequence elements (communication units) are no greater than sentences; paragraphs, for instance can be replaced by elements

consisting of their constituent sentences. This reduction to sentences is applied both in setting the elements into context logic and giving world semantics for the output.

A polylogue output is represented then by a sequence of elements of the form (2). There may appear to be some awkward questions as to what makes these sequences cohere as something we should want to reckon as like multiple dialogues, as opposed to arbitrary concatenations of sentences in contexts. The answer is two-fold. Firstly, the polylogue output is coupled with, and constrained by, an appropriate polylogue setting. Secondly, and more significant, there are more holistic restraints upon a polylogue output. Most important polylogues must conform to certain sets of rules. Closure under enough of these sets of rules is crucial to the unity of polylogues.

The rules controlling polylogues come in several (overlapping) varieties. There are, firstly, *linguistic* rules, beginning at the top with such comprehensive rules as that the locutions of a polylogue conform, isolated (and some quoted) expressions apart, to the colloquial grammars of recognised language or communication media.⁵ From that super-rule it follows that a great many more specific grammatical rules, well-formation rules, apply to locutions in polylogues. But a polylogue is not ill-formed should it include sub-dialogues in different languages, as it may. Requirements of well-formation have to be more generously construed, to allow for multi-cultural settings, with several languages involved (as, e.g. in simultaneous translation settings).

It is something the same with a second group of rules, *logical* rules. There are polylogues where participants may differ as to logic, and consequently share only a limited intersection of rules. But though there is such a variety of logics that common ground is ruled out, few of these logics are "spoken", and breakdown of communication in a dialogue is much more likely through language failure than through logic failure, which is a rather academic concern. There would, it seems, be little practical loss of generality in restricting polylogues to those conforming to normal logical conditions, that is to *normal* polylogues.⁶

Let us superpose the usual logical connectives, & (approximating 'and'), v ('or') and ~ ('not') on those polylogues whose languages, as determined by their records, do not include them. (We can also superpose quantifiers, such as U ('every') and P ('some'), and other connectives, but the usual constants will serve to illustrate the

general procedure.) Mostly, normally, such connectives *will* be included, at least in approximate form; but failing that there are two things we can do. Either we can restrict the polylogues to normal ones which will contain the connectives in some form. Or, better, we can extend polylogues by these connectives, subject to their rules. These will furnish the *normal extensions* of polylogues, and every polylogue will have such an extension (though perhaps in vacuous form, e.g. if the communicational medium is entirely interrogative or imperative). Let us decide to allow the connectives to operate in a well-formed fashion across the whole range of declarative locutions, though in some cases, those of multilingual polylogues, this will involve language splicing; for instance A&B will be well-formed though A and B derive from different languages.⁷ It is useful, though not essential, to distinguish (for each polylogue) a subclass of declarative locutions; and for present purposes this is best done by determining whether they can significantly hold. That is, A is a *declarative* locution iff the quotation of A can be said significantly to hold (or to hold true). What significantly holds can also significantly fail to hold (or hold false) and conversely.

The connective rules for a normal polylogue ρ , for all declarative locutions A and B, are then as follows, where ξ symbolises holding in and ξ failing to hold in :

- & : (A&B) $\xi \rho$ iff A $\xi \rho$ and B $\xi \rho$
 (A&B) $\xi \rho$ iff A $\xi \rho$ or B $\xi \rho$
 V : (AvB) $\xi \rho$ iff A $\xi \rho$ or B $\xi \rho$
 (AvB) $\xi \rho$ iff A $\xi \rho$ and B $\xi \rho$
 ~ : $\sim A \xi \rho$ iff A $\xi \rho$
 $\sim A \xi \rho$ iff A $\xi \rho$

The rules respectively match the right and left rules of tableau and Gentzen systems. The rules also hold when contexts are uniformly factored in, and could have been presented in contextual form, for instance as follows :

$$(A \ \& \ B)(c) \ \xi \ \rho \ \text{iff} \ A(c) \ \xi \ \rho \ \text{and} \ B(c) \ \xi \ \rho; \ \text{etc.}$$

