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Common Ground: Between Formal Pragmatics and Psycholinguistics

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Keywords

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Abstract

Common ground is the information that the participants in a conversation treat as background information for the purposes of their interaction. We review two traditions of research on common ground. The formal tradition, consisting mainly of theoretical linguists and philosophers of language, has developed increasingly sophisticated formal models of common ground to generate predictions about an expanding range of empirical phenomena. Meanwhile, the psycholinguistic tradition has focused on a narrower range of phenomena while developing more realistic theories of the psychological mechanisms that allow us to select and represent common ground. After summarizing these two traditions, we consider several reasons why they should be reintegrated, and we argue that the best way to bring them back together would be to adopt a cognitive-pluralist approach, whereby language users have access to a variety of mechanisms for managing background information, which are more or less available and efficient depending on the communicative situation and the kind of information mentally represented as well as the cognitive demands of each mechanism.

1. INTRODUCING COMMON GROUND

Common ground is the information that two or more interlocutors treat as shared background information for the purposes of an interaction. We can illustrate this idea with a minimal pair of examples (cf. Heal 1978, Lederman 2017). Suppose that two friends, Sam and Ethan, have spent election night together avoiding news coverage. Then, one of two things happens:

TV: While Sam and Ethan are sitting on the sofa together, Ethan turns on the TV, whereupon he and Sam together see an image of the incumbent celebrating victory.

PHONES: Sam and Ethan separately, and coincidentally, receive text messages from friends that consist of the same image of the incumbent celebrating victory.

In both scenarios, Sam and Ethan each come to believe that the incumbent has won. However, in the TV scenario, this information also takes on an additional, public status between them that it lacks in the PHONES scenario: It becomes common ground.

This status has been argued to play a wide range of roles in conversation, shaping both the design and interpretation of linguistic utterances. For example, common-ground theorists have analyzed assertions as proposals to update the common ground and have argued that it is therefore often infelicitous to assert what is already common ground (Stalnaker 1978, p. 325). This explains why it would be strange for Sam to utter example 1 in the TV scenario but not in the PHONES scenario:

- (1) I have just seen the incumbent, victorious. #TV/✓ PHONES

Another influential idea is that when an interlocutor makes an utterance with a presupposition, this presupposition must be common ground. Or, at least, interlocutors must be willing and able to accommodate it—that is, to immediately identify what was presupposed and proceed as though it was already common ground (Lewis 1979). Our minimal pair bears this out: When used as an attitude verb, *surprise* triggers a presupposition that its complement is true, which is why example 2 is strange in the PHONES scenario (where it is not common ground that both Sam and Ethan have seen the incumbent celebrating) but not in the TV scenario (where the information is public):

- (2) Are you surprised to see that the incumbent has won? ✓ TV/#PHONES

The roles of common ground in assertion and presupposition combine to explain the following minimal pair (adapted from Lewis 1979):

- (3a) The incumbent has children, and all the incumbent's children are excited.
(3b) #All the incumbent's children are excited, and the incumbent has children.

By uttering the first clause of example 3a, a speaker proposes to add the proposition that the incumbent has children to the common ground, and this, in turn, satisfies the presupposition that is triggered by *all the incumbent's children* in the second clause. By contrast, with the clauses' order reversed in example 3b, the presupposition that the incumbent has children needs to be accommodated to interpret the first clause, making the second clause redundant, and so, infelicitous.

Common ground also plays a special role in the use and interpretation of context-sensitive expressions. For example, quantifier phrases, such as *everyone*, are normally contextually restricted in a way that seems to be guided by common ground. It is much easier to imagine a felicitous

utterance of example 4 in the TV scenario than in the PHONES scenario, presumably because the extra information in the common ground would make it easier for Sam and Ethan to coordinate on an appropriate restriction for *everyone* (e.g., supporters of the incumbent):

- (4) Everyone is going to be excited. ✓ TV/#PHONES

Similarly, the acceptability of example 5 in the TV scenario but not in the PHONES scenario seems to arise from the fact that the information in the common ground plays a special role in the design and interpretation of pronouns and other definite noun phrases. Roughly, one should utter a definite noun phrase only if the common ground will make it obvious who the referent is (Clark & Marshall 1981, Stalnaker 1978):

- (5) He looks excited. ✓ TV/#PHONES

The dual roles of common ground in recording the effects of upstream speech acts and in determining the felicity and interpretation of downstream speech acts make it useful for explaining anaphoric phenomena, in which the meanings of later utterances depend on those of earlier utterances. For instance, in example 6, the pronoun *he* is most naturally understood as anaphoric on *the incumbent*:

- (6) I am watching the incumbent celebrate. He looks excited!

One promise of common-ground theories is to offer a unified explanation of anaphoric uses of pronouns (as in example 6) and deictic uses (as in example 5). In both scenarios, the sentence *He looks excited* updates the common ground with information about whichever male is already represented as most prominent. But whereas this prominence has extralinguistic causes in example 5, it is due to the pronoun's antecedent in example 6.

Following this informal characterization of common ground, we loosely organize our review around a historical narrative. In the 1970s, a number of philosophers and linguists developed an influential formal-pragmatic model with a representation of common ground at its center. This model became influential, in part because it offered a unified account of a wide variety of pragmatic phenomena. However, the model was also idealized in a number of ways, abstracting away from both a variety of other pragmatic phenomena and the details of the underlying psychological mechanisms. Much subsequent work on common ground can be understood as a series of attempts to lift these idealizations, but this work largely split into what we call the "formal" and "psycholinguistic" traditions. Whereas the formalists have complicated the model to cover a wider range of conversational phenomena, psycholinguistic models of common ground have mostly focused on one phenomenon (definite reference) while seeking more realistic accounts of the underlying cognitive mechanisms.¹

Each of these traditions has made significant progress toward its respective aims, but they have become less integrated over time. In Section 2, we summarize key developments from the two traditions. In Section 3, we argue that the two traditions' insights are more compatible and mutually illuminating than has been supposed. Finally, in Section 4, we argue that the best way to combine the two traditions is by means of a pluralist approach to the cognitive mechanisms that underlie common ground.

¹Psycholinguists have also worked on other phenomena that common ground has been posited to explain (e.g., on presupposition; see works in Schwarz 2014). However, to the best of our knowledge, this work has not been used to motivate models of common ground, which are our focus here.

