

# LEAST COLLABORATIVE EFFORT OR LEAST INDIVIDUAL EFFORT: EXAMINING THE EVIDENCE

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## Abstract

In Clark's Collaborative theory, least collaborative effort is seen as one outcome of the joint production of language. This assumption is problematic in three respects. Firstly, the claim for least collaborative effort is made in contrast to rather idealised conceptions of 'least effort'. Secondly, the way in which effort is often measured seems somewhat simplistic: utterance length does not necessarily equate to utterance effort. Finally, assuming that shifts in language behaviour and changes in modality necessarily lead to overall least effort fails to engage with the complexity of the situation. It is argued that the experimental evidence can be more effectively explained by seeing the reduction of effort being an individual motivation rather than a jointly conceived one: the shifts in behaviour often cause more work for one participant than another, and can even have deleterious effects on another individual's performance.

## 1. Introduction

Clark's Collaborative Theory of language use (e.g. Clark, 1996) claims that language is jointly produced through a process involving ratified participants who collaborate in order to increase their common ground. Clark also makes the claim that this process leads to participants minimising the joint effort which they use in order to communicate (least collaborative effort). It is the aim of this paper to evaluate this second claim. First, Clark's theory itself will be outlined briefly.

To Clark, the jointness of language use is key: the process is not reducible merely to the contributions of two (or more) individuals. He distinguishes between what he terms autonomous and participatory action. Autonomous actions are done individually, whereas participatory actions are done as part of a joint act. Thus, practising your part in a band arrangement is an autonomous action, whereas playing the same music with the band is a participatory action. The reasoning behind this is that the participatory action requires you to adjust your behaviour to the other participatory actions that make up the overall joint action. There is little point in you (correctly) repeating a phrase if everyone else forgets: you adjust your behaviour to the other participatory actions which make up the joint action.

The minimal unit of joint action in the Collaborative Theory is the contribution, which consists of a presentation and acceptance phase. Each utterance should be considered as a presentation and needs to be accepted by the addressee(s) before the contribution can be considered complete, and before any information in the presentation can be considered to be added to the speakers' common ground. So, a question is not accepted until the addressee has produced a response which shows that they have understood it as a question, and have also understood it as asking for the same information which the speaker intended. It is this process of building common ground which is termed 'collaboration'.

Interactants collaborate in the accumulation of common ground and in the process share both information and knowledge of how that shared information was produced. This status is unique to those ratified participants in the conversation – those who actively engage in the process; side-participants, overhearers, omniscient bystanders, etc. do not share the same degree of common ground, because although they may have access to the same set of utterances, it is

not *their* understanding which is being monitored. This difference in understanding is clearly demonstrated by experimental evidence (Clark & Schaefer, 1987; Schober & Clark, 1989; Wilkes-Gibbs & Clark, 1992). Later work in this area has explored the notion of collaborativity further by looking at the sensitivity of participants to changes in the context, such as the swapping of dialogue partners part way through an experiment (e.g. Horton & Gerrig, 2002) or the effect of different media on the communication process (e.g. computer mediated conversation (CMC) or addition of the visual channel).

Alongside the claim for collaboration has been a claim for *least collaborative effort*. This was derived from the behaviour of interactants in the first major article on collaborative theory (Clark & Wilkes-Gibbs, 1986), who decreased the length of their referring expressions and the number of turns taken over the repeated trials, and also used the process of refashioning (see section 2.1) to agree on a conceptualisation of the tangram<sup>1</sup> to which they were referring. This argument for least collaborative effort seems to have been unproblematically accepted, and it appears now to have become a standard assumption within the collaborative theory (e.g. Bortfield & Brennan, 1997; Clark & Brennan, 1991; Clark & Krych, 2004).

While the argument for language use being a joint activity seems well-supported, the evidence for the joint minimisation of effort seems more questionable. There are certainly alterations in behaviour over time, or shifts associated with changes in participants or the medium used for the interaction. However, the conclusion that these shifts *necessarily* lead to a reduction in overall effort – and are motivated on a joint rather than an individual basis – is much more problematic.

Firstly, there is the question of measuring effort, and the comparison of the level of effort involved in different kinds of linguistic behaviours (producing a minimally disambiguating referring expression vs. refashioning, for example). This issue becomes more complex when comparisons are being made between participants with different linguistic abilities (e.g. Bortfield & Brennan, 1997; Perkins & Milroy, 1997), or between linguistic effort and other cognitive behaviours (e.g. Clark & Krych, 2004; Gergle, Kraut & Fussell, 2004; Schober, 1995). It is particularly difficult to make these measurements when one effect of the behaviour seems to shift some effort from one participant onto another: how is it possible to judge whether one person's gain outweighs the other's loss?

This is connected to the problem of whether this minimisation of effort (if such it is) should be viewed as a joint activity or an individual one. The shifts in work that are seen could as easily be attributed to the opportunism of individuals as to the philanthropy of co-participants (e.g. Clark & Wilkes-Gibbs, 1986; Schober, 1995; Wilkes-Gibbs, 1986). Indeed, as some individuals seem to be negatively affected by the behaviour of their co-participants (e.g. Davies, 1998, 2006; Wilkes-Gibbs, 1986), the appeal to collaborative effort seems problematic at best. There is also evidence that interactants are both risk-averse, and sometimes act to their own advantage (Davies, 1998, 2006; Horton & Gerrig, 2002).

This paper makes the argument that while the production of meanings may be joint, the participants within the dialogue also have individual motivations, which include the desire to limit the amount of effort they invest. While the experimental work to date has shown shifts and

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<sup>1</sup> Tangrams are Chinese puzzles which use seven triangle shapes to create a whole range of composite figures. These figures could be perceived as pictures of different things by different people, and thus in this experimental context it is up to the participants to generate a referring expression which will disambiguate a particular figure for both of them. Clark & Wilkes-Gibbs (1986) reproduce the set of tangram figures which they used.

some possible reductions in effort, I argue that these are better explained by an appeal to individual rather than joint decisions, as these changes are not necessarily beneficial to all.

## **2. Least Collaborative Effort**

According to Clark and his co-workers, not only do interactants collaborate in the process of communication, they also aim to minimise their joint effort.

Principle of Least Collaborative Effort

“Participants in a contribution try to minimise the total effort spent on that contribution – in both the presentation and acceptance phases.”