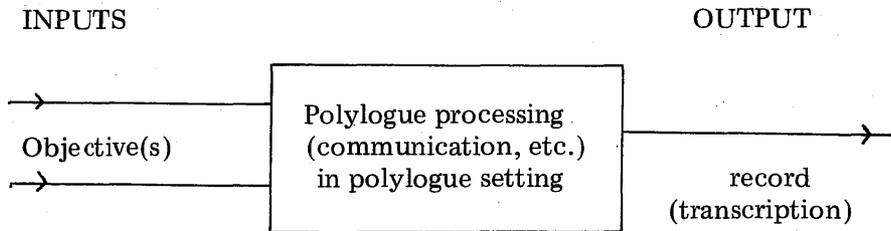
In a *classical* polylogue σ , where always A fails to hold in σ iff it is not the case that A holds in σ , all classical tautologies hold. But, more generally, in normal polylogues no such tautologies hold. The underlying structure is a 4-valued one, as in the American plan for

relevant logics, where locutions can hold, fail, neither hold nor fail or both hold and fail as well as holding. That is normal polylogues allow correctly for both incompleteness and inconsistency, in contrast with the subclass of classical polylogues, which are 2-valued.

Nevertheless there is an induced logic of importance on normal polylogues, that of entailment and interdefined terms. For declarative locutions A and B , A entails B iff, for every normal polylogue ρ , if $A \xi \rho$ then $B \xi \rho$ and if $B \not\xi \rho$ then $A \not\xi \rho$. The induced logic of entailment is exactly the theory of first degree entailment of Anderson and Belnap⁸. Thus for normal polylogues, $A \& B$ entails B , A entails $\sim\sim A$, and so forth. But $A \& \sim A$ does not entail B , C does not entail $B \vee \sim B$, etc. To be sure, rival classes of polylogues could be selected to bring out different classes of results. The argument would then be (that of RLR) that the class of normal structures is a natural and important one. Further points in the argument would explain that limitations of classical or intuitionistic kinds upon structures would be much too severe, mistakenly trivialising inconsistent polylogues. Yet some selection, or restriction, is essential if any logic is to emerge. Otherwise there is no logic.

Requisite restrictions are naturally imposed through the *objectives* of polylogues, and restrictions of this kind are regularly imposed in dialogue theory; e.g. dialogues are information-oriented (Hamblin 71, p. 133) or information-seeking (Hintikka and Saarinen). But the underlying objectives of polylogues are much more diverse than those of such communication. They include transacting business (e.g. in exchanges or a trading market), computing algorithms, trying to solve a problem, interfacing with a computer, playing games, reaching agreement on a course of action, interviewing, studying primates, having dinner out, passing the time of day, and so on. Naturally the underlying objective may have a significant affect in converting a polylogue into a known and more tractable shape, e.g. to the analogue of a situation in game theory or with Markov algorithms. Although an overarching objective of typical polylogues is communication (of which conversation is a special case), it is *not* an invariable objective, for instance in real monologues, and it is only a qualified objective where participants can communicate in principle but refuse to do so, or, as in Prisoners' Dilemma situations and games, are excluded from doing so.

Now the objectives can be represented as inputs to polylogue processing, so that an *oriented polylogue* can be given simple systems representation thus :



Indeed it may seem that without problem-defining inputs the setting is so general that nothing can be done with it, no results achieved — a bad thing in this result-hungry civilization. In certain respects that is so. But general settings are worth glimpsing, even if “interesting results” emerge only *when* enough restrictions are imposed, *as* a result of the restrictions. Moreover it is no bad thing to reflect in a theory how joint communication efforts, directed at problem solving or just making contact, commonly fare, namely often inconclusively, without results to show. Who needs results?

For, hardly surprisingly, without restriction the main thesis of general polylogue theory is Feyerabendian: *Anything goes*. In particular (at least as so far explained), any exchange or communication at all (including null ones) may appear on the output record. Feyerabend may have been wrong about science, which does impose some restrictions, but by God he was right as adapted to polylogue theory: communication can be about anything whatsoever and turn out virtually anything transcribable at all. That is why every restriction communication theory or dialogue logic tries to impose fails to easily-designed counterexamples; the theorem-inducing restrictions fail outside duly restricted contexts. The main thesis is thus highly destructive of other theorems.

