Saying and shaking 'No'

Andy Lücking
Université de Paris, Goethe University Frankfurt

Jonathan Ginzburg
Université de Paris

Abstract

In many instances, the head shake can be used instead of or in addition to verbal 'No'. Based on previous work on negation in dialogue, we observe head shaking as answer particles and as responding to an implicit or an exophoric (i.e., real world situation) antecedent. Exophoric head shake, however, seems to come in two flavours: with positive and with negative emotional valuation of the antecedent situation. We provide semantic analyses for all three uses (and a head nod) within an HPSG version which is implemented in Type Theory with Records and the dialogue framewok KoS. In particular, we extend on previous work by grounding "exophoric negation" in positive or negative appraisal. Finally, we briefly speculate about differences between verbal 'No' and head shaking due to (the lack of) simultaneity.

1 Introduction

The particle 'No' is the prime means for expressing negation in discourse. Probably its most prominent used is answering a polar question:

(1) a. A: (1) Do you want some coffee? / (2) You don't want some coffee?

  b. B: No

Also a head shake can be used in this context, either in addition to or instead of 'No' (Kendon, 2002) (we use the symbol '⊙' to represent a head shake):

(2) a. A: (1) Do you want some coffee? / (2) You don't want some coffee?

  b. B: ⊙

The interchangeability of 'No' and head shake seems to be licensed in other contexts as well. Further uses of "No" discussed by Tian & Ginzburg (2016) are called '"No" with exophoric antecedent' and '"No" with implicit antecedent'. Both uses are exemplified in (3) and (4), respectively. The adult speakers in (3) indicate negative appraisal/classification (Scherer & Ellgring, 2007; Barrett, 2017) of the observed events (example (3a) arguably involves the projection of a possible outcome in the given context). Hence, the negation particle involves an exophorically provided antecedent (namely the observed event).

(3) a. (*A child is about to touch a socket*) Adult: No!

  b. (*A discovers that the beer cooler is empty*) A: No!

B in the discourse in (4) makes A think that B split with his or her girlfriend (4b). A develops a corresponding belief (4c). This belief $p =$ *that the girlfriend and B split* is the argument (implicit antecedent) of B's negation (4d).

(4) a. A: How's your girlfriend?

  b. B: She is no longer my girlfriend.

  c. A: Ah, I'm sorry.

  d. B: No, she is my wife now.

Both occurrences of *No* in (3) and (4) can be replaced by the head shake without a change in meaning:

(3′) a. (*A child is about to touch a socket*) Adult: 🔄

  b. (*A discovers that the beer cooler is empty*) A: 🔄

(4′) d. 🔄 She is my wife now.

That is not to say that head shaking and saying 'No' are fully equivalent; there is a difference in the medium of communication. Head shaking, when addressing an interlocutor, requires joint visual attention. For instance, for the adult preventing the child from reaching the socket the child have to be aware of the adult's head shake (and interpret it as referring to its action). Spoken communication proceeds on the acoustic channel, which requires auditive perception. Given this proviso, the above examples provide evidence that the head shake and the particle 'No' are both form variants of the same lexical resources (this in cultures where the head shake is associated with negation and not with affirmation, as it is in Bulgaria and, with some modifications, Greece, Turkey, and Southern Italy; Jakobson, 1972). It seems that the conjecture of Kendon (2002), namely that the uses of the head shake all share a negative kernel, can be corroborated.

A head shake can be used by a speaker to emphasize negative utterances. An example is given by Bill Clinton in (5).[1] Note that three chunks of head shake gestures are produced, one for each of the negated verbal sub-utterances (*never … not … never*). Repetition seems to be used as a temporal means of aligning head movements and the scope of negation.[2]

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[1]The speech can be retrieved from the University of Virginia's Miller Center of Public Affairs, where the relevant section starts around 6 min 33 sec: https://millercenter.org/the-presidency/presidential-speeches/january-26-1998-response-lewinsky-allegations.