Clark & Schaefer (1989: 269)

If effort is minimised in each and every contribution, then it would not seem inappropriate to expand the focus of least collaborative effort to whole conversations (which indeed is what Clark and his co-workers seem to do elsewhere, see for example Clark & Wilkes-Gibbs, 1986; Wilkes-Gibbs, 1986; Clark & Brennan, 1991; Clark & Krych, 2004). To this end, I developed the following definition of least collaborative effort:

“Participants in a conversation try to minimise the total effort spent in that interactional encounter.” Davies (1998: 63)

Various types of evidence have been cited in support of this principle, from the decreasing length of referring expressions, to the decreased use of language when a visual channel is available. These will now be considered in turn.

### **2.1 Refashioning Referring Expressions and Decreasing Conversation Length**

When interactants are trying to pick out difficult to describe shapes from a set of similar items, they do not automatically produce a disambiguating referring expression. Rather, they jointly produce and agree on an expression which is understood and accepted by both interactants: this process is termed refashioning. The following example is taken from Clark & Wilkes-Gibbs (1986: 22):

- A: Um, third one is the guy reading with, holding his book to the left  
B: Okay, kind of standing up?  
A: Yeah.  
B: Okay.

The Director offers a conceptualisation which is refashioned slightly by the Matcher before it is agreed on by both. In later repetitions of the task, the expression employed to re-use the agreed conceptualisation progressively became shorter. For example, “the next one looks like a person who’s ice skating, except they’re sticking out two arms in front” (trial 1) was gradually shortened to “The next one’s the ice skater” (trial 4) and eventually became just “The ice skater” in trial 6 (Clark & Wilkes-Gibbs, 1986: 12).

Clark & Wilkes-Gibbs argue that there are two indicators of least collaborative effort here. Firstly, the process of refashioning itself involves less work than the Director having to produce a ‘perfect’ referring expression first time, because of the degree of effort which would be needed

to achieve that. Secondly, the decrease in length of the referring expressions and the concomitant reduction in conversation length over the trials showed that the participants were exploiting their increased common ground to decrease the amount of talk needed, and thus their collaborative effort.

## 2.2 Adapting to Criterion Level

The grounding criterion as defined by Clark & Schaefer (1989: 262) states that participants will pursue their understanding “to a criterion sufficient for current purposes”. The argument behind this is that interactants will invest more time and effort understanding critical information (e.g. instructions given to an individual during their driving test) than information they perceive to be less critical (e.g. the precise statistics of a sports event in which an individual has only a passing interest). This would predict that interactants with a high criterion (HC) would be prepared to spend more time and collaborative effort to ensure understanding than those with a low criterion (LC). Such behaviour would be consistent with the Principle of Least Collaborative Effort because effort would be conserved where the criterion was not set sufficiently high. This was tested by Wilkes-Gibbs (1986) in her city centre map task.

Pairs of interactants were given maps of a city centre. Each map had a complementary set of grid squares blocked out, and therefore the pair of speakers needed to exchange information in order to fill in the gaps. Unknown to the participants, they were assigned to two different groups. The HC participants were told that they would need to know the route well enough to describe it to someone who needed to drive it, whereas the LC ones were told that they would just need to estimate how long it would take to drive the route if you started at 1pm. Three types of pair were used: HC/HC, LC/LC and HC/LC. All participants were asked to draw the route on a full map after the dialogue; this was to assess their degree of understanding. One significant difference was found between the HC pairs and the LC pairs: the HC pairs talked for substantially longer, although there was no significant difference in the accuracy of their reproduction of the route. However, the mixed pairs did significantly worse than either of the matched pairs.

The difference in dialogue length – and the accompanying difference in the number of words and turns – between the matched pairs was taken to be an adjustment in the amount of collaboration, and thus an adjustment to *current purposes*. The outcome with regards to the mixed pairs is rather more difficult to account for. Wilkes-Gibbs’ explanation is that the greater flexibility of the HC participants enables them to accommodate to the needs of their partner – hence the dialogue length being similar to that of the LC pairs. However, this does not account for the mixed pairs’ poorer performance, or the particularly poor performance of the HC participants.

## 2.3 Adapting to the Addressee

Several researchers have investigated the effect of changing some aspect of the addressee: altering what they can see (Schober, 1995), swapping addressees part way through a task (e.g. Brennan & Clark, 1996), using non-native speakers (Bortfield & Brennan, 1997), using aphasics (Perkins & Milroy, 1997). In some cases, the issue of least collaborative effort has been a primary focus; in others, its consideration has been more an aside.

Schober’s (1995) study investigated the effect of changing the perspective of what the Director and Matcher could see. The experiment used a circular piece of cardboard which looked rather like a pizza with odd ‘toppings’ (Schober’s description). Each of the ‘toppings’ had a

number on it, and it was the Director's task to describe the location of each number so that the Matcher could label their board appropriately. There were three conditions to this experiment, which the participants were warned about in advance: same perspective, Matcher's board rotated 90°, Matcher's board rotated 180°. The point of the experiment was to investigate whether the descriptions produced by the Director were affected by the change in offset conditions: were the explanations mostly director-centred, matcher-centred, both-centred or neutral descriptions? In both offset conditions, neutral descriptions were the most frequent, with matcher-centred descriptions the next in line; however, the use of neutral descriptions increased over the three trials, whereas matcher-centred descriptions decreased. For the non-offset condition, both-centred descriptions were most popular (difficult to have specifically matcher/director-centred descriptions when there's no distinction in perspective), but neutral descriptions were the next category, and again they increased in percentage (at the expense of both-centred descriptions) over the three trials.

The popularity of neutral descriptions was seen as evidence for least collaborative effort, because this decreased the Director's effort in contrast with trying to produce matcher-centred descriptions. As Schober (1995: 242) says:

“If the participants had wanted to minimise effort only for the Matcher, they could have used only matcher-centred descriptions. The fact that they also used neutral perspectives suggests that they may have been trying to minimise efforts for both parties.”

While it is likely that neutral descriptions decrease effort for the Director, the effect on the processing effort needed by the Matcher is not so clear. This issue will be returned to in section 4.1.