A corollary is then that the usual sorts of restrictions that are imposed in order to obtain dialogue logics fall by the wayside in polylogue theory (as do conversational postulates, and the like). What dialectician would put up with these limitations anyway? An important casualty is consistency — a constraint policy applied, though not necessarily in classical ways, in all the main approaches to dialogue logic (Australian, Anglo-American, Finnish, etc.). But this is an unwarranted constraint, which should be removed in any case, since those engaged in communication may well be dialecticians, who are undaunted by contradictions, and work with

paraconsistent logics (as would, we presume, most extraterrestrials engaged in communication).⁹

Let us illustrate some of this with an elementary example drawn from logical theory, which will also provide some introduction to the semantical theory. Perhaps in this early phase of development of polylogue theory it is more illuminating to work with examples (maybe by third generation polylogues, playing with a more general theory will be a realistic goal), Suppose then the setting consists of a group of intensional logicians and of computers, and a select one of the super-computers is nicknamed 'God'. The computers are of course thoroughly classical, reflecting prevailing logical ideology; they are programmed in terms of classical two-valued logic and their hardware is two-valued (Boolean). But their languages permit of intensional extensions of the classical base, and we can conveniently suppose that they are also equipped with some modal or relevant logic. By contrast, some of the intensional logicians roundly reject classical logic.

Let us suppose firstly, that they come in virtually all shades and stripes, and commonly as fairly strict object-systems types (none of this fancy common-meta-logic stuff): There are Peripatetics ('S for Syllogism' types), who reject such redundancies in reasoning as $A \rightarrow A$ (e.g. as Begging the Question); there are Brazilians who reject such Aristotelean constraints on communication as $\sim(A \ \& \ \sim A)$; there are Dutch Sympathizers who reject such anti-dialectic themes as $\sim\sim A \rightarrow A$ and $A \vee \sim A$; there are the Jers who reject Modus Ponens; and so on. You name it, and we've got it, examples anyway (to exaggerate conveniently: for much of the variety see OP and RLR). The upshot is that there is no shared logical domain; the common logic is zero. Of course it will be argued that these queer types are using logical connectives in a different, *unusual*, sense — which is right in a sense, yet misleading in a more important sense. But can all our logicians communicate? Can they engage in a polylogue? The answer is, Yes, to both questions, the underlying reason being that it has already been supposed that these logicians share a certain amount, if not logical principles; for example, some acquaintance with formal methods and systems. Consider a seminar setting where each logician presents, say in turn, what he or she takes to be a correct non-vacuous logical argument. Then, in every case, this argument will be rejected, in one way or another, handwaving or whatever. by other logicians, perhaps as fallacious, perhaps as involving lesser invalid principles, etc. Formal logic is not basic to

communication, or presupposed in all polylogues. This begins to demolish both the prevalent themes "No common logic, no communication"¹⁰ and "no logical consistency (or no principle of noncontradiction), no communication", at least as applied to explicit logical assumptions. Of course, such notions as that of an argument and a general negating or rejecting have been retained, but *without* specific principles; even the background informal logic can be exceedingly weak and some communication occur.

Suppose, secondly, that by some good fortune our sample of logicians is restricted to rather orthodox relevant logicians — or that all the logicians involved come to learn the normal connectives &, \vee , \sim , by some such rules as those already given and are prepared to extend their logical theories by them. Thus, they are all prepared to grant classical tautologies (in connectives &, \vee , \sim) for classical situations (though *not* closure under classical rules).