[2]Aligning gestures with the scope of verbal negation is known from manual gestures. Harrison (2010) observes that the stroke of the 'palm down horizontal across body' gesture (i.e., the hand is moved across the body, opened and the palm turned down; then the hand is moved along the horizontal axis)—a gesture that frequently co-occurs in negative contexts—is usually produced on the negation particle and the post-stroke hold is aligned with its scope.

(5)   *I never told anybody to lie (.) not a single time (..) never*

   [repeated ⊙↶↷]   (.) [repeated ⊙↶↷] (..) ⊙↶↷

The negative particles in (5), *never* (two times) and *not*, establish a negative context in which head shaking can be used in an affirmative way (that is, affirming the negative claims). In the following, we focus on the head shake as an answer particle and as expressing affirmation in negative contexts, as exemplified above. We first summarize the linguistic means we think are needed to analyze head shake (and verbal 'No') in Sec. 2. Sec. 3 then introduces a formal framework that lives up to the requirements. The formal tools are applied to the above-given examples in Sec. 4. The analyses extend on previous work, most notably on Tian & Ginzburg (2016). Discussing head shake in negative contexts reveals uses of the head shake which are dissociated from its accompanying speech. We show how to account for them. Finally, we provide examples for the head shake in *positive contexts*. We unify both, negative and positive head shakes, into an appraisal-based analysis, which we call *noetic* head shakes. We conclude in Sec. 5.

2   Requirements

In order to account for the uses of head shake and 'No' observed in Sec. 1 in terms of linguistic theory, one needs at least

  a. a dialogical framework that defines speakers and illocutionary interactions,

  b. distinguishes negative and positive propositions,

  c. offers a means for representing appraisals (noetics),

  d. and provides access to the exophoric context.

Posing a polar question is a speech act, or, as we prefer to say, an illocutionary move in dialogue. Hence, a dialogue framework is the natural formal-linguistic method for analysing head shaking (a.). The semantic ontology of the linguistic framework has to distinguish between positive and negative propositions used as propositional kernels of polar and other questions (b.). Not only is the content of head shake and verbal 'No' sensitive to the polarity of the question—see examples (1) and (2)—, it is also needed for explaining the variance of the answer particles *oui* (affirming a positive question) and *si* (denying a negative question) in French, or *ja* (affirming a positive question) and *doch* (denying a negative question) in German.

   As attested in exophoric (3), 'negating a situation' seems to involve or rest on an emotional evaluation of that situation. Although one could model sentiment in terms of speaker presuppositions, interfacing to a more systematic treatment of appraisal would be preferable (c., d.).

Finally, a representational means for transcribing the head shake in terms of a sign-like structure is needed in order to make head movements accessible for grammar modelling in HPSG (see Lücking, 2020 for an overview), respectively HPSG$_{TTR}$, a HPSG variant expressed in term of a Type Theory with Records (Cooper, 2008; Ginzburg, 2012), which we use for the sake of formal uniformity, as will become clear shortly.

The theoretical framework we use is KoS (Ginzburg, 2012). KoS already provides the structure and items needed for requirements a.–d. A basic introduction is given in the following section.

3 Background

KoS is a variant of a dynamic update semantics. On a dynamic semantic view, the meaning of an utterance is its update potential, its change of the present context. The simplest model of context, going back to Montague (1974) is one which specifies the existence of a speaker, addressing an addressee at a particular time. This can be captured in terms of the type in (6).

$$
(6) \quad \begin{bmatrix} \text{spkr} & : & \textit{Ind} \\ \text{addr} & : & \textit{Ind} \\ \text{u-time} & : & \textit{Time} \\ \text{c}_{\text{utt}} & : & \text{addr(spkr,addr,u-time)} \end{bmatrix}
$$

The object in (6) is *record type* from Type Theory with Records (TTR, Cooper, 2012; Cooper & Ginzburg, 2015; Cooper, 2021), a structured set of fields consisting of labels (left to the colon) and (simple or complex) types (right to the colon). Record types classify situations. The type in (6), for instance, classifies situations (*records*) with two individuals and one is talking to the other.[3] If there is such a record, the record type is non-empty. Such a record, a *witness* for (6), is shown in (7):

$$
(7) \quad \begin{bmatrix} \text{spkr} & = & a \\ \text{addr} & = & b \\ \text{u-time} & = & t_4 \\ \text{c}_{\text{utt}} & = & e_0 \end{bmatrix}
$$

The record type classifies the record if and only if the following *judgements* (indicated by a colon) hold: a, b : *Ind*, t_4 : *Time*, and e_0 : addr(a,b,t_4)—see the above-given references for more complete expositions; an exposition from the perspective of HPSG is given in Lücking et al. (2019).