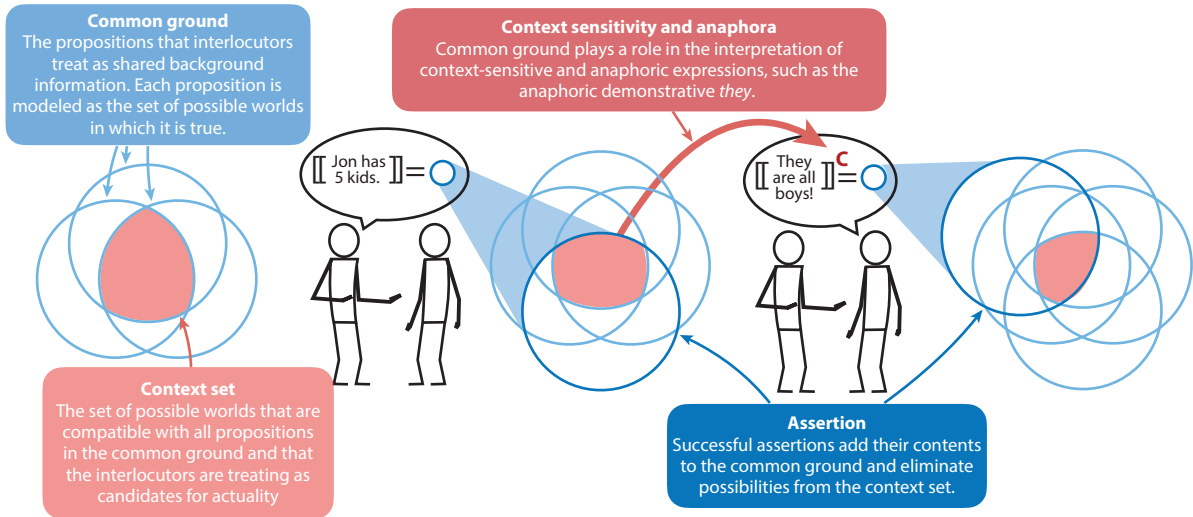


Figure 1

The common-ground-based model of conversation developed by Stalnaker (1970, 1973, 1974, 1978), Karttunen (1974), and others. Common ground is modeled as a set of propositions (each of which is a set of possibilities), and the context set is the set of possibilities compatible with all propositions in the common ground (i.e., at the propositions' intersection). Successful assertions add their content to the common ground, thereby shrinking the context set. The use of subsequently uttered context-sensitive expressions is constrained by the resulting state of the common ground.

2. HISTORICAL OVERVIEW

A theory of common ground first took shape as part of a formal-pragmatic model developed by Stalnaker (1970, 1973, 1974, 1978) and Karttunen (1974). This model is built using the tools of possible-worlds semantics, in which a proposition is modeled as the set of possibilities (or possible worlds) in which it is true (see **Figure 1**). Common ground is then modeled as a set of propositions. Derivatively, the context set is the set of possible worlds that are compatible with all of the propositions in the common ground—that is, the intersection of all of the propositions in the common ground. In effect, the context set is the set of possibilities that the interlocutors are treating as live candidates for actuality and that they are seeking to decide between in conversation. Conversations are modeled as cooperative exchanges in which participants take turns adding propositions to the common ground by asserting them. By adding new information to the common ground, assertions eliminate possibilities from the context set, thereby whittling down the candidates for actuality. By updating the common ground in this way, interlocutors also shape the future of the conversation by constraining which assertions and presuppositions are felicitous, changing which uses of anaphoric and context-sensitive expressions are available, and so on. Stalnaker's model is therefore a dynamic model, in the sense that it treats common ground as an evolving body of information that is altered by speech acts in ways that change which speech acts are subsequently performable.

What is this model a model of? The original answer, and the one that remains most influential in the formal tradition, is that common ground is the body of propositions to which the interlocutors bear the right kind of iterated propositional attitudes.² This line of thought originally grew

²A propositional attitude is any mental representation that involves an agent taking an attitude (e.g., belief, knowledge, desire, hope, intention) to a proposition (e.g., *that the incumbent has won the election*).

out of earlier work on common knowledge (also called “mutual knowledge”; we use these terms interchangeably) (Lewis 1969, Schelling 1960, Schiffer 1972). The most influential definition of common knowledge invokes intersubjectively iterated propositional attitudes, as follows:

Common Knowledge (iterated)

- (7) A and B commonly know that p , if and only if (ia) A knows that p ; (ib) B knows that p ;
(iia) A knows that B knows that p ; (iib) B knows that A knows that p ; . . .

(Schiffer 1972, pp. 30–31)

One possible treatment of common ground is to identify it with the set of propositions that the interlocutors commonly know, in the sense of definition 7. This would explain the difference between our two scenarios from Section 1: In the PHONES scenario, Sam and Ethan each know who won the election (satisfying clauses ia and ib of definition 7), but neither knows that the other knows, or knows that the other knows that they know, etc., and it is their possession of this further knowledge that constitutes the information’s publicity in the TV scenario. A number of scholars have argued that satisfying clauses iia and iib is also insufficient, however: If Sam knows that Ethan saw the election result but thinks that he thinks that she did not see it, she might not treat this information as common ground (cf. Clark & Marshall 1981, Schiffer 1972). Increasingly elaborate thought experiments of this kind led to infinitely iterated definitions, such as definition 7.

However, although some theorists who define common ground in terms of an iterated attitude would say that the attitude in question is by default knowledge (Yalcin 2024), nearly all would deny that it is always knowledge. People sometimes unwittingly treat falsehoods as common ground, for example, which suggests that a more general definition of common ground would identify it with common belief, which can be articulated by replacing each instance of *knows* in definition 7 with *believes*. Even more influentially, Stalnaker (2014) has argued that common ground is made up of the propositions that we commonly accept for the purposes of the conversation. “To accept a proposition,” Stalnaker (1984, p. 79) tells us, “is to treat it as a true proposition in one way or another—to ignore, for the moment at least, the possibility that it is false. One may do this for different reasons, more or less tentatively, more or less self-consciously, with more or less justification, and with more or less feeling of commitment.” This view is motivated by cases in which what we believe comes apart from what we treat as common ground—for instance, when someone says something with which we disagree but we let it slide to avoid conflict, when we engage in extended pretense or fictional discourse (Stokke 2023), or when we communicate things via insinuation that we would not openly acknowledge (Camp 2018).

We use the term “iterated theories” to refer to the broad family of views that identify common ground with the set of propositions that interlocutors take infinitely iterated attitudes toward. In Section 3.1, we consider the objection that these theories are psychologically unrealistic. However, it is worth emphasizing that while the formal-pragmatic model originally came packaged in terms of iterated propositional attitudes, the two ideas are separable: The formal model could be paired with some other theory of how agents arrive at and mentally represent the shared information represented by the model.

As its creators acknowledge, this formal model of conversation “is highly idealized and oversimplified, best regarded as an artificial game designed to model some of the features of the structure of a discourse” (Stalnaker 2014, p. 89). For example, although Stalnaker informally theorizes about defective contexts (i.e., situations where interlocutors treat conflicting information as common ground), his formal model does not aim to make predictions about what happens in those situations (Stalnaker 1978, p. 322). It also ignores speech acts that cannot be thought of in terms of cooperative information sharing, such as questions or commands. And it tells us little about

the cognitive mechanisms whereby we accumulate and maintain common ground. As we see in Sections 2.1 and 2.2, much subsequent work on common ground has been concerned with finding ways to lift these idealizations, thereby turning the model into a more comprehensive and realistic representation of conversation.

Given how heavily idealized the common-ground model initially was, one might wonder why it became so influential. The answer is that it was used to understand and connect a range of pragmatic phenomena—including those discussed in Section 1—that had hitherto been approached as an array of unrelated puzzles. It is the model’s unifying explanatory power that explains its initial and enduring influence.