Now the position held by each participant (what it takes, or gives, true, etc.) will be reflected in a world. And the communication links between participants are reflected in what way may be called "accessibility relations" between the worlds. While the worlds of the computers are classically-behaved and closed under classical operations those of the intensional logicians, which may be radically different metaphysically, may not be. In short, the *polylogue modelling* contains worlds closed under different logics, reflecting the emerging lack of consensus in logic. Thus whatever is "carried unanimously" in the sense of holding in all worlds, it is not classical logic, though classical tautologies are carried in classical worlds, such as actual world, God's world, may be. The way is now open for the introduction of some modal-style connectives (e.g. L and M) and for a generalisation of Jaśkowski-style discussive logics, that is, as output logics for the sorts of discussions of logicians and computers envisaged. Such a development provides a fairly comprehensive framework for pluralism, both logical and in other respects (and is carried through in Sylvan). The type of worlds semantics infiltrated applies not merely to discussive logics, which condense specialised polylogues¹¹, but can be extended to all polylogues.

Like all theories, polylogue theory can be equipped with a worlds semantics (in fact of various sorts: pure world, tableaux, probabilistic, game theoretic). Fortunately the semantics works also for restricted subtheories, where distinctive logical theories are imposed — else there would be much less point in supplying it. The

idea is this: the languages of an arbitrary polylogue are mapped to a common logical base, namely free λ -categorical theory (extended as necessary by transformations). This can be done for every language. Then the methods of universal semantics, as adapted for dynamic theories (in JB, p. 345), are applied to the transformed λ -categorical output. These semantics straightforwardly extend to take in the further classes of rules under which polylogues may be closed.

The third class of rules under which polylogues may be closed are *procedural* rules of one sort or another, social conventions, rules of assembly, committee rules, and the like. By contrast with logical rules, these rules of assembly are overtly conventional. Nonetheless they are often presented as, in some sense, optimizing what is to be achieved through assembly. Thus, 'the object of Rules of Order is to assist an assembly to accomplish the work for which it was designed, in the best possible manner' (see Vixman, p. 18). These rules are set then in terms of the polylogue objective, namely transacting certain committee work expeditiously. Seen in terms of this objective they are far from arbitrary, however conventional looking — but are considerably, though hardly uniquely, constrained.

Any organised group such as that of church, club or government runs by rules, which organising participants generally understand. One set of rules widely used in governing meetings and resolving disagreement is Robert's Rules, published in *Robert's Rules of Order* last century (see Vixman). Any polylogue, such as that of an assembly, congress, or parliament, designed to conform to these rules will be called a *Robert polylogue*. The main end effect of Robert's rules is on polylogue output, though that is not the only immediate effect. For instance; it is required that some participant be nominated as chairperson (or "speaker") and occupy that controlling role; so polylogue setting is also effected. Operation of the rules on output presupposes that other rules are already in force: for instance, linguistic rules applying to the chosen or recognised communicational medium of the polylogue (see the remarks on the organisation of an occasional or mass meeting, p. 88). Robert's rules apply after these rules are met, to rule certain procedures out of order. Accordingly, we can distinguish outputs (and so some extent stages of outputs) as *out of order*, or simply *out*, and *in order*, or simply *in*. Though Robert polylogues will go out of order, an objective is to keep them in order, and out of order as little as feasible (as with company trucks or airplanes). In this

respect rules on output are like holistic significance rules. But the rules of order are *far* more sweeping than logical or significance rules, and in fact determine much more than strictly procedure. For example, they enable an 'assembly to avoid altogether any question which it may deem irrelevant, unprofitable or contentious' (see 'Objection to the Consideration of Question', p. 39).

Of course the difficult external issues of when, for instance, a question or statement *is* relevant¹², are really avoided, by cunningly reducing them to an internal polylogue matter for participant opinion, and so rendering them more readily testable. Then, given such requirements on order, it is evident that a Robert polylogue has a sufficiently constrained output for there to be little doubt as to its coherence; it hangs together by virtue of the rules.