Another aspect of effort is the way in which interactants deal with both changes in context and changes in addressees. Brennan & Clark (1996) used a lexical entrainment task to examine both how referring expressions are affected when the decision set is modified (i.e. by adding competitor items), and when this condition is combined with a Matcher replacement part way through the task. In this set of experiments, there were three trials. Trials A and C used the same set of flashcards with a mix of basic items (e.g. car, fish, shoe) and tangrams. Trial B replaced some of the basic items with extra instances of one of the items (e.g. add a sneaker and a high-heeled shoe to the loafer which was already there). Predictably, most of the participants shifted to a more specific and disambiguating referring expression in Trial B. But the more interesting issue was what would happen when they returned to the original set of cards: would they retain the recent more complex referring expression, or return to the more basic referring expression used in Trial A? About 50% of the pairs retained the more recent conceptualisation.<sup>2</sup> However, a further experiment – which used Trials B & C only, and switched Matcher in Trial C for 50% of pairs – showed that Directors typically used a basic level term with new Matchers, but retained the previous conceptualisation with original Matchers. Therefore, these facts were specific to particular addressees.

A similar joint commitment to a particular conceptualisation was found by Metzger & Brennan (2003). In this case, the conceptualisation was manipulated with the Director being part of the experiment: he introduced a pre-set conceptualisation, and managed the process of

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<sup>2</sup> Although this was also affected by frequency: if there had been more B trials than A trials, then there was more likelihood of retaining the more complex expression. This showed an effect of recency/frequency over informativity.

entraining on it with the naïve Matcher. Halfway through the trials, the Director changed the term used for another pre-set conceptualisation. In 50% of the dialogues, the Matcher was also changed at this point, and there was no effect on the dialogue. In the remaining 50%, where the original Matcher was still in place, this caused changes in the gaze pattern (the Matcher looked at other objects as well as the intended ones) and selecting the object took longer. This shows that such behaviour was unexpected, and led the Matcher to look for some reason for the change in expression.

The preference for retaining an agreed conceptualisation seems beyond doubt. Brennan & Clark's Directors show an awareness of this through their alteration in behaviour with a new Matcher, in the same way that Metzger & Brennan's Matchers demonstrate an expectation of it through their confusion at the switch from an entrained expression. Neither set of authors makes a claim in relation to least collaborative effort here, but the effect of adjustments in behaviour surely do have an impact on effort used, and I will return to this in section 4.2.

Bortfield & Brennan's (1997) matching task is similar in some ways to Brennan & Clark (1996) as it is concerned with the process of entrainment, but in this case the focus is on the developing language skills of a non-native speaker interacting with a native speaker (mixed pair) in comparison with a matched pair of native speakers. The objects chosen were a set of pictures of different types of chair (taken from a catalogue), most of which could easily be named by native speakers, but would more often prove a challenge to non-native ones. The question was what type of referring expressions would they entrain on? The 'ideal input' view (given as a marker for the autonomous view of language) would predict a lower degree of entrainment, and when it occurred the speakers should only entrain on native-like referring expressions. The non-native speakers should then be able to demonstrate this new knowledge by producing more idiomatic referring expressions in the post-test than the pre-test.

The results showed that entrainment happened to the same degree with mixed pairs as matched pairs, and also that some of the expressions entrained upon were idiosyncratic rather than idiomatic. Bortfield & Brennan argue that this demonstrates the collaborative nature of these conversations, as the entrained expression was refashioned and agreed through both speakers rather than merely being a naming process activated by the native speaker alone. It was also noted that native speakers in mixed pairs used more words and turns in either role (in this design, the pairs alternated between being Director/Matcher) in comparison to non-native speakers. This was considered to be an instantiation of least collaborative effort because it recognised the different abilities of the speakers: "if partners optimize effort collectively by taking each other's costs into account, then native speakers should utter relatively more words as Directors or Matchers than non-natives in the very same roles." Bortfield & Brennan (1997: 131).

It is interesting to note that Perkins & Milroy (1997) make a similar type of claim with respect to the minimising of collaborative effort in aphasic/normal pairs in a task-oriented dialogue. They argue that normal speakers recognise the increased cognitive load experienced by the aphasic speaker, and thus increase their own input accordingly. The extended sequences of clarification and repair found in their dialogues are thus taken as evidence of increased collaboration to attain grounding (rather than failures in the process). However, they did not perform any quantitative measures, so it is unclear whether the normal speaker did produce more words and turns than the aphasic speaker (as in the study described above), or whether the split was more equal. Cases where the (perceived) competence of the speakers is not the same are particularly interesting with respect to the measurement of effort, as we have little idea of what

the increase in effort for any individual interactant might be. This issue of measuring effort and how comparisons are made will be addressed in section 3.

## **2.4 Adapting to the Medium**

All the research described so far in this section refers to ‘talk’, where the participants can’t see each other or each other’s workspaces: they are reliant solely on the auditory channel. The effect of two other media on grounding and effort has been investigated also: CMC (Clark & Brennan, 1991; Newlands, Anderson & Mullin, 2003) and adding the visual channel (Gergle et al., 2004; Clark & Krych, 2004).

The nature of visual information made available to the participants in Clark & Krych (2004) and Gergle et al. (2004) is rather different. For the former, the Directors and Builders were co-present, and in 50% of cases, the Director could see the Builder’s workspace where the Builder constructed simple Lego models as a result of their communication. This meant that gestures such as head-nods and pointing could be used as well as speech. In the latter case, the workspace was on a computer screen; the Helper and Worker were not co-present. The Worker’s task was to complete an online puzzle, with the information given by the Helper. In this case, physical gestures could not be used, but access to the visual environment (in two experimental conditions) meant that the Helper had visual evidence of understanding, and also could use deictic expressions.

The basic argument for both Gergle et al. (2004) and Clark & Krych (2004) is that adding the visual channel makes task-oriented conversations faster, thus making them more efficient and necessarily decreasing collaborative effort. Like Clark & Brennan (1991), they argue that their subjects adjust their grounding behaviour to exploit the channels available. So, because the workspace is available for view (as at least one condition in both sets of experiments), interactants exploit this by using visual evidence for grounding, thus removing the need for extended verbal grounding and checking (Clark & Krych, 2004, found that both the absolute time and percentage of time spent checking plummeted in the visual condition). Gergle et al.’s study also showed that this effect was time-critical – delay update of the workspace by just a few seconds, and much of the gains were lost.