2.1. The Formal Tradition

The formal tradition has focused on explaining a wider variety of conversational phenomena, often by adding complications to the common-ground model. An early, influential example is David Lewis’s (1979) model of the conversational score, which, like the score of a baseball game, is a dynamic record of various kinds of information about what has happened so far in the “language game” that is relevant to determining what can happen next. Alongside a body of presupposed information (i.e., Stalnaker’s common ground), Lewis posits six additional components of the conversational score, each of which can be updated in characteristic ways by certain speech acts and changes which speech acts are possible going forward.

One influential example is Lewis’s (1979) idea of a permissibility sphere, which changes in response to authoritative speech acts of command and permission (the boss says, “Stay late”) and affects which subsequent statements about obligation and permission are true (the employee says, “I have to stay late”). This was the first in a long tradition of proposals about how to model the updates and downstream consequences of the speech acts that we perform using imperative sentences (e.g., Kaufmann 2012, Portner 2007). A second example is Lewis’s idea that the context includes shifting standards of precision for vague predicates (e.g., are we using *tall* to mean tall for a basketball player or tall for a toddler?). This inaugurated a tradition of work in which the common ground is used to model not just information about the extraconversational world but also information about the conversation itself, including participants’ short-term agreements about how to use context-sensitive expressions within it (e.g., Barker 2002, MacFarlane 2016). Lewis’s general strategy—positing complications to the common ground to capture more phenomena—has been even more influential than his specific proposals about what to add.³

We now want to zoom in on two influential proposals about how to complicate the common ground. The first is the proposal that, in addition to a body of presupposed information, interlocutors must keep track of a shared representation of the question(s) that they are seeking to answer (Beaver et al. 2017, Carlson 1982, Grosz & Sidner 1986, Roberts 2012b, Van Kuppevelt 1995). For example, in Roberts’s (2012b) influential model, the Stalnakerian common ground is accompanied by the question stack—an ordered list of questions, the topmost of which is the question under discussion (QUD). Just as asserting a proposition is proposing to add it to the common ground, to ask a question is to propose it as a new QUD. If Stalnaker’s context set represents the

³Subsequent work has posited further complications to explain, for instance, nonassertoric speech acts, such as commands, questions, and exclamations (Farkas & Bruce 2010, Harris et al. 2018); conversational implicature, indirect speech acts, and insinuation (Asher & Lascarides 2001, Camp 2018); nonfactual assertions and disagreements (Gibbard 2003, Yalcin 2012); lying and deception (Stokke 2018); interlocutors’ strategies for resisting and negotiating speech acts (Bledin & Rawlins 2020, Farkas & Bruce 2010); the difference between conversational contributions that can be directly responded to and those that are backgrounded (Simons et al. 2017); fictional discourse (Stokke 2023); and hate speech (Langton 2012, McGowan 2019).

live possibilities that interlocutors are trying to choose between as the overarching aim of their joint inquiry, then the questions in Roberts's stack embody strategies of inquiry—shared subgoals to direct the inquiry toward more manageable and specific topics. Roberts captures this idea by modeling questions as sets of mutually exclusive answers (following Hamblin 1973) and by thinking of the QUD as partitioning the possibilities in the context set into a collection of subsets, each of which represents a possible live answer to the QUD. The interlocutors' immediate conversational goal is then to answer the QUD by making assertions that eliminate some of the cells of this partition.

Roberts uses this model to predict our judgments about which speech acts are relevant. An assertion is relevant only if it partially answers the QUD—that is, if it rules out at least one live answer. A question is relevant if it poses a live subquestion of the QUD, which is a question not already answered by the common ground, each of whose complete answers would partially answer the QUD. Roberts uses this definition of relevance to refine Grice's (1975) theory of relevance implicature. On Roberts's view, the search for an indirect meaning is triggered when the speaker asserts something that, taken literally, is not relevant to the QUD (and therefore not cooperative), and the search for indirect meanings is constrained by the assumption that the speaker must have implicated something that is relevant. Roberts also argues that the function of prosodic focus is closely related to the QUD. Roughly speaking, when making an assertion, it is felicitous to focus an expression only if replacing that expression with an appropriate *wh*-phrase would yield a sentence whose content is the QUD (e.g., "Who is here?" "JIM is here"/#"Tom is HERE"). On this view, the function of prosodic focus is to probe and reinforce the QUD.⁴

Although the question stack and QUD are additional elements of context, over and above the common ground of the original formal model, it should also be clear that the QUD model cannot be understood without common ground and that it also gives the common ground important new jobs to do: The model generates predictions about relevance, implicatures, and prosodic focus as a function of both QUD and common ground. These types of interactions represent one kind of reason for a common-ground theorist to think about at least some common-ground-external elements of the conversational score.

The second influential proposal is the idea that we should think of common ground as including object representations in addition to propositions. Lewis (1979) himself formalized this idea by including a salience-ranked list of entities among the elements in the conversational score (cf. Stojnić 2021), but a much more influential strategy has been to rethink the representation of common ground itself, modeling it as (or as including) a collection of discourse referents (Kamp 1981, Karttunen 1976) or file cards (Heim 1982, 1983), which are shared representations of the people and things under discussion. Another modeling strategy has been to modify Stalnaker's context set so that each element is not just a possible world but a pair consisting of a possible world together with an assignment function, which is a possible mapping from noun phrases to their referents (Groenendijk & Stokhof 1991, Mandelkern 2024). Heim (1982, pp. 228–29) shows how to think of these sets of world–assignment pairs as abstract representations of sets of her file cards, much as Stalnaker's context set is an abstraction from the common ground. The intuitive idea behind these modeling approaches is that our assertions do not just add information about the

⁴Others have used QUD models to predict data about, among other phenomena, epistemic modals (e.g., *might*, *probably*) (Dever & Schiller 2021, Yalcin 2007), propositional-attitude verbs (*knows*, *believes*) (Schaffer 2007, Yalcin 2018), contextual enrichment of utterances' literal meanings (Schoubye & Stokke 2016), loose speech (Hoek 2018), disjunction (Simons 2001), and presupposition projection (i.e., data about when sentences inherit the presuppositions of their parts) (Simons et al. 2017). This explanatory versatility has made QUD models highly influential.

world to the common ground, thereby eliminating possibilities from the context set; assertions also add information about the discourse itself—for instance, by introducing new people and things as topics for discussion or by making familiar things more salient. This is modeled as the introduction of new object representations to the common ground or as the manipulation of the assignment functions that are available in the context set. We group these theories together as advocating for objectual common ground (i.e., common ground as including representations of objects), as opposed to Stalnaker’s propositional common ground (i.e., a set of propositions).