That does not mean that the output of a Robert polylogue need be logically coherent in the sense of complying with logical rules and avoiding fallacies, as perusal of Hansard will quickly reveal. What is in order, such as properly affirming the consequent, may be fallacious. Logical rules and requirements can be imposed on top of rules of order, and evidently these two sorts of rules are somewhat independent. We can easily envisage polylogues, resembling some contemporary logic seminars but perhaps captured more exactly in some medieval forms, where rules of *logical order* are imposed upon rules of seminar order. A point of logical order will draw attention to some fallacy in validity or other logical infelicity.¹³ To succeed however it will have to be a point conceded at least by the chairperson; an intuitionistic objection, for instance, will not get past an alert classical chairperson. An interesting problem of poly-logical relativism lurks here; the wider question is how much objectivity logic can obtain, and to what extent some background is always presupposed (if less blatant than in a chairperson's or participant's opinions).

The fourth set of rules under which polylogues may be closed do concern participants' opinions and beliefs, or, differently again, but as Hamblin prefers to put it, their commitments. Each participant has, throughout a polylogue, a *commitment store*, resembling a computer store, in terms of which a running tally of the participants' commitments, or "axioms", is kept (Hamblin 70, p. 257). Hamblin's System 1, for instance, is essentially characterised by 'a single rule to the effect that no locution occurs which is already a commitment of the speaker or any hearer' (71, p. 135), a rule reflected in an appropriate inductive definition of their commitment stores. A

polylogue which violates the rule is out of (store) order.¹⁴ It is difficult to take such commitment rules as this with the same seriousness as some of the other types of polylogue rules. However, the underlying intention of such rules is serious, and logical, enough: the requirement of maintaining a certain consistency.

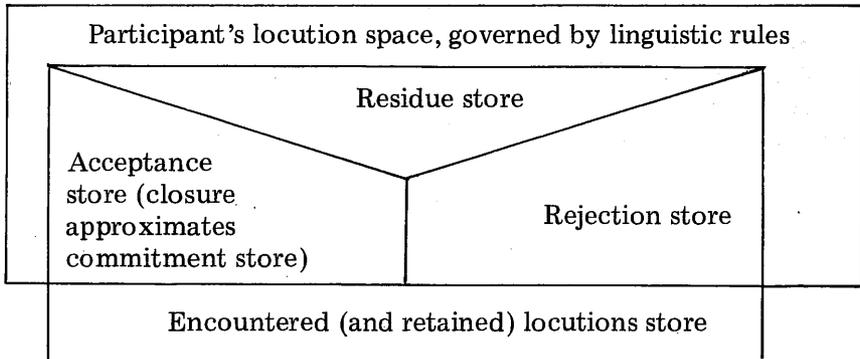
A speaker who is obliged to maintain consistency needs to keep a store of statements representing his previous commitments, and require of each new statement he makes that it may be added without inconsistency to this store (70, p. 257).

Hamblin recognises the problematic character of classical consistency and associated rationality requirements, and attempts to dilute them (pp. 263–64); but exactly how this is to be achieved remains obscure ('a matter for regulation in a given system'). However his exclusion of explicit contradictions, pairs such as A and $\sim A$, is still too severe, and is liable to lead back to classical implausibility. It is too severe because it cuts out dialogues involving dialethicians, for example, such as may be conducted concerning logical or other paradoxes; it also excludes dialogues involving immediate inconsistency but with equivocation as an escape mechanism.

Consistency is often demanded, erroneously, as a way of ensuring a certain regularity or uniformity, that a speaker sticks to his ground and does not shift (as Hamblin's discussion, among others, reveals). But to guarantee this consistency is not required; it is usually enough that the store can continue to be drawn upon, without change. And *this* is what is upset by the tricky move of retraction, or store deletion (though inconsistency too can be removed in this way). Certainly in polylogues in general participants can reduce their commitment stores, for instance delete previous axioms. Hamblin describes such a polylogue, a 'Why-Because [dialogue] system with questions' which includes deletion, and which also serves 'to model a number of [traditional] fallacies' (p. 265).¹⁵

More sophisticated participants will have three operational stores for encountered locutions, roughly an acceptance store, a rejection store, and a residue store (for those locutions from which judgement is withheld or for which judgement is inappropriate), as illustrated: (see following page).

Locutions transmitted and locutions received will be drawn from these stores. It is tempting to furnish stores not only for participants, but for the polylogues in which they participate. The polylogue acceptance store for an on-going parliamentary polylogue, which is not an elementary set-theoretical construction from participants'



acceptance stores, will contain, for example, the motions passed. Thus it affords a reflection of the parliamentary will.