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[3] We are simplifying a bit since *addressing* need not be achieved just by speaking, but also by non-vocal signalling.

However, over the last decades it has become clearer how much more pervasive reference to context in interaction is. The visual situation is a key component in interaction from birth (see Tomasello, 1999, Chap. 3). Expectations due to illocutionary acts—one act (querying, assertion, greeting) giving rise to anticipation of an appropriate response (answer, acceptance, counter–greeting), also known as adjacency pairs (Schegloff, 2007). Extended interaction gives rise to shared assumptions or *presuppositions* (Stalnaker, 1978), whereas epistemic differences that remain to be resolved across participants—*questions under discussion* are a key notion in explaining coherence and various anaphoric processes (Ginzburg, 2012; Roberts, 1996). These considerations among several additional significant ones lead to positing a significantly richer structure to represent each participant's view of publicized context, the *dialogue gameboard* (DGB), whose basic make up is given in (8), following the recent version including *mood* described by Ginzburg et al. (2020):

$$
(8) \quad DGBType := \begin{bmatrix}
\text{spkr} & : & Ind \\
\text{addr} & : & Ind \\
\text{utt-time} & : & Time \\
\text{c-utt} & : & addressing(spkr, addr, utt\text{-}time) \\
\text{facts} & : & Set(Prop) \\
\text{vis-sit} & = & \begin{bmatrix} \text{foa} & : & Ind \vee Sit \end{bmatrix} : RecType \\
\text{pending} & : & List(LocProp) \\
\text{moves} & : & List(IllocProp) \\
\text{qud} & : & poset(Question) \\
\text{mood} & : & Appraisal
\end{bmatrix}
$$

Here *facts* represents the shared assumptions of the interlocutors—identified with a set of propositions. *Vis-sit* represents the visual situation of an agent, including his or her focus of attention (*foa*), which can be an object (*Ind*), or a situation or event (*Sit*). The remaining fields concern locutionary and illocutionary interaction: Dialogue moves that are in the process of being grounded or under clarification are the elements of the *pending* list; already grounded moves are moved to the *moves* list. Within *moves* the first element has a special status given its use to capture adjacency pair coherence and it is referred to as *LatestMove*. The current question under discussion is tracked in the *qud* field, whose data type is a partially ordered set (*poset*). *Mood* tracks public displays of emotion, crucial for *inter alia* laughter and smiling (Ginzburg et al., 2020). Mood will be needed in order to model noetic negation. The value of mood is a structure of type *Appraisal*, which is built after the *Component Process Modell* of Russell (2003):

(9)

$$
Appraisal := \begin{bmatrix} \text{pleasant} & : & \begin{bmatrix} \text{pred} = \text{pleasant} : EmotivePred \\ \text{affect} : \begin{bmatrix} \text{pve} & : & \mathbb{N} \\ \text{nve} & : & \mathbb{N} \end{bmatrix} \end{bmatrix} \\ \text{responsible} & : & RecType \\ \text{power} & : & \begin{bmatrix} \text{pred} = \text{powerful} : EmotivePred \\ \text{control} : \mathbb{N} \end{bmatrix} \end{bmatrix}
$$

Basically, (9) captures the degree of pleasantness of an agent towards an emotion-triggering responsible (a record of some record type), which can be either positive (*pve*, pleasant) or negative (*nve*, unpleasant). The scalar predicate *powerful* specifies the degree of control an agent possesses in relation to the trigger. Appraisal is updated according to *PleasantnessInc*, where the polarity of the update (i.e., whether it contributes to pleasantness or unpleasantness) depends on the value of δ, weighted by ε (see Ginzburg et al., 2020, p. 31):