Objectual common ground is motivated as the central component of dynamic theories of anaphora, which interpret indefinite noun phrases (e.g., *a woman*) as devices for introducing new object representations to the common ground, and definite noun phrases (e.g., *she, the woman*) as devices for adding information to the object representations already available.⁵ We will not attempt a detailed summary of the motivations for these theories, many of which involve intricate patterns of interaction between grammatical phenomena and common ground. But here is a simple illustration: Unless it is common ground that a certain woman is particularly salient, it would normally be baffling to start a conversation by saying, “She is a banker.” We might explain this by saying that the common ground does not help us to identify a referent for *she*. However, one can begin a conversation by saying, “I know a woman. She is a banker.” Uttering the first sentence must therefore change the common ground in some way that licenses the second sentence. Propositional theories struggle to explain this, since it was already presumably common ground that the speaker knows a woman, and so their assertion could not have added a new proposition to the common ground. By contrast, objectual theories can explain the contrast by saying that it is felicitous to utter a pronoun, such as *she*, only when there is a salient female-marked object representation in the common ground, and the function of uttering “I know a woman” is to create and make salient just such an object representation. It is crucial for this explanation that, as Heim (1982, p. 249) puts it, “discourse referents are not referents”; rather, they are shared representations that connect anaphora to their antecedents, and their relationship to actual entities in the world may be more or less underspecified.

We have tried to give a taste of the myriad ways in which formal models of common ground have been complicated, and why. However, these technical innovations and empirical advances raise questions about the underlying psychology of the conversational score—about what the formal models are modeling—which have mostly gone unaddressed. Lewis’s (1979) own remarks about how the conversational score relates to interlocutors’ psychology are cryptic and noncommittal. Roberts sometimes says that the question stack represents interlocutors’ goals or plans (Roberts 2012b, pp. 3, 12, 26), but these remarks have not yet been developed into a detailed, empirically testable theory. And although Heim (1982, p. 288) presents her theory of common ground as an extension of Stalnaker’s, it seems that Stalnaker’s reduction of common ground to iterated propositional attitudes cannot be straightforwardly extended to objectual models since object representations are not propositional. So, although the formal tradition has made progress on lifting some of the common-ground model’s idealizations—those dealing with its narrow empirical scope—it has simultaneously deepened the model’s psychological idealizations.

2.2. The Psycholinguistic Tradition

Herbert H. Clark and colleagues proposed the first psycholinguistic model of common ground (Clark 1996, Clark & Carlson 1981, Clark & Marshall 1978) as a response to what they call “the

⁵In dynamic semantic systems, these context-updating functions are built into sentence meanings, whereas dynamic pragmatic systems reduce context updating to pragmatic reasoning (Lewis 2014, 2021).

processing paradox of mutual knowledge” (Clark & Marshall 1981): While the formalists’ arguments for the need for mutual knowledge in human communication are impeccable (Lewis 1969, Schiffer 1972), mentally computing an infinite recursion of propositional attitudes would take an infinite amount of time—contrary to our everyday experience of conversation. To solve this processing paradox, Clark & Marshall (1978, 1981) argue that instead of mentally representing common ground as iterated propositions, interlocutors must rely on heuristics to assess mutual knowledge. In other words, interlocutors must find the right shared bases—or evidence—for assuming common ground.

According to Clark (1996), common ground is the foundation for all joint action, including the construction of speaker meaning and its understanding by the addressee. However, the proposed heuristics for assessing mutual knowledge have a much narrower scope, as they are formulated in relation to definite reference alone: When interlocutors make or interpret a definite reference, they look for evidence of triple copresence—namely, an event including the speaker, the addressee, and the intended referent (Clark & Marshall 1978, 1981). The strongest evidence of triple copresence comes from physical copresence (e.g., when two friends are jointly looking at a painting in a museum), followed by linguistic copresence (e.g., when one of these two friends later refers to *the beautiful Picasso*). The third heuristic for assuming common ground is cultural copresence, which includes all the knowledge, beliefs, and suppositions shared by the members of a community. Relative to the personal experiences that lead to physical and linguistic copresence, cultural copresence offers less reliable evidence of common ground. Clark & Marshall (1981) argue that the three basic types of definite reference reveal an obvious fit with mutual knowledge: Deixis corresponds with physical copresence, anaphora with linguistic copresence, and proper names with cultural copresence.

To efficiently search for evidence of triple copresence in memory, interlocutors are supposed to keep a mental record of reference diaries, including significant events in the personal experiences and cultural histories that they share with others (Clark 1996; Clark & Marshall 1978, 1981). These reference diaries are built such that during conversation, interlocutors maintain in memory a model of what their partner has in mind—their perceptions, knowledge, and ongoing thoughts—and constantly update it, expanding their common ground with every turn in the conversation. In sum, these reference diaries form the memory basis for physical, linguistic, and cultural copresence, which are the heuristics that interlocutors rely on for establishing mutual knowledge—rather than engaging in an infinite recursion of propositional attitudes.

In a series of laboratory experiments, Clark et al. (1983) tested the hypothesis that, in instances of physical copresence, listeners understand reference based on what they believe is mutually salient to both interlocutors (see also Wilkes-Gibbs & Clark 1992). However, Keysar (1997) challenged their interpretation of these and other findings, arguing that they are compatible with theories of language comprehension that do not assume a role for common ground. In Keysar’s view, an experimental paradigm can show a reliable effect of common ground during language comprehension only when it distinguishes the listener’s own perspective from the information they share with the speaker; otherwise, the listener might be using their own, private ground for interpretation, as that would be more parsimonious than tracking mutual knowledge. These arguments mark the birth of the Director task, which has become a classic eye-tracking paradigm in psycholinguistics.

In the original setup of the Director task, a participant and a confederate Director stand on opposite sides of a vertical grid of objects, but not all objects are in their common ground because some of the cells are occluded for the Director, who is supposedly ignorant of their contents. Thus, when the Director instructs the participant to, for example, “move the small candle,” the smallest of three candles is visible only to the participant, who must then select between the medium-sized

candle in the common ground and the smallest candle in their privileged view. Originally, Keysar et al. (1998a) designed this task to reliably test the claim made by Clark & Carlson (1981, p. 328): “The comprehension process must keep track of common ground, and its performance will be optimal if it limits its access to that common ground. Whether its design is actually optimal in this respect is a question that can only be answered empirically.”

Contrary to the Restricted Search hypothesis defended by Clark & Carlson (1981), participants in the Director task do not limit their search for the intended referent to those objects in the open cells of the grid. In fact, participants show a tendency to first look at the smallest candle in their privileged view—sometimes even reaching for it—before picking up the medium-sized candle in the common ground (Keysar et al. 1998a,b, 2000). Keysar and colleagues interpret their results as evidence of a two-stage model of reference resolution, whereby a listener’s initial search for an intended referent is driven by their own egocentric perspective, and the common ground only plays a role in a later monitoring process that detects errors and adjusts interpretation accordingly (Epley et al. 2004). Contrary to Clark and Carlson’s view that limiting referent search to the common ground would be optimal, Keysar et al. argue that their Egocentric Anchoring and Adjustment model may be more efficient since listeners can often afford to be egocentric and rely on their own perception of salience (which should often be analogous to the speaker’s) (Keysar et al. 2003) or on the speaker engaging in audience design (i.e., speakers’ tailoring of their message to the listeners’ needs) (Keysar et al. 2000), ultimately resorting to conversational repair if need be (Barr & Keysar 2004).