For formulation of the quasi-logical rules applying to these stores, we can neatly relativise Gentzen and Lukasiewicz notation. Thus $\vdash_x A$ expresses that (participant) x accepts A , and likewise the conditionalised form $A \vdash_x B$ that x accepts B given or on the condition A . The rejection symbolism $x \dashv\vdash A, A_x \dashv\vdash B$ (and $\Gamma_x \dashv\vdash \Delta$) are correspondingly construed.¹⁶ The encountering requirement tilts the logic of normal participants in the direction of analytic implication (discussed in RLR). For example, for normal x , where $\Gamma \vdash_x A \ \& \ B$ then $\Gamma \vdash_x A$ and $\Gamma \vdash_x B$, and also conversely (i.e. $\&$ is normal); but, though $A \vdash_x C$ and $B \vdash_x C$ guarantee $A \vee B \vdash_x C$, neither of the addition principles, where $\Gamma \vdash_x A$ then $\Gamma \vdash_x A \vee B$, and where $\Gamma \vdash_x B$ then $\Gamma \vdash_x A \vee B$, hold in general because unless the adjoined locution is already in Γ it may not have been encountered. By contrast, the logic of the corresponding commitment relation, with commitment a suitable closure of acceptance, will resemble that already introduced, of first degree entailment, because commitment is not bounded by encountered locutions.

What belongs in participants' stores provides bases for various communicational modal logics based on polylogues.¹⁷ For each participant can again be viewed as supplying a world, with the accessibility relations between worlds communication lines between individual participants. Let us fix the context, so furthermore that everything is normal. Then the basic communication relation C can be contracted to the useful form $C(A,x,y)$, x communicates A to y . Participants x and y are in communication if some locution is communicated, so we can define our two-place accessibility relation

thus: $C^1(x,y) =_{Df} (PA)C(A,x,y)$. The resulting direct communication relation C^1 can be taken to be reflexive, $C^1(x,x)$, but little else, so the resulting modal systems will be of Feys (system T) type. However indirect communication relations are also important, and we can define chain communication stepwise, thus:

$$C^2(x,y) =_{Df} (Pz)(C^1(x,z) \& C^1(z,y)), \text{ with such a } z \text{ a translator;}$$

and generally

$$C^n(x,y) =_{Df} (Pz)(C^1(x,z) \& C^{n-1}(z,y)), \text{ for } n \geq 2; \text{ and}$$

$$C^*(x,y) =_{Df} (Pn)C^n(x,y), \text{ for the ancestral } C^* \text{ of } C^1.$$

Each of these relations will furnish modal systems, with the transitive C^* delivering S4 type systems. A *transparent* polylogue is one in which every participant can communicate, by some chain, with every other i.e., C^* is connected. Transparency is a necessary condition for a dialogue in the usual sense.

For communicational model structures we can take frames $\langle G,K,C \rangle$, where G is some participant, supercomputer God if we prefer a classical base world, K a set of normal participants, and C some one of the two-place communications relations defined. A two-valued interpretation function I can then be defined as follows for all initial locutions, for x in K :

$$I(A,x) = 1 \text{ iff } A \xi x \text{ iff } \Vdash_x A.$$

In normal polylogues I is extended by the rules already given those for ξ , for connective $\&$, \vee and \sim . The modal functions L and M are of course evaluated in the usual way, namely

$$I(LA,x) = 1 \text{ iff, for every } y \text{ such that } C(x,y), I(A,y) = 1, \text{ and}$$

$$I(MA,x) = 1 \text{ iff, for some } y \text{ such that } C(x,y), I(A,y) = 1.$$

So result communicational modellings for a variety of relevant modal logics (including those studied in RLR, part II).

But there are persuasive arguments for making these logics many-valued, and bases for doing so are already supplied. For several changes can be made on the assignments for initial locutions, using

the assertion, rejection and residue stores, and also what falls outside them, to provide various 3-valued and 4-valued initial, assignments. And these can be extended using the 4-valued rules given for normal polylogues, or by other many-valued rules, to all modal logical locutions. Such interesting modal systems have yet, it seems, to be investigated.