In Clark & Krych’s study, the participants’ co-presence meant they could also see each other’s facial expressions and gestures. This enabled Clark & Krych’s subjects to use other resources for grounding: physical gestures (which were interpreted as intentional communication), more deixis, in-speech self-adjustment (i.e. updating instructions on the fly because of the Builder’s behaviour) and careful timing of acknowledgements to provide the most effective feedback to their partner. It is an interesting question to consider whether having to manage all these different modalities so precisely is necessarily easier than using speech alone.

In all the studies discussed in section 2, there is evidence that speakers adapt to the context of the speech event in which they are involved, whether this in terms of modifying their behaviour in repetitions of the task, or modifying it due to the person they are speaking to, the medium they are using to communicate or the visual information they have available to them. The question is whether these changes do require less overall effort, and how this can be substantiated. It is to this issue that I now turn.

### 3. Measuring and Comparing Effort

#### 3.1 The Principle of Least Effort

The claim for least collaborative effort is made most explicitly in contrast to a classical principle of least effort (e.g. Clark & Wilkes-Gibbs, 1986; Clark & Brennan, 1991). The refashioning behaviour of the pairs in tangram matching tasks (section 2.1) is set in opposition to an idealised model of an individual producing a minimal disambiguating referring expression (with little thought for the role of the addressee). While the argument for the role of the addressee is clear – and thus the justification of the collaborative view over the autonomous view – the choice of this particular contrast is less straightforward.

Firstly, the claim that refashioning is less effortful than this concept is not really open to discussion. Garey & Johnson (1979, as cited in Dale & Reiter, 1995) argue that producing a minimal disambiguating referring expression in a given context would be extremely effortful for the speaker: an NP-hard task in computational terms. Almost any method of referring to an object will thus involve less effort than this, and therefore the claim of a decrease in effort is not particularly meaningful. Secondly – and this issue is related to the first – such a contrast would only be worthwhile if it were believed that humans did act in this fashion. It should be clear from the scale of the problem that this is unlikely. Indeed, Pechmann's (1984, as cited in Levelt, 1989) experiment showed that when referring to a white cup in set which only included a black bird and a white bird, interactants regularly used the over-explicit term *white cup*. The expression *cup* would have been sufficient to disambiguate the item from the set – and thus would have been the minimal term necessary.

Clark & Brennan (1991) use the tenets of Grice's Cooperative Principle as their exemplar of least effort. The ideal utterances should be appropriately informative and brief – a similar model to that of the perfect referring expression described above. Again, I have two arguments with this. Firstly, producing such “flawless presentations” (Clark & Brennan, 1991: 134) is extremely effortful – a point which is recognised by Clark & Brennan in relation to the issues of time pressure and errors; claiming a decrease in effort from this position is thus not particularly significant. Also, it is generally accepted that humans do not act in this way, rather, they act in a time-constrained manner because of the conflicting goals they face (e.g. Carletta, Caley & Isard, 1995). Secondly, equating Grice's Cooperative Principle (CP) solely with a notion of least effort is also problematic in a more philosophical sense. Because of the nature of Grice's work – introspective, and not based on data collection & analysis – it is difficult to translate it into a precise empirical formulation (Davies, 1998, 2006). However, an analysis of the CP in the context of Grice's other work on language clearly demonstrates that the position of the CP in his overall framework is rather more complex than least effort alone. Grice's interest in language is focussed on what he sees as its basis in rational action, and whilst some concept of least effort may be a component of this motivation, it certainly cannot be reduced to this alone (see Davies, to appear, for a more detailed discussion of these issues).

While Clark and his co-workers may well be right about interactants trying to minimise effort, making these kinds of comparisons do not strengthen their case. These issues also raise questions about how effort can be measured, and what types of effort are being accounted for.

#### 3.2 Measuring Effort

Many of the studies investigating the collaborative theory use the amount of talk speakers use as an indication of the effort invested. Clark & Wilkes-Gibbs (1986) use the length of the



conversations and the length of the referring expressions; Wilkes-Gibbs (1986) uses conversation length and the number of words per turn (for measuring collaborative effort); Bortfield & Brennan (1997) also use the number of words used; Horton & Gerrig (2002) use the number of 'idea units' in a referring expression; Gergle et al. (2004) count words to measure 'efficiency'; Clark & Krych (2004) use number of words and time taken for the task. All of these measures orient to a very quantitative notion of 'effort' rather than considering that an equivalent length of utterance may not equate to an equivalent amount of effort.

However, Clark & Brennan (1991) show a clear awareness of there being a wide range of possible costs to the speaker and addressee, ranging from production and formulation costs (speaker), reception costs (addressee) to costs associated with delaying an utterance, changing speaker or having to deal with misunderstandings and errors. And indeed, later definitions of the Principle of Least Collaborative Effort show some orientation to cost-benefit analysis. This could be in relation to medium or in relation to the constraints on the interactants themselves. In relation to the visual channel, Clark & Krych (2004: 64) argue: "...people are opportunistic: they try to select from the available methods the ones they think take the least effort for the two of them jointly – the least cost in time, resources, errors, etc."

This issue is raised by Walker (1995, 1996), who deconstructs some of the aspects of effort needed – particularly in relation to what Clark & Brennan term production, formulation and reception costs – in her computer simulation DesignWorld. As she says (1995: 107):

"The number of utterances to complete a dialogue cannot be used as a measure of collaborative effort because this number bears no relation to the quality of the problem solution and only takes into account some of the processes involved."

According to Walker (1995: 106), collaborative effort involves at least:

- Retrieval processes to access previously stored beliefs in memory
- Communicative processes related to generating and interpreting utterances
- Inferential processes on own and other beliefs

Her measure of efficiency looks at the relative effort invested in a dialogue (the above categories, with weighting according to their computational difficulty) compared to the task performance.<sup>3</sup> Davies (1998, 2006) takes a similar approach (though less formal) to a set of task-oriented dialogues taken from the HCRC Map Task Corpus (Anderson et al., 1991). In this study, utterances were coded according to the strategies chosen by interactants. The relative effort involved in each strategy type was weighted according to the amount of planning required (utterance level and task goals), reasoning about beliefs and the complexity of the utterance. This generated an overall effort score for the whole dialogue, which was then compared to the interactants' relative success in the task.<sup>4</sup>

While this differentiation of effort levels is still rather crude and limited (in comparison to Clark & Brennan's, 1991, 11-item list, say), it is certainly an improvement on simply counting words, turns or timing conversations. This issue is especially important given the weight which the notion of effort is given in Clark et al.'s studies. The underlying collaborative theory is not

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<sup>3</sup> Performance = quality of solution – collaborative effort.