(10) *PleasantnessInc*$(\delta, \varepsilon) :=$

$$
\begin{bmatrix} \text{pre:} \begin{bmatrix} \text{LatestMove.cont} : IllocProp \end{bmatrix} \\ \text{effect} : \begin{cases} \delta < 0 & : & \begin{bmatrix} \text{Mood.pleasant.affect.pve} = \\ \quad \text{pre.Mood.pleasant.affect.pve} - (1 - \varepsilon) \times \delta : \mathbb{N} \\ \text{Mood.pleasant.affect.nve} = \\ \quad \text{pre.Mood.pleasant.affect.nve} + \varepsilon \times \delta : \mathbb{N} \end{bmatrix} \\ \text{else} & : & \begin{bmatrix} \text{Mood.pleasant.affect.pve} = \\ \quad \text{pre.Mood.pleasant.affect.pve} + \varepsilon \times \delta : \mathbb{N} \\ \text{Mood.pleasant.affect.nve} = \\ \quad \text{pre.Mood.pleasant.affect.nve} - (1 - \varepsilon) \times \delta : \mathbb{N} \end{bmatrix} \end{cases} \end{bmatrix}
$$

The pleasantness update in (10) exemplifies the general mechanism from KoS which describes the evolution of context in interaction. Coherent interaction proceeds according to *conversational rules* which allow to update a previous dialogue state (pre) according to the illocutionary move made by a participant into the new dialogue state (effect). Two (comparatively simple) rules which will be used below are given in (11).

(11) a. Ask QUD-incrementation: given a question q and ASK(A,B,q) being the LatestMove, one can update QUD with q as MaxQUD.

$$
\begin{bmatrix} \text{pre} & : & \begin{bmatrix} q & : & \text{Question} \\ \text{LatestMove} = \text{Ask(spkr, addr, q)} & : & IllocProp \end{bmatrix} \\ \text{effects} & : & \begin{bmatrix} \text{QUD} = \langle q, \text{pre.QUD} \rangle & : & \text{poset(Question)} \end{bmatrix} \end{bmatrix}
$$

b. Assert QUD-incrementation: a straightforward analogue for assertion of (11a): given a proposition p and ASSERT(A,B,p) being the Latest-Move, one can update QUD with p? as MaxQUD.

$$\begin{bmatrix} \text{pre} & : \begin{bmatrix} p & : & \text{Prop} \\ \text{LatestMove} = \text{Assert(spkr, addr, p)} & : & \text{IllocProp} \end{bmatrix} \\ \text{effects} & : \begin{bmatrix} \text{QUD} = \langle \text{p?, pre.QUD} \rangle & : & \text{poset(Question)} \end{bmatrix} \end{bmatrix}$$

The dialogue gameboard (8) as well as the conversational rules make use of *locutionary* and *illocutionary propositions* (types *LocProp* respectively *IllocProp*). Both are special kinds of propositions. Due to clarification interaction, among others, in KoS propositions are modelled as Austinian (Austin, 1950; Barwise & Etchemendy, 1987) propositions, that is, pairs of situations and situation types: $\begin{bmatrix} \text{sit} & : & Rec \\ \text{sit-type} & : & RecType \end{bmatrix}$. A locutionary proposition is a speech event (the record) and its classification by a grammatical type: $\begin{bmatrix} \text{sign} & : & Rec \\ \text{sign-type} & : & RecType \end{bmatrix}$. An illocutionary proposition is the content of a locutionary proposition used within a dialogue move (the illocution defines the kind of move).

Now what about negative and positive propositions? This distinction is hard to make, for instance, within a possible world semantics which regards propositions to be sets of possible worlds. On such an account, a negative proposition would be the complement set of the set of worlds belonging to the negated proposition. Thus, there are two sets of possible worlds but there is no way of determining which is a 'negative' one. Following Cooper & Ginzburg (2015, Sec. 7.1), the type-theoretic account provides a straightforward way of introducing negative (and positive) propositions:

(12) a. If T is a type, then $\neg T$ is a type.

b. *RecType*$^\neg$ is the type of negative record types.

c. T : *RecType*$^\neg$ iff $T = \neg T'$ and T' is a type.