The types of rules distinguished are not intended to exhaust those to which polylogues can be subject, but rather to illustrate main types. Satisfactory generality would require, however, not so much a full classification of types, as a more comprehensive theory of rules. Though such a theory is conspicuously lacking in contemporary methodology, the gap is a general problem, not just one for polylogue theory, and not a topic to embark upon at the conclusion of an exploratory introduction to polylogues.

One of the broader aims of polylogue theory is to offer a unified framework for a great deal of apparently disparate and often uneven work and theory, both within philosophy and outside it. Plainly it affords a setting for theories of dialogue, conversation and communication, and differently, for a theory of fallacies. But it is also intended to offer a more exact framework for the investigation of cross-cultural communication, and its limitations, and incommensurability arguments and themes, as well as for studying cultural and logical pluralism. Sometimes theories as general as polylogue theory are despised because they deliver few results. However, unification is important, results are again not everything, and can be had anyway for duly specialised polylogues, and a general theory is important in clarifying negative "results", such as that this or that is not be expected in general or cannot be proved.

Polylogue theory throws into interesting new perspective several traditional and contemporary philosophical problems. A couple of examples, from the philosophy of mind, will explain how. Frequently the only connections between participants will be through their communication lines. A contemporary problem is how to pick out humans from among other participants, which may include computers, animals, extraterrestrials. Widening the field of selection in this way, and recalling humans' often abysmal discriminatory ability even with things like wines, a general resolution of the problem is evident. There is *no* guarantee that humans or groups of them will be able to make the requisite discriminations. Moreover, where they do succeed, we know, more or less, what sort of cues they will use, for example Turing tests and

conditions thereon.

A more ancient problem is as to how we know what is going on (mentally) in other participants, a generalised "other minds" problem. (The "other minds" problem itself is in effect a polylogue communication question; how we discover by limited channels as to what is in various other human stores). Again the evidence is that in general we do not know, especially as regards creatures from more remote cultures. But sometimes we can find out in various ways, most simply in the case of computers where we can examine programs and also total functions. And we can envisage doing better than we frequently manage as regards other natural intelligence, namely by direct hook-up, drastically shortening the communication lines (as Culbertson has explained), that is, in effect, by transforming polylogues into other polylogues.

It is not an altogether unrelated matter that significant (mental) phenomena such as that of the group mind and also the collective will, as well as (less directly) that of individual consciousness, can be given polylogue representation. Consciousness is modelled in this sort of way: it is the focus, the central facilitator, of organised thought and experience, the components of which are supplied by the separate active mental elements, the participants, and the output transcribes the stream of consciousness.

But it is the linkages outside philosophy, as now normally conceived, that are perhaps more striking. One reason is that so much of contemporary life and organisation consists of situations of polylogue form: business meetings, committee sessions, workshops, conference mornings, seminars, etc.. etc. They are all structured arrangements of participants, assembled and functioning for given restrictive objectives, in a regulated way, and supplying a distinctive and analysable symbolic output. It is not very surprising then that much of the more exact parts of organisation theory and of political theory can be included within polylogue theory, especially as every game can be expressed as a polylogue. We leave it as a non-trivial exercise for the diligent reader to show how positive political theory (as presented, for instance, in the later chapters of Riker and Ordeshook) can be integrated into polylogue theory, by way of exchange polylogues, voting polylogues, and so forth.

A serious weakness of an introduction of this type is, undoubtedly, that it gestures at such applications, but does not make them. Like too many other programmatic papers, and like too much piecemeal philosophy particularly, this paper promises much and

delivers little.¹⁸

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NOTES

¹Of course logicians have sometimes stretched 'dialogue' beyond dictionary senses to cover work 'polylogue' is intended to do.

²That is, printed transcripts of Westminster-style parliamentary proceedings.