<sup>4</sup> In this task, Followers tried to replicate on their own map the route which was drawn on the Giver's map. The route on the map negotiated a number of features (small, labelled pictures – e.g. *ravine*, *blacksmith*, *telephone box*), about half of which were shared, and the remainder were unique to either the Giver or Follower's map.

affected, but questioning the way effort is measured threatens the foundations of least collaborative effort, in particular the experimental evidence on which it is based.

### **3.3 Comparing Effort**

Allied to the issue of measuring effort is the question of how one type of work is seen as more or less effort than another. Whilst the overall measurement of effort in these studies is based on number of words, etc., a number of claims are made about the relative effort involved in changing perspective, changing referring behaviour, changing modalities and changing the forms of language used (which is related to change in modality).

The most important and pervasive of these is the effect of adding the visual channel: introducing the resources of gaze and/or access to the workspace (e.g. Gergle et al., 2004; Clark & Krych, 2004). Where the workspace was available to the Director/Helper as well as to the Builder/Worker, the tasks were completed more quickly and with less words and turns than when the interactants had access to talk alone. In both cases, the trading of linguistic work for the work of processing visual information and using gestures and timing visual feedback was construed as being necessarily less effort overall for both parties.

While this may be true, it is questionable whether researchers currently have the means to assess the effect of this shift so accurately – certainly no research was cited by the authors in support of such a claim. Clark & Krych (2004: 67) do show some awareness of a potential issue, by saying: “At least some gestural acts, we assume, are more efficient for grounding than the vocal acts that would be needed without them.” But this is only oriented to one aspect of the additional work which has been suggested above, and they give no evidence for their assumption.

Even in the two articles cited, the alternative work with which the words and turns are replaced are shown to be complex in their own right, and also to be tightly time-constrained. When interactants make intentional gestures as a replacement for talk, they have to make sure that their partner is looking at them – a missed gesture is entirely lost, whereas a missed piece of talk should at least provoke a prompt from the addressee to demonstrate that the talk was not heard properly or understood (Clark & Krych, 2004: 76). This is in addition to work involved in planning and producing that gesture. Interactants also need to react to gestures in a timely fashion, exactly as in talk: a lack of prompt feedback from the Director was seen as implicating an incorrect action (Clark & Krych, 2004: 73). The precise timing of gestures is as important as the precise timing of talk: such as timing a head nod rather than a verbal acknowledgement (Clark & Krych, 2004: 76). The talk itself is also subject to more timing constraints: Directors often paused in instructions whilst waiting for Builders to do something – for example, select a block – before continuing (Clark & Krych, 2004: 73), or timed an acknowledgement precisely to confirm the accuracy of an action (Clark & Krych, 2004: 74). Talk could also be revised and self-repaired on a moment by moment basis according to the actions going on in the workspace, or the speaker could use talk in combination with gestures: these types of work would not be necessary (or available) without the visual channel. And while gaze did not make a significant difference to any of the results in Clark & Krych (2004), Bavelas, Coates & Johnson (2002) showed the importance of its precise timing in their study of addressee gaze in a task where the speaker was telling a story. It is also interesting to note that when access to the workspace was delayed by 3 seconds (via a computer screen, Gergle et al., 2004), the effect of the visual channel was largely lost: the amount of time taken was about the same as the no-workspace condition, and amount of talk was significantly more than the synchronous workspace condition (although

it was also still significantly less than the no-workspace condition). This reinforces that visual conditions are subject to time constraints which are at least as exacting as talk-only conditions.

Another claim for reduced effort in workspace-visible conditions is the alteration in referring behaviour. Gergle et al. (2004: 610-611) comment on an increase in the use of deictic pronouns rather than more linguistically complex referring expressions. Clark & Krych (2004: 69-70) notice the same pattern, but use this as evidence of other-monitoring rather than a decrease in effort. Indeed, it is not clear whether these types of expressions – although shorter – are necessarily easier to process, particularly in terms of *joint* effort. They may well be easier for the speaker to produce, but Newlands et al. (1993: 342) argue that pronouns and ellipses are harder to process for the addressee than full noun phrases.

The trade-off between the work involved in producing ‘one-off’ referring expressions and the work involved in the processing of refashioning is equally hard to judge. While I have argued against the utility of a minimal disambiguating referring expression as a valid contrast to refashioning, the concept of the contrast between an autonomous process and a collaborative one still stands. Therefore, there is a posited contrast between a speaker producing a referring expression which is a ‘naming’ and largely sufficient to disambiguate the item from the decision set,<sup>5</sup> against a speaker producing a referring expression which is clearly speculative, with hedging and try markers, which then seeks to engage the addressee in a process of agreeing on a revised expression. The question is whether the latter process is necessarily less effort for *both* participants than the former one. In terms of talk, the number of turns and amount of words is probably greater for refashioning than the ‘one-off’ expression; however I have argued above that this is not a particularly useful way to measure effort. In this case, it would hide the much greater formulation and production costs borne by the speaker. There are shifts in effort here, but does it necessarily lead to an overall decrease?

I would argue that the same type of shifts in effort can be found in Schober’s (1995) perspective manipulation task, with the same reservation regarding an overall decrease in effort. Schober argues that the shift in referring expressions from matcher-centred to neutral descriptions in the offset conditions leads to an overall minimisation of effort. This is because matcher-centred expressions would minimise Matcher’s effort at the expense of the Director’s effort, and director-centred ones would minimise the Director’s effort at the expense of the Matcher’s. While I would agree that is probably less effortful for the Director to produce neutral rather than matcher-centred descriptions, it is harder to agree that the saving for the Director is necessarily greater than the extra cognitive load imposed on the Matcher.

It is obvious from the evidence above (and much other detail in all these studies) that interactants do change their behaviour when faced with different situations and modalities. I have queried the validity of least collaborative effort as the driving force behind this, and the question then becomes if least collaborative effort cannot provide a sufficiently robust explanation, then what is the alternative?

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<sup>5</sup> This is a suggested weaker interpretation of the concept of a minimal disambiguating referring expression. It fulfils the same function in terms of modelling the autonomous process of referring, but makes a lower (and more credible) demand on the speaker.