Negative types are licensed by negation particles in speech. Both negative and positive types (of propositions) are needed for analysing head shake uses (see Sec. 4 below). The negation mechanism of negative types does not rest on truth value flipping but on *preclusion*: a situation is of negative type, $s : \neg T$, iff the situation is of a positive type T' which precludes T. This is the case if the union of the extensions of T and T' is empty (i.e., there is no s such that $s : T$ *and* $s : T'$), or if T is a negative type itself such that $T = \neg T'$ (recursion condition). Note that the latter ensures that T is equivalent to $\neg\neg T$, although the polarity between two types remains distinct: T is a positive type (assuming that T is not formed according to (12a))

and $\neg\neg T$ a negative one. Encoding negativity in semantics, not in truth-value flipping, is in line, we argue, with the additional processing load imposed by negation (see, e.g., Kaup, 2006). A negative Austinian proposition (*NegProp*) is defined as a paring of a situation and a negative situation type (cf. Cooper & Ginzburg, 2015, Sec. 7.1): $\begin{bmatrix} \text{sit} & : & Rec \\ \text{sit-type} & : & RecType^{\neg} \end{bmatrix}$. Positive propositions (*PosProp*) are defined in the obvious, similar way.

4 Analysing head shake uses

For representing head shakes we adopt the simple but useful representation format presented by Crasborn (2014), where head movements are transcribed along three dimensions, *Type*, *Start direction*, *Repetition*:[4]

(13)

Type	Start direction	Repetition
N(od), S(hake)	L(eft), R(ight)	$1, 2, 3, \ldots \in \mathbb{N}$

For instance, shaking the head seven times in a row where head movement initiates to the head shakers' right side is glossed 'SR7' (which is what Clinton does in his first head shake repetition in (5)).

In Sec. 4.1 we look at head shakes used as answering polar questions. In Sec. 4.2 we show how head shake simultaneous with speech lead to a contradiction, or to an exophoric but dissociated interpretation. Exophoric uses are further discussed in Sec. 4.3, where positive and negative valenced head shakes are distinguished.

4.1 Answering polar questions

Lexical entries and phrasal rules are construed as types for interaction, they refer directly to the DGB via the field *dgb-param*. In particular, all signs have dgb-params that include the addressing condition (6). For instance, the lexical entry for the head shake that answers a polar question as in (2) virtually is the same as the lexical entry of 'No' used in that way, too, and following Tian & Ginzburg (2016), is given in (14).

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[4]We adopt only the kinematic representation, not the functional one since the latter is absorbed by our semantic representations. A complete head movement is one instance of a back-and-forth rotation around an axis (vertical in case of nodding, horizontal in case of head shaking).

(14)
$$
\begin{bmatrix}
\text{shape} = \text{S}xy : \textit{HeadMovement} \\
\text{dgb-params} :
\begin{bmatrix}
\text{spkr} : \textit{Ind} \\
\text{addr:} \textit{Ind} \\
\text{u-time:} \textit{Time} \\
\text{c1} : \text{addr(spkr, addr, u-time)} \\
p : \textit{Prop} \\
\text{MaxQUD} = p? : \text{PolarQuestion}
\end{bmatrix} \\
\text{content} = \text{Assert(spkr,addr, u-time,NoSem}(p)) : \textit{IllocProp}
\end{bmatrix}
$$

Here 'S', following (13), represents the decisive feature of a shaking movement performed by the head, x and y underspecify its start direction and repetition, respectively. We are not aware of any evidence that the start direction of a head shake has any semantic effect. Repetition leads to obvious emphasis. However, following work on manual co-speech gesture (Harrison, 2010), repetitions can temporally align head shakes with verbal negation scope, as observed in (5).