³A good example of the way this inflexibility causes problems is provided by the adicity problem faced by language structures given set-theoretic form. This adicity problem for λ -categorical and type-theoretic languages is discussed in Rennie and also JB. But the "problem" now strikes me as an artificial one, generated largely by the set-theoretical representation.

⁴A real advantage of the "game" formulations of Hintikka and others is that this sort of inaccessibility is avoided. However Hintikka's presentations remain, like his embedding epistemic logic, unduly modal, thus encountering substitutivity failure. Of course the artificial game modelling, through sets of tableaux, is much too restrictive to model more than part of the range of polylogues (as its authors would acknowledge, while pointing out that they achieve some genuine logical strength). Moreover, the standard game-theoretic setting imposes conditions, such as winning, losing or drawing, and introduces actions such as prizes, which do not significantly apply to ordinary conversations (as Mackenzie points out). Note that an ultra-modal game presentation was already advanced by Hamblin (in 70), indicating, among other things, that the advantages of game formulations can be arrived at in various ways.

⁵Animals without recognised languages are not excluded from participating in such polylogues so long as they have, as they typically do, other communicational means, e.g. a system of sounds, or the like, conveying information.

⁶The strategy here resembles that adopted in JB to deal with the logic of fiction. For fictional stories may, in a more serious way, flaunt normal logical requirements.

⁷ There are other options, of course, of less generality, where this sort of language splicing is prevented. At several points, in fact, in this development, we have made choices where other theories are possible and also not unreasonable.

⁸ For proof, further explanation of the American plan, and so on, see RLR. Note that underlying polylogue structure is immaterial for the proof.

⁹ There is no need to explain paraconsistent and dialethic logics in Belgium. But for the non cognoscenti a detailed introduction is provided in OP. Our presumption about extraterrestrial communication would be challenged by the more orthodox. For example, Mackenzie, though far from classically committed, argues for a requirement of immediate consistency (which figures importantly in his analyses of *argument* and *logical behaviour*): see especially his 84.

¹⁰ Even if the principle 'No common logic, no communication' held, it would not follow that there must be a one logic for each polylogue, only common ground for each pair of parties in a polylogue that manage to communicate. But one thing is clear, that *direct* communication is not transitive: α can communicate with β and β can communicate with γ does *not* imply α can communicate with γ - except indirectly through β for instance. But we do often appeal to such transitive closure: parties can communicate then if there is some chain of intermediaries by which they can communicate. The situation with languages illustrates some of the main points here: α and γ speak languages which are mutually incomprehensible but party β has a language which overlaps both or is bilingual.

¹¹ On the discussion origin (in the format of Platonic dialogues) of Jaśkowski logics, and, on their features and world semantics, see OP.

¹² Fought with, in an apparently losing battle, by Dascal, for example, in an attempt to explicate Grice's conversational supermaxim: Be relevant! Would that Grice had applied his maxim to logical theory, instead of lending his work for defence of irrelevant logic!

¹³ Such was Bentham's proposal for a new theory of fallacies, mentioned in passing by Hamblin (70, p. 284).

¹⁴ Or *illegal*, as Hamblin less satisfactorily puts it. For there is little doubt that his rules resemble the rules of court procedure and order, rather than those of judgement and sentence.

¹⁵The adequacy of the notion of “modelling” fallacies which is involved deserves however to be questioned. It is that a polylogue “models” a given fallacy if the fallacy can be realised but a rule prohibiting it could be formulated (cf. 70, p. 279). There is nothing distinctively to do with fallacies in this; and without distinguished polylogues *every* sound and unsound argument admits of such treatment. With the deletion of axioms (which Hamblin does not generally permit, but could vary things to allow) we touch upon non-monotonic logics, which are certain to feature in the elaboration of polylogue theory.

¹⁶We have stuck with the essentially behavioural construals, partly because these are easily connected with artificial intelligence, though there are many tempting alternatives — such as, prepared to accept, acceptable, etc. — linked with “potential” stores closed under “prudential” rules and the like.

¹⁷The ideas that follow emerged from discussions with Len Goddard.

¹⁸My thanks to Jim Mackenzie and to Len Goddard for critical and constructive comments on earlier versions of this paper.

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