## 4. Whose effort is it anyway?

### 4.1 Who benefits?

In several of the studies I have identified shifts in the way effort is apportioned, and whilst it is extremely difficult to measure overall joint effort, it is possible to look at the effect on individuals.

In the tangram matching experiments like Clark & Wilkes-Gibbs (1986), it is the Director who seems to benefit most in comparison to the posited autonomous model. Rather than having to invest large amounts of effort in formulation and production to create a one-off referring expression, they can lower their criteria for production with the expectation that their addressee will take on some of the work. So the price the Matcher pays for being a ratified participant and having his<sup>6</sup> common ground attended to is the work needed to engage in a joint process with the Director.

For Schober's (1995) perspective manipulation task, the shift is rather more interesting, as rather than there being just a posited behaviour and an actual behaviour, we see a change from one behaviour to another during the task. In the offset condition, the Directors often started off using more matcher-centred descriptions, but over the study they shifted to using more and more neutral descriptions. Even in the no-offset condition, the neutral descriptions were used by the Directors more frequently as the task progressed (although both-centred descriptions remained more popular). Given that neutral descriptions do not require the extra cognitive effort needed to process planning from another perspective, it would seem reasonable to assume that these expressions are less effort-intensive than matcher-centred ones. So, shifting from matcher-centred descriptions to neutral ones is likely to be a noticeable decrease in effort for the Director. On the same basis, however, it would also seem reasonable to assume that neutral descriptions are more effort-intensive for Matchers to process than matcher-centred ones. Neutral description does not seem to be the first perspective that is used by these Directors and Matchers (i.e. it does not seem the most natural/obvious to them), and it is also interesting to note that most of the descriptions uttered by Matchers in response use matcher-centred descriptions – they prefer the effort of changing perspective than remaining with the neutral description perspective offered by the Director (which goes against the predictions of the Output-Input Coordination model, and thus seemingly against the predictions of least collaborative effort, Garrod & Anderson, 1987; Garrod & Doherty-Sneddon, 1994). So again it would seem to be the Matchers who are the ones to see their effort input increase – they have to process neutral descriptions, and manage the conversion of these into matcher-centred ones.

A slightly different pattern is seen when the visual channel is introduced. Although both interactants talk less, the reduction for the Builders is far more than that for the Directors (Clark & Krych, 2004). So, while the Directors still have to provide information verbally, much of the work of Builders (demonstrating understanding and checking) can be achieved by non-verbal means, and it is. The benefit would seem to be to the Builder here, because much of the work of confirming grounding (whether non-verbal or verbal) shifts almost solely to the Director, and much of the extra work of monitoring and producing speech timed to actions is also the responsibility of the Director.

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<sup>6</sup> For ease of reference, Directors (or equivalents) are referred to as female, and Matchers (or equivalents) are referred to as male. This was the pattern adopted in Clark & Wilkes-Gibbs (1986), and I have generalised the principle to all studies described here.

In entrainment, the continued use of a referring expression would also seem to be a way of minimising effort – but in this case it is a decision taken by each speaker in turn. Once a conceptualisation has been agreed, there is no reason to embark on a potentially effortful sequence of refashioning. This is demonstrated by the reluctance of the Directors in Brennan & Clark’s (1996) study to relinquish their agreed expression for a picture set with three types of shoe (or car, etc.) when the picture set is exchanged for one which has only one of these items. This is also a clear demonstration that more talk does not necessarily seem to be more effort: if minimising amount of talk were a priority, then Directors should quickly shift from the longer referring expression needed for the more complex picture set to a shorter one. The expectation of a consistent use of a conceptualisation is also confirmed by the confusion of the Matchers in Metzger & Brennan (2003), when their Directors shift referring expression without warning after several repetitions of the task. The Matchers seek some reason for this change: they spend more time looking at the objects in front of them, rather than immediately locating the desired object as they had done previously with the entrained expression.

Garrod & Clark (1993: 105,123) make the point that while maintaining the conceptualisation in this way<sup>7</sup> is likely to be effort-minimising, it is difficult to differentiate between effort minimisation on an individual or joint basis. In this case, the behaviour seems to benefit both interactants – which is not the case for our previous examples – and it may well be true that both individual and joint effort is minimised. The question then becomes whether minimising individual effort happens to lead to minimising joint effort in this situation, or whether the minimising of joint effort is the primary motivation. I will return to this issue in the final section.

#### 4.2 Current Purposes

If, as Clark & Wilkes-Gibbs argue (1986: 33), interactants adjust the degree to which they ensure grounding “to a criterion sufficient for their current purposes”, then it is to be expected that they will invest less time and less effort when they believe their need for understanding to be lower.

Wilkes-Gibbs (1986) did indeed find this with her city map task. However, what she also found was a strong negative effect on the performance of HC participants when paired with a LC participant. Wilkes-Gibbs explains this result by arguing that one feature of a HC participant is the ability to accommodate to the needs of others – so they adjust downwards to the needs of the LC participant, and produce a similar amount of talk to the matched LC pairs. However, this does seem a rather rose-tinted view of events: the supposed flexibility of these HC participants leads to a task performance (drawing the route on the map) statistically worse than any other participant category.

While many of these studies tend to concentrate on the positive aspects of the joint production of language – that speakers work together and create a level of shared meaning only understood by them – it also has a potentially negative aspect. Producing meanings jointly means that you are reliant on the *current purposes* that your partner brings to the dialogue: if they can see no reason for a greater criterion for understanding, then why should they increase their effort beyond what they see to be necessary? In this case, the criterion level of the participants was manipulated by Wilkes-Gibbs, but there is no reason to believe that in talk in general, speakers

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<sup>7</sup> Their discussion refers to their Output-Input Coordination model, rather than the Clarkian definition of entrainment. In my view, these two models are sufficiently similar for Garrod & Clark’s comments to generalise to entrainment (although see Brennan & Clark, 1996, for their view on the differences).

will always have the same commitment to joint understanding. In Davies (1998, 2006), a similar deleterious effect was found on the task success ratings of mixed pairs in comparison to matched pairs in HCRC Map Task dialogues (Anderson et al., 1991). Pairs were rated on the relative number of high effort strategies each participant used. If both participants used a similar number of these strategies (whether high or low) then they were considered a matched pair; if there was a difference in the number of strategies used by each participant then they were considered to be a mixed pair. This judgement was made post-hoc rather than being built into the research design, so it not only reinforces the results found by Wilkes-Gibbs, but also clearly demonstrates that participants bring different current purposes to a task (and that this difference can have an overall effect on task success).