Pickering and Garrod propose another two-stage model of common ground in their Interactive Alignment Theory of dialogue (Garrod & Pickering 2004, Pickering & Garrod 2004). In their view, Clark’s psycholinguistic model of common ground (Clark 1996, Clark & Marshall 1981) is computationally more feasible than the iterated attitudes of mutual knowledge, yet it still requires interlocutors to keep in mind a complex model of their conversational partners’ knowledge, separate from their own. Pickering and Garrod argue that rather than constantly updating a model of their partners’ mental states (which is unnecessarily computationally taxing), interlocutors engage in an automatic, unconscious process of interactive alignment, whereby their mental representations are aligned at different levels (e.g., low-level alignment of words and syntax leads to higher-level alignment of situation models). This body of aligned representations, which interlocutors synchronously build as conversation proceeds, is what Pickering and Garrod call “implicit common ground” (Garrod & Pickering 2004, Pickering & Garrod 2004). Interlocutors do not need to infer the contents in each other’s mind and construct separate mental representations since they can simply rely on their implicit common ground.

In instances of miscommunication, interlocutors rely on the implicit common ground for interactive repair, which allows them to realign their representations without having to model each other’s mental states. It is only when these straightforward means of repair fail that interlocutors may go beyond the implicit common ground and rely on full common ground (Garrod & Pickering 2004, Pickering & Garrod 2004). Unlike implicit common ground, which is the basis of interactive alignment, full common ground is a specialized, nonautomatic process that is only used when radical misalignment becomes obvious. Drawing inferences about common ground is therefore an optional strategy that interlocutors employ only when resources allow, and it is normally not necessary.

In a more recent development of their mechanistic account of dialogue, Pickering & Garrod (2021a,b; see also Gandolfi et al. 2022) introduce the notion of shared workspace, which includes all the elements that are in the interlocutors’ current focus of attention. For example, in the standard Director task, the objects in the open cells of the grid and the utterances produced by the Director and the participant would all be in their shared workspace. The objects in the

occluded cells, on the other hand, would be in the participant's individual space. Rather than being representational, the shared workspace contains the actual elements over which interlocutors' representations are formed, and alignment is established between their shared representations.⁶

In the shared-workspace framework, situation models and linguistic representations are both first-order representations that can form first-order alignments. Yet communicative success also depends on second-order representations, which are invoked when interlocutors meta-represent their alignment. Thus, interlocutors' situation models contain tokens that can be m-tagged when interlocutors meta-represent their alignment on a given token (e.g., CANDLE-token-m would correspond to the candle in the middle of the table if both interlocutors were staring at it and/or talking about it). M-tagging also reflects each interlocutor's confidence in their meta-representation of alignment on a continuous scale, such that m-tagged tokens have an m-tag value between 0 (no alignment) and 1 (full alignment; e.g., CANDLE-token-m-1 versus LAMP-token-m-0.22). Importantly, m-tagging results from the interlocutors' constant comparison of their respective representations to monitor whether they are aligned or not (Gandolfi et al. 2022).

In line with previous psycholinguistic models, Horton & Gerrig (2005a,b, 2016) tried to provide a more psychologically plausible account of common ground than the infinite chain of reasoning proposed by Schiffer (1972) and other formalists, as well as Clark & Marshall's (1978, 1981) reference diaries, which they deem too computationally burdensome to form the basis of everyday conversation. In Horton and Gerrig's view, conversational common ground is an emergent property of ordinary processes of memory encoding and retrieval, and it does not require specialized mental representations. Thus, each participant in a conversation functions as a memory cue for the retrieval of associated information through an automatic search process known as "resonance." Rather than maintaining a mental model of the listener or tagging information to support common-ground inferences, interlocutors rely on partner-specific associations in long-term memory (including those between a conversational partner and an intended referent), which work as input for language production processes.

When a conversational partner serves as a memory cue for the retrieval of associated relevant knowledge, utterances are more likely to be consistent with pragmatic expectations about the common ground (Horton & Slaten 2012). However, those memory representations that permit audience design need to become accessible within the time course of language production, and the relative accessibility of particular memory representations depends on people's experiences with their interlocutors. For example, when two people talk about a certain topic regularly, relevant information will be more readily accessible in their next conversation. By contrast, information that is only weakly associated with a conversational partner may not be sufficiently accessible to result in audience design. In those cases where interlocutors do not automatically access information relevant to the common ground, they can engage in strategic commonality assessment through more controlled memory search processes. In sum, according to Horton & Gerrig (2005a,b, 2016), people gain access to the information they share with their interlocutors through domain-general memory processes acting over ordinary memory traces, and these processes may be automatic or strategic depending on the relative accessibility of partner-specific information in long-term memory.

The most recent psycholinguistic theory of common ground was proposed by Heller & Brown-Schmidt (2023), who reject previous notions of common ground in favor of a cognitive architecture that includes separate representations of the interlocutors (self and others) and a cognitive process that continuously compares these representations during conversation, outputting both

⁶It is worth noting that psycholinguistic models often refer to the contents of common ground as objects rather than propositions, although they never seem to make explicit commitments about this view.

similarities and differences in mental states. This cognitive architecture is motivated by laboratory tasks where speaker and listener have different visual and/or epistemic perspectives (akin to the Director task), and conversational scenarios with similar constraints, as well as the asking of information questions—a linguistic phenomenon not previously addressed by psycholinguistic models of common ground. Heller and Brown-Schmidt argue that previous theories characterized communication as the growing of common ground or alignment, losing sight of the importance of differences in the interlocutors' perspectives. In their theory, by contrast, mutual knowledge is understood as perspective similarity, which is just one of the two possible outputs of the comparison process, with perspective differences being equally important.

Rather than a dedicated representation for common ground, the Multiple Perspectives Theory posits separate mental state representations for the self and other, a view that has antecedents in the formal tradition (Farkas & Bruce 2010; Gunlogson 2004, 2008; Lascarides & Asher 2009) and in Pickering and Garrod's shared-workspace framework (Gandolfi et al. 2022), which also posits that interlocutors constantly compare their perspectives and meta-representations of alignment during dialogue. Heller & Brown-Schmidt (2023) conceive of mutual knowledge as a transient representation that updates the interlocutors' representations of self and other and is used in the moment for both language production and comprehension. Based on documented memory limitations and asymmetries between speakers and listeners, Heller and Brown-Schmidt predict that speakers will often assume mutual knowledge when their listener actually needs to rely on inference to derive the intended interpretation.

As the foregoing review shows, psycholinguists have been preoccupied with the tractability of common ground, positing cognitive mechanisms that can account for interlocutors' ability to quickly and efficiently coordinate their background information. This represents an attempt to lift the main idealization of the formal tradition. However, whereas formalists have sought to expand the empirical scope of their models, psycholinguistic models have narrowed their empirical scope by focusing almost exclusively on definite reference while mostly ignoring other phenomena that have animated the formalists' discussions.

3. BRIDGING THE TRADITIONS

The formal and psycholinguistic traditions have become increasingly disconnected—to their detriment, we think. This section aims to remove obstacles to their reintegration, thereby paving the way for progress toward both greater empirical scope and greater psychological realism within a single theory.⁷ In Section 3.1, we argue that an apparent substantive disagreement between the two traditions rests, at least in part, on a conceptual misunderstanding. In Section 3.2, we argue that the positive proposals of both traditions are all best understood as compatible, partial solutions to a larger problem.