The semantics of 'NoSem(p)' is sensitive to the polarity of the proposition it applies to. To this end, positive (*PosProp*) and negative (*NegProp*) propositions have to be distinguished (cf. Sec. 3). If a negative particle (*not, no, n't, never, nothing*) is part of the constituents of a proposition $\neg p$, then $\neg p$ is of type *NegProp* ($\neg p : NegProp$). The corresponding positive proposition—the one with the negative particle removed, so to speak—is p ($p : PosProp$). With this distinction at hand, *NoSem* works as follows:

(15) $\text{NoSem}(p) = \begin{cases} \neg p & \text{if } p : PosProp \\ p & \text{if } p : NegProp \end{cases}$

(Note that the result of 'NoSem(p)' is always of type *NegProp*; $p : NegProp$ means that $p = \neg q$, which *NoSem* leaves unchanged, as expressed in the second condition of (15).)

The head nod can be analysed along analogous lines. The form is given by a possibly repeated nod, the polar sensitivity is captured in terms of 'YesSem'; the corresponding lexical entry is given in (16):

(16)
$$
\begin{bmatrix}
\text{shape} = \text{N}xy : \textit{HeadMovement} \\
\text{dgb-params} :
\begin{bmatrix}
\text{spkr} : \textit{Ind} \\
\text{addr:} \textit{Ind} \\
\text{u-time:} \textit{Time} \\
\text{c1} : \text{addr(spkr, addr, u-time)} \\
p : \textit{Prop} \\
\text{MaxQUD} = p? : \text{PolarQuestion}
\end{bmatrix} \\
\text{content} = \text{Assert(spkr, addr, u-time, YesSem}(p)) : \textit{IllocProp}
\end{bmatrix}
$$

The semantics of *YesSem* is *not* just the mirror image of *NoSem* but rather an identity function and given in (17):

(17) $\text{YesSem}(p) = \begin{cases} p & \text{if } p : PosProp \\ p & \text{if } p : NegProp \text{ (preferred over } \neg p) \end{cases}$

The second condition in (17) amounts to a confirmation of a negative question, albeit as a preferred interpretation, as illustrated a (18) and (19).

The opposition between head shaking and nodding implements a binary system. Its 'two-sidedness' apparently gives rise to a truth-based answering system (or a positive–negative system in the original terms of Pope, 1972, p. 115). Adopting the response examples for positive questions from (Krifka, 2013, p. 2) provides support for this assumption, as testified with both verbal and nonverbal response items (the icon '⊙' represents a head nod):

(18)   A: Did you steal the cookie?

    a.   B: Yes. / ⊙ (= B did steal the cookie.)

    b.   B: No. / ⊙ (= B did not steal the cookie.)

However, things get less clear with negative questions. According to Krifka (2013), all four combinations of answer fragments 'Yes' and 'No', and agreement respectively disagreement are possible (i.e., (19a).(i) and (ii) and (19b).(i) and (ii)), according to our *NoSem* and *YesSem* the situation is more tidy (the answers in (i) are strongly preferred over those in (ii), indicated by '$^?$'). Apparently, there is some variance in speaker judgements, which is also attested in the study of Berry et al. (2017) (on the German language).

(19)   A: Did you not steal the cookie?

    a.   B: Yes. / ⊙ ((i) *Yes, I didn't.*, (ii) $^?$*Yes, I did..*)

    b.   B: No. / ⊙ ((i) *No, I didn't.*, (ii) $^?$*No, I did..*)

This raises the question how head movements are interpreted in a polarity-based answering systems (agreement–disagreement systems in the original terms of Pope, 1972, p. 115) such as German, French, or Swedish. For German, the pattern for responding to a positive question is the same as for English, since the affirmative alternative *doch* is excluded:

(20)   A: Hast Du den Keks gestohlen? ('Did you steal the cookie?')

a. B: Ja. / ⌣⃗ (= B did steal the cookie.)

b. B: Nein. / ⌣⃗ (= B did not steal the cookie.)

c. #B: Doch.

Doch is allowed in a negative context, where it rejects a negative proposition. This is shown in (21), where *Ja* 'Yes' and *Nein* 'No' are interpreted in terms of *YesSem* respectively *NoSem*. The only way to reject the proposition requested by the negative question is to use *doch* (although (21b) seems to be better than (21a)). While the particle can be used alone or accompanied a head nod, neither head movement gives