This is not to say that interactants are entirely inflexible about criterion or the effort they are willing to invest – just that they need to see a reason for adjusting their behaviour (particularly if more effort seems to be required). Wilkes-Gibbs' LC participants see no reason to increase their effort – their goal can be achieved at the level they have chosen, and there is nothing about their partner which suggests more input will be required. However, Bortfield & Brennan (1997) show that native speakers can increase their input when paired with a non-native speaker than a native speaker, and Perkins & Milroy (1997) suggest the same finding when a normal speaker is matched with an aphasic speaker (although they do not report any quantitative measures). So interactants *can* alter their behaviour according to their judgement of their partner, as well as their judgement of the task. However, the shifts noted here are due to perceived speaker deficits, and it could be argued that the interactants need to shift their behaviour in order to *maintain* their current purposes. What seems to be demonstrated in both Wilkes-Gibbs (1986) and Davies (1998, 2006) is a reluctance by one speaker to *adapt* their current purposes to that of another's – particularly if greater effort will then be required from them.

A similar type of result – albeit at a more micro-level – was found by Horton & Gerrig (2002). Their picture matching task used 18 items equally divided between tangrams and pictures from nature guides; each of two Matchers had 12 items, so six of each Matcher's items were shared with the other Matcher, and six were unique to them. In the first three trials, all 18 pictures were used, so each Matcher would only have had the opportunity to entrain on 12 out of the 18 items. In trials 4 to 6, one Matcher worked with the Director on the whole set of items; the other Matcher then worked with the same Director (with the same full set of pictures) in trials 7 to 9. This has a certain amount in common with Brennan & Clark (1996), but the involvement of two Matchers allowed not only a study of the collaborative process of entrainment, but also a chance to see whether the Director behaved differently at the two points at which there was a change in Matcher/picture set.

In the first transition (trial 4) the number of shared idea units continued to decrease from trial 3 (for items that become unshared in trial 4); this is in contrast to the result which might have been predicted from Brennan & Clark (1996)<sup>8</sup>. It should also be noted that even though the expressions did continue to get shorter, there was still a statistical difference between the length of expressions used for pictures shared with the new Matchers, and those not shared. Therefore, this continued reduction cannot be attributed to a lack of sensitivity to the transition and the effect of shared and unshared items. This pattern is in contrast with that found at the second

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<sup>8</sup> Although it should be noted that the length of referring expressions was measured in a slightly different way in these two studies, so a certain amount of caution is needed in their comparison. Horton & Gerrig (2002: 595) counted 'idea units' rather than the number of words in a referring expression. This measure counts content words/phrases only – nouns, adjectives and prepositional phrases.

transition point (trial 7). Here, the unshared items see an increase in length of referring expression and in the amount of hedging used; this was particularly true for unshared tangrams. It should also be noted, however, that there was still a significant difference in expression length for shared and unshared items, so this increase was not indiscriminate, but rather targeted carefully by the Director.

Horton & Gerrig discuss the differences in behaviour at the two transition points in terms of the Director learning about what information her audience needs. This appeal to the notion of learning seems reasonable, particularly as Horton & Gerrig note that the number of requests for more information from the Matcher increased significantly in trial 4. This would have provided feedback to the Director about the appropriateness of the strategy chosen. In terms of effort, it also suggests that when faced by a different context, interactants do not increase effort indiscriminately. Instead, they look for some indication that more effort is needed. If this is evident, and meets with their criterion (current purposes) for the task, then more investment in target areas may be made (and perhaps reductions made elsewhere), which is what seems to occur here. As discussed previously, Wilkes-Gibbs' LC participants presumably don't *recognise* the need for more effort, and thus none is forthcoming.

The importance of learning is also seen in Davies (1998, 2006), where participants in the HCRC Map Task corpus shifted their effort in later trials (participants did the task four times with different maps and different partners) to focus more on the aspects of the maps which they didn't share rather than those that they did. While their overall effort did not change (measured as an overall score for a dialogue based on the effort needed for the strategies they used), the way in which they used it did: this led to an improvement in task success. Without the ability to learn, a change in performance could only be explained by shift in current purposes – as the degree of understanding and thus task success appear to be tied to this – which I do not believe to be a satisfactory explanation. Rather, participants are relatively inflexible in the amount of effort invested, but they can learn to use it more effectively.

More evidence for speakers being effort-averse is also provided by Horton & Gerrig (2002). Whilst the participants did entrain together on particular referring expressions, the choice of the conceptualisation was largely governed by the Director. Where Matchers did offer alternative conceptualisations or extra information, this information was only used 36% of the time, so “Directors adjusted to Matchers by modifying the perspectives they themselves had used rather than incorporating conceptualizations proposed by the Matcher.” (Horton & Gerrig, 2002: 600). If we accept the argument that retaining a perspective is less effort than changing it (e.g. Garrod & Anderson, 1987; Garrod & Clark, 1993; Garrod & Doherty-Sneddon, 1994), then it would seem here that Directors are minimising their effort, potentially at the expense of the Matcher. It also suggests that in this collaborative process, the Director has more say and more control: they largely impose their perspective upon the Matcher. After all, they are the ones with the privileged information. This ability to control the conversation is demonstrated by the success of the methodology used by Metzging & Brennan (2003): without the Director's ability to impose the conceptualisation used, this study would not have been able to investigate the effect of changing the perspective used part way through. It is worth noting that Metzging & Brennan do not report having to discard any data due to this approach not working. The increased likelihood of retaining the Director's conceptualisation may also partly explain the entrainment on idiosyncratic expressions in Bortfield & Brennan (1997), particularly in the cases where non-native speakers were Directors in the first trial.

If participants are making individual – and differentiated – decisions on their criterion level for a particular task/dialogue, then they are also making individual decisions about the effort they are prepared to invest. This suggests that whilst there are collaborative aspects to dialogue, there are also individual ones of equal importance.