3.1. Iterated Attitudes

Aside from their different idealizations and methodologies, formalists and psycholinguists are divided by an apparently substantive disagreement about iterated-attitude theories of common ground, which tend to be assumed by formalists and rejected by psycholinguists. The origin of this

⁷Some might deny that this is a desirable aim because they take common ground to be a model of objective and normative features of conversation rather than of features of human psychology (e.g., DeVault & Stone 2006, Gauker 1998, Geurts 2019, Stojnić 2021). We lack the space to properly address these views here, but our response, in brief, is that even if common ground is construed as something nonpsychological, we still need a psychological theory of how communicators keep track of it. For a more detailed response, we refer readers to Harris (2019, 2024).

disagreement is Clark & Marshall's (1981, p. 15) processing paradox, which psycholinguists have tended to cite in agreement (Horton & Brennan 2016, Horton & Gerrig 2005a, Pickering & Garrod 2004). This argument can be seen as inaugurating psycholinguists' search for psychologically realistic alternatives to iterated theories.

We think that this dispute is less substantive than it appears. First, notice that formalists and psycholinguists tend to agree about paradigmatic cases of common ground. For example, Clark's (1996, p. 93) example of physical copresence, in which a father and son are looking at a conch shell on the beach, is nearly identical to examples used by Schiffer (1972, pp. 33–36) to illustrate mutual knowledge and by Stalnaker (1978, p. 323) to illustrate how common ground can arise from a manifest event.

However, according to Clark & Marshall (1981; cf. Clark 1996), although physical copresence would justify any of the states of knowledge needed for iterated common knowledge, attaining each of these states would require an extra process of "checking" that the proposition is true. Since this process would take "a finite (though small) amount of time or capacity" (Clark & Marshall 1981, p. 15), it cannot be done an infinite number of times in a finite span. Clark and Marshall therefore propose that interlocutors skip all of those steps by using a heuristic that takes them directly from recognizing physical copresence to treating information about the conch as common ground.

By contrast, Schiffer and Stalnaker would say that the father and son already possess iterated common knowledge without needing to go through any extra process. Like many philosophers of mind, they deny that we need to separately check or even entertain each proposition that we come to know. As Schiffer (1972, p. 36) puts it, "it is no objection to the claim that *S* knows that *p* that the thought that *p* never once entered *S*'s head." Likewise, they would insist that there is nothing paradoxical about knowing infinitely many propositions; for example, you currently know that your index finger is shorter than 5 inches long, that it is shorter than 6 inches long, that it is shorter than 7 inches long, and so on, even if you have never gone through any process of checking that each of these propositions is true.

What could knowledge be, such that an infinite amount of it could be acquired by and stored in a finite mind? This, of course, is a matter of controversy (Schwitzgebel 2023). But, as it happens, the most prominent defenders of iterated theories of common ground are on record defending one of the following three views:

- i. Dispositionalists argue that to believe (or know) that *p* is to be disposed to think and behave in the right ways—for instance, to be disposed to judge *p* true if the question arises, or to act on one's plans and desires as if *p* is true (Schwitzgebel 2013).
- ii. Functionalists argue that to believe that *p* is to possess an inner state that causally interacts with perception, action, and other mental states and processes in believe-that-*p*-like ways (Lewis 1972, Stalnaker 1984).
- iii. Interpretationists say that to have a belief is to be someone whose thoughts and behavior can be predicted and explained using a theory that credits one with the belief (Davidson 1982, Dennett 1971).

By the standards of any of these theories, the father and son in Clark's (1996) example each qualify as possessing iterated common belief, and since each of these beliefs is true and epistemically warranted, they also possess iterated common knowledge.

However, not every philosopher of mind would agree:

- iv. Representationalists about belief would argue that to believe (or know) that *p* requires having a discrete mental representation of *p*—for instance, a suitably tokened sentence in the language of thought (Fodor 1975, Quilty-Dunn et al. 2023)—and that someone who

appears to have infinite beliefs really just has an infinite number of dispositions to quickly acquire the relevant beliefs as needed (Audi 1994). Turning these dispositions into actual beliefs would require some process that takes time and cognitive capacity.

Clark & Marshall's (1981) processing paradox therefore seems to tacitly presuppose a representationalist theory of belief/knowledge.

If this diagnosis is correct, then what may have looked like iterated theorists' unresponsiveness to a devastating objection turns out to be a tacit disagreement over the nature of belief that has long divided philosophers of mind. Representationalists take beliefs to be concrete mental representations that interact with cognitive mechanisms. By contrast, theories i–iii take beliefs to be abstract properties of minds, which could be realized by a variety of underlying mechanisms. One thing that could constitute a belief in the abstract sense is a belief in the concrete sense; for instance, a person's disposition to judge that *p* (etc.) could arise from their possession of the right mental representation. But a dispositional belief could also be grounded in a mechanism (such as a heuristic) that can produce a mental representation as needed. This suggests that the mechanisms posited by psycholinguists are compatible with iterated theories. For example, dispositionalists could argue that the psycholinguists' cognitive mechanisms are what give rise to the infinite dispositions that constitute iterated common knowledge. The flip side of this compatibility, however, is that iterated theorists (i.e., nearly all formalists) should recognize that they have told us little or nothing about the cognitive mechanisms that allow interlocutors to select and represent common ground—a point that has been obscured by their talk of propositional attitudes.

3.2. Theoretical Scope

Our next reconciliatory claim is that none of the extant theories of common ground can do it all: Each makes sense of at most some of the data that a theory of common ground should explain. Consider again iterated theories. Putting aside questions of psychological plausibility, there are powerful reasons to think that these theories cannot account for every scenario in which interlocutors distinguish common ground from what they privately believe.⁸ One reason is that we regularly communicate in the ways that common ground was posited to explain, even when we know we cannot achieve the relevant iterated attitudes with our utterances. This is what Harris (2020) calls “publicity-averse situations” (see also Simons 2025). For example, when you send a message to a colleague who rarely reads their email, or when you teach a class that includes students who, you think, are not understanding what you are saying, or when you think that a Parisian waiter did not understand your order, you do not immediately come to believe (or even accept) that they believe what you said. This means that you and your addressee do not satisfy any of the meta-representational clauses of an iterated definition of common ground (e.g., anything beyond clauses ia and ib in definition 7).

Crucially, communicators in publicity-averse scenarios can still successfully communicate by means of assertions and can still use definite reference, anaphora, presupposition, and context-sensitive expressions, in ways that depend on what they previously communicated (Harris 2020, Simons 2025). The Parisian waiter may still have understood your order of “steak and french fries,” for example, even if you suspect that they did not, and in that case, you might still try to communicate more by saying, “Not too much salt on the fries, please.” Of course, this risks miscommunication, but you might be willing to take this risk because you have some hope (if not

⁸Armstrong (2018) argues that children and some nonhuman animals, who are not capable of iterated attitudes, make use of a kind of common ground. This motivates less demanding mechanisms that may also be at work in human adults.

belief) that you will be understood. This suggests that communicators must have some cognitive mechanism(s) for choosing which information to treat as background, other than treating it as commonly known, believed, or accepted.