## 5. Discussion

In this paper I have argued that there are a number of problems with the concept of least collaborative effort, in terms of the way in which it has been contrasted with a classical principle of least effort, how linguistic effort is measured and compared with other linguistic or cognitive effort, and the assumption that the claim for the jointness of meaning creation must encompass joint motivations in other aspects of cognitive behaviour.

Setting the process of refashioning against some outdated notion of an autonomously produced minimal disambiguating referring expression to argue for least collaborative effort is not useful because this notion would be ridiculously effort-intensive. It is also not very clear whom this notion is supposed to be ‘least effort’ for: certainly not for the speaker. The problem of contrasting utterance-level behaviour with Grice’s Cooperative Principle as an exemplar for least effort is rather more complex. Firstly, translating Grice’s theoretical construct into a practical definition is fraught with difficulty in itself (Davies 1998, 2006). Secondly, the analysis chosen is not one which sits easily with the rest of Grice’s program: he saw rationality as the underpinning of human behaviour, not efficiency (Chapman, 2005; Davies, to appear). If these two arguments are to be seen as the theoretical justification for the claim of least collaborative effort, then the construct is already in difficulty.

Added to this is the issue of how effort is measured. The basic method employed – typically counting words, turns, or time taken – is too simplistic. The length of an utterance in itself does not dictate how effortful it was to produce. Looking at only the physical realisation of language discounts all the other aspects of language production and comprehension, such as the modelling of beliefs, utterance planning and interpretation, and the retrieval of information (Walker, 1995, 1996; Davies, 1998, 2006). It isn’t just measuring effort that is problematic, comparing the effort required by different linguistic behaviours involves the same type of issues. Is it necessarily true that refashioning is less collaborative effort than an autonomous naming process? Or that retaining an entrained term when a shorter term would suffice is less collaborative effort than agreeing a new conceptualisation? It is certainly the case that interactants seem to *prefer* these behaviours, but that in itself is not sufficient to provide evidence for the concept – to argue in such a manner would be rather circular.

This problem becomes increasingly complex as researchers try to compare the relative effort involved in the substitution of one cognitive behaviour for another. In studies where interactants could see each other and/or one another’s workspaces, they did talk less. But other cognitive behaviours then became relevant, such as using gestures as communication like headnodding, or holding up an object for approval, or timing one’s linguistic output to coordinate with the addressee’s actions. All of these behaviours are tightly time-constrained, and involve effort in both planning and execution. It is questionable whether these are necessarily less effort than the linguistic alternatives, even if they are quicker.

The issue of comparing the input of participants when they are perceived to have varied cognitive abilities is subtly different again. Both Bortfield & Brennan (1997) and Perkins & Milroy (1997) make the claim that a greater input by the native speaker or non-aphasic speaker respectively represents least collaborative effort because producing language should be less



effort for them than the non-native or aphasic speaker. While this is intuitively attractive, it is difficult to test empirically: how can the greater cognitive load of one be translated into equivalent effort for the other? The shift in behaviour by the speakers shows an awareness of audience design (also shown when Matchers are switched in other tasks), but does not necessarily provide evidence for least collaborative effort.

While making overall comparisons of effort between different situations is difficult to achieve, more can be said about the shifts in behaviour and effort of individuals. Directors in Clark & Wilkes-Gibbs (1986) benefit from the refashioning process by avoiding the costs in planning a minimal referring expression, but Matchers then have to engage in the effortful process of refashioning. The major benefit in Schober's (1995) perspective task also goes to the Directors: they avoid the planning work of designing utterances from another's perspective, whereas the Matchers have to interpret from an utterance not designed specifically to their perspective. In contrast, it is the Builders/Workers who seem to benefit most in the visual/workspace condition (Clark & Krych, 2004; Gergle et al., 2004); their linguistic input decreases far more than their partners, but they do not gain as many additional tasks (because these are mostly associated with instruction-giving and checking, the realm of their partners). Entrainment may be the only case where both participants benefit – if, of course, it is agreed that retaining the same conceptualisation is less effort even when the referring expressions may be longer than necessary (e.g. Clark & Brennan, 1996). In this case the question becomes whether the motivation to limit effort in this way is collaborative, or the outcome of two individuals taking a decision which happens to benefit them both equally.

The evidence for individual motivation is at least as strong as that for a collaborative motivation. The examples above show that the shifts in effort often seem to benefit one participant at the expense of the other – which would not seem to be a particularly collaborative approach. Such self-interested action can also be seen elsewhere in the studies. Horton & Gerrig's (2002) Directors tend to impose their conceptualisations during the entraining process, which may be less effort than fully engaging with the possibility of another perspective. Wilkes-Gibbs' (1986) LC participants retain their low criterion approach at the expense of their HC partners, presumably because they see no reason to change their behaviour (unlike those in Bortfield & Brennan, 1997); Davies (1998, 2006) showed the same negative effect of LC participants on HC partners. Horton & Gerrig's Directors also show themselves to be effort-averse, by first not increasing the effort invested in the first transition to one Matcher, and then by carefully shifting effort to maximise benefit to their new Matcher in the second transition. A similar pattern was found in Davies (1998, 2006), where improved audience-design led to the same amount of effort being distributed more effectively.

The key aspect here is recognising the individual's role in the construction of a joint action. Whilst what the individual is doing is (in Clark's terms) participatory rather than autonomous, it has to be remembered that it is the act itself which is participatory rather than the person who produced it. To say that we can engage in collaborative activity whilst making decisions which may be more to our benefit than to others is not to deny that we are acting jointly. The theory of joint action does not have to entail selflessness. Therefore the Principle of Least Collaborative Effort is not necessary to Clark's Collaborative Theory as a whole, and it is not the overall theory that we are questioning.

What we have tried to challenge is the unproblematised acceptance of the Principle of Least Collaborative Effort. It is currently impossible to prove whether the behaviour of the participants in these experimental situations necessarily constitutes the least overall effort

required for that task – it is not verifiable, and therefore to claim otherwise is immediately problematic. In addition, I have demonstrated that certain decisions taken by individuals change the relative balance of work (usually in their favour), suggest a reluctance to increase effort invested, and can have deleterious effects on other participants' performance. All of this undermines the Clarkian position, and indicates an orientation to individual needs as much as to joint ones, and thus to a desire to decrease individual effort as much as to decrease joint effort. Therefore it can be suggested that while conversation is a collaborative activity, decisions about effort are made on an individual basis.

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