These publicity-averse scenarios cause parallel problems for psycholinguistic accounts as well. For example, Clark's (1996) explanation for why the contents of utterances normally become common ground is that they, like the conch shell between the father and son, are physically copresent and therefore have the features that trigger the linguistic copresence heuristic. But publicity-averse situations do not meet this condition, because they give at least one interlocutor salient reasons to doubt that the other can perceive or understand their utterance. These situations also interfere with the grounding moves that, Clark (1996, chapter 8) thinks, we typically use to signal uptake and reinforce the common ground (e.g., you cannot nod in response to an email, and you might suspect that the Parisian waiter's nod does not signal genuine understanding). Similarly, Horton & Gerrig's (2005a, Horton & Gerrig 2016) memory account of common ground does not make the right predictions in those instances where a speaker knows that they shared an experience with their listener (e.g., went to a concert together) but also suspects that the listener might not remember (e.g., because the concert was a long time ago). Yet these arguments do not demonstrate that we never use iterated attitudes, Clark's heuristics, or Horton and Gerrig's memory-retrieval mechanism as a strategy for selecting which information to treat as common ground; what follows is only that these strategies cannot be successful in every communicative situation.

A further threat to the scalability of some accounts is the existence of conversations in which interlocutors treat information they do not believe as common ground. We all routinely participate in conversations of this kind, such as when we feign agreement to avoid conflict, or when we deliver a friend to their surprise party. A remarkable feature of these situations is that common ground seems to play its usual role in assertion, presupposition, context sensitivity, definite reference, and anaphora regardless of whether all interlocutors believe everything in the common ground, all are merely pretending to believe, or some believe it and others are pretending. As explained in Section 2, formalists have accounted for this by defining common ground in terms of what the interlocutors accept for the purposes of the conversation (Stalnaker 2002, 2014). Acceptance, on this view, is an attitude or category of attitudes that may involve treating a proposition as true provisionally and for some purpose, such as when one makes a supposition to see what follows from it or to play devil's advocate. This is a powerful generalization of the common-ground model, but the mechanisms that psycholinguists have posited for selecting and representing common ground do not seem to be compatible with it.

Clark's (1996) physical and linguistic copresence heuristics depend on what interlocutors actually perceive, and Horton & Gerrig's (2005a, Horton & Gerrig 2016) memory-retrieval mechanism depends on their actual memories, whereas at least some acceptance-without-belief scenarios would seem to require common ground to depend on our psychological mechanisms for joint pretense or imagination instead. Acceptance without belief also solves a problem that Heller & Brown-Schmidt (2023) take to be devastating for the notion of common ground: that interlocutors can sometimes communicate successfully even when one of them has a false belief (and this is known by the other). However, that argument is critical only if one equates common ground with mutual knowledge, and not if common ground can also include propositions that are merely accepted for the purposes of the conversation. In general, acceptance is a powerful tool for repairing defective contexts.

A further reason to doubt that any extant account can explain all of the data is that information in the common ground seems to come in different representational formats. In Section 2.1, we summarize reasons to think that common ground includes object representations. This line of

thought has recently led some researchers to argue that common ground must be at least partially built out of object representations that cognitive scientists have posited for other reasons, such as the mental files that philosophers of mind have posited to make sense of object-directed thought, or the object files that vision scientists have posited to explain our capacity for object tracking (Brody 2020, Kamp & Learnihan-Sylvester 2026, Lewis 2025, Murez & Recanati 2016). However, common ground cannot be wholly built out of object representations because some common-ground information is not about particular objects (e.g., the proposition that all dogs are mammals). This suggests that neither purely propositional nor purely objectual representations can do all of the work of common ground. And this line of thought can be extended when we consider other complications of the common-ground model, such as QUDs, which seem to be a representation of neither propositions nor objects but rather of goals or plans (Roberts 2012b; on plans, see also Charlow 2013, Harris 2021, Lewis 2021, MacFarlane 2016). Given its diverse functions, it is an open question how many different kinds of mental representations may be needed to capture common ground.

4. COGNITIVE PLURALISM ABOUT COMMON GROUND

We have argued that no extant theory of common ground can do it all. Nor is it obvious how to generalize any one theory. We think that this is no accident; humans use a number of different cognitive mechanisms to select and represent common ground. Different researchers have focused on different ones and have often understood the results to be competing theories of a single phenomenon. We would like to recast these theories as accounts of mechanisms that might coexist within a single mind, complementing each other as parts of a larger, multifaceted solution to the problem of how to select and represent shared background information. We call this view “cognitive pluralism about common ground,” or “pluralism” for short: the idea that we have more than one cognitive mechanism for managing common ground. The advantage of pluralism is that it allows us to account for both the sources of variability in common-ground use and its processing demands. In what follows, we consider each of these advantages in turn.

4.1. Empirical Reasons for Pluralism: Sources of Variability

The first source of variability in common-ground use stems from the diversity of linguistic phenomena relying on interlocutors’ background information. The cognitive mechanisms posited by psycholinguists are customized to explain definite reference, but, as shown in Sections 1 and 2.1, common ground also has other jobs to do. It is doubtful that any one cognitive mechanism could take care of the roles of common ground in definite reference, assertion, presupposition (and presupposition accommodation), the many forms of context sensitivity, anaphora, and so on—particularly when we consider that information in common ground can be known, believed, or merely accepted for the purposes of the conversation.

Another important source of variability in common-ground use comes from the wide range of situations in which people communicate, which makes some psycholinguistic accounts viable in some communicative situations but not in others. For example, Clark & Marshall’s (1981) physical copresence heuristic and Pickering & Garrod’s (2021b) shared-workspace framework are useful for face-to-face discussions of perceptually available topics but not when communicators cannot see each other or their subject matter. Similarly, Horton & Gerrig’s (2005a, Horton & Gerrig 2016) automatic memory-retrieval mechanism may be useful to draw information from shared memories with interlocutors but not when talking with strangers (Rubio-Fernandez et al. 2019) or about topics that are not connected to shared memories (Jara-Ettinger & Rubio-Fernandez 2021).

A third kind of variability relates to the nature of the mental representations underlying common ground. In Section 2.1, we show how work in the formal tradition suggests that common ground needs to encompass information in different representational formats, such as shared representations of propositions (e.g., the proposition that the incumbent won), representations of the entities under discussion (e.g., the incumbent), and representations of goals (e.g., learning the results of the election). Since these different kinds of representations have different formats, we might need to rely on different cognitive mechanisms or processes to make use of them (see Rubio-Fernandez et al. 2025). For example, we may need to make use of object-file systems to track individuals under discussion (Brody 2020, Lewis 2025), or our planning systems to coordinate goals (Roberts 2012a).

Relatedly, common-ground mechanisms must operate over both short- and long-term memory representations [what Arnold (2008) calls “local” versus “global” assumptions]. However, psycholinguistic models tend to focus on one or the other (cf. Pickering & Garrod 2021b). For example, Horton & Gerrig’s (2005a, 2016) model of common ground focuses on long-term memory representations, which could explain the formulation of first mentions (e.g., whether to refer to *Dr. Evans* or *our children’s pediatrician*, depending on whether the addressee knows who Dr. Evans is) but could not account for anaphora (e.g., whether to refer to Dr. Evans as *she* depending on the antecedent’s discourse accessibility). Conversely, Heller & Brown-Schmidt’s (2023) theory, with its focus on transient representations of mutual knowledge that are used in the moment, could contribute to a theory of how short-term memory figures in anaphora resolution but not to a theory of how shared memories become accessible in long-term memory for the purpose of formulating first mentions.

Finally, an important source of variability not accounted for by previous theories of common ground is the cross-linguistic differences in grammatical markers of new-familiar information (for discussion, see Rubio-Fernandez 2024, Shukla et al. 2022). For example, whereas speakers of languages with definite articles must signal a familiar referent for the benefit of their addressee (e.g., “We bought the house” versus “We bought a house”), in languages without articles, it is often the listener who must infer from the context whether the speaker is referring to something new or familiar. Seen this way, the division of pragmatic labor between speakers and listeners managing common ground may vary depending on the language (Rubio-Fernandez 2025).

4.2. Empirical Reasons for Pluralism: Processing Demands

Pluralism is also motivated by considerations of computational complexity (also called “tractability”), which has played a central role in the psycholinguistic tradition. However, some recent psycholinguistic models also raise tractability worries. In Pickering & Garrod’s (2021b) shared-workspace framework (see also Gandolfi et al. 2022), interlocutors need to constantly monitor each other’s discourse representations to m-tag those that are aligned, and they need to do so with an estimated degree of probability. Similarly, in Heller & Brown-Schmidt’s (2023) Multiple Perspectives Theory, interlocutors must constantly compare their mental states during conversation, registering all differences and similarities, also in probabilistic terms. It seems right to us that interlocutors must at least sometimes represent discrepancies in their background information—for instance, to decide of whom to ask a question, to identify and repair defective contexts, or to accommodate presuppositions (Simons 2025).⁹ However, there are good reasons to think that representing conflicting beliefs is cognitively demanding (Westra & Nagel 2021), and it is therefore

⁹Formal-pragmatic models typically idealize away from phenomena that involve representing differences in perspective. However, formalists were the first to acknowledge that these are real and important phenomena

questionable whether interlocutors can communicate while constantly comparing their mental states and classifying them as similar or different with a distinct probability—especially in multiparty conversation.¹⁰

Another important consideration regarding the processing demands of using common ground is the relative efficiency of different psycholinguistic accounts. Keysar and colleagues' Egocentric Anchoring and Adjustment model (Keysar et al. 1998a, 2000, 2003) and Pickering and Garrod's original Interactive Alignment mechanism (Garrod & Pickering 2004, Pickering & Garrod 2004) were put forward as efficient alternatives to the cognitive demands of constantly monitoring common ground in conversation. While both these models allowed for a late, effortful use of common ground for conversational repair, they do not endorse cognitive pluralism, in our sense of the term, since they do not consider egocentric processing or alignment as efficient mechanisms for managing common ground (but rather as alternatives to using common ground).

Arnold (2008, 2010) also put forward an efficient referent production system whereby speakers use their own discourse model to calculate the relative accessibility of a given referent (e.g., whether Dr. Evans was mentioned recently enough to refer to her as *she*) rather than explicitly considering the addressee's discourse model. Along similar lines to those of Keysar et al. and Pickering and Garrod, Arnold argues that this efficient mechanism would often have the same outcome as taking the addressee's perspective while being less cognitively demanding. However, Arnold acknowledges that her prediction crucially depends on the addressee being attentive during the conversation (otherwise, they might not understand whom *she* refers to).

From a pluralist perspective, a continuous comparison of the interlocutors' mental representations (Gandolfi et al. 2022, Heller & Brown-Schmidt 2023, Pickering & Garrod 2021b) would be an extremely taxing default mechanism, whereas an egocentric language production and comprehension system (Arnold 2008, 2010; Garrod & Pickering 2004; Keysar et al. 1998a, 2000, 2003; Pickering & Garrod 2004) would often fail depending on the listener's engagement in the conversation (which can compensate for speakers' egocentric language production) and the speaker's audience design (which can compensate for listeners' egocentric language comprehension). Instead of proposing default strategies operating across all communicative situations, a cognitive-pluralist account would posit a variety of common-ground mechanisms: those that project our own perspective as shared with our interlocutor (and are therefore more efficient) and those that require actively taking our interlocutor's perspective (which are more costly but often worthwhile).

Finally, cognitive pluralism is compatible with the view that language users not only have a variety of cognitive mechanisms at their disposal to manage common ground in different communicative situations, and for different linguistic phenomena, but they also can combine different cognitive mechanisms in any one exchange depending on their goals, what is at stake, and their

that a theory of common ground must explain, identifying defective contexts (Stalnaker 1978), noncooperative contexts (Camp 2012, Cummins 2024), and publicity-averse situations (Harris 2020). If formalists have not modeled perspective differences yet, it is only because nobody currently knows how to create predictive formal models of these phenomena.

¹⁰Heller & Brown-Schmidt (2023) propose that this continuous comparison process is limited to relevant information, but they do not operationalize relevance, and they cite several authors whose concepts of relevance are not compatible, either with each other or with their own view: The relevance theoretic notion is the ratio between cognitive effects and processing effort (hence a technical term for "efficiency") (Sperber & Wilson 1995), while Grice's and Roberts's notion of relevance is indeed the one intended by Heller and Brown-Schmidt (meaning "pertinence"). Yet Grice (1975) offers no formalization of this notion, and the one proposed by Roberts (2004) relies on the very notion of common ground that Heller and Brown-Schmidt are trying to eschew.

cognitive resources. For example, if two Canadians see a hockey puck sitting between them, physical copresence may be enough to make it common ground that something is there, but to make it common ground that it is a hockey puck, they may also need to rely on cultural copresence. Yet these strategies can also be profitably combined with explicit meta-representation. Thus, one of our two Canadians, having deployed both heuristics, might also wonder whether the other doubts their knowledge of hockey (since they themselves do not look stereotypically Canadian). This sort of meta-representation could be an optional way to second-guess or fine-tune a representation of common ground that has been built using rough-and-ready heuristics. Of course, as mentioned in Section 3.2, publicity-averse situations (e.g., when we email a colleague who rarely reads their email) prevent double-checking of common ground. Therefore, meta-representation, too, is best seen as just one more cognitive mechanism, which is useful in some situations and for some purposes, but not others.

5. CONCLUSIONS AND FUTURE DIRECTIONS

Common ground emerged as part of a model that offered unifying explanations of diverse pragmatic phenomena. The formal and psycholinguistic traditions have each lifted some of this model's idealizations, and have thereby made significant progress, but in orthogonal directions: The formal tradition has built more complicated formal models to explain more phenomena while ignoring questions about cognitive mechanisms. The psycholinguistic tradition has theorized increasingly realistic cognitive mechanisms while narrowing the range of phenomena they explain.

We have tried to begin the process of integrating these two orthogonal forms of progress. We hope that future theories of common ground will incorporate both broad empirical coverage and realistic, independently motivated theories of the underlying psychological mechanisms. We think that these theories would do well to self-consciously adopt a cognitive-pluralist approach, which would in turn lead them to seek new empirical methodologies that can uncover the different mixtures of cognitive mechanisms that support our capacity to select and represent common ground in different situations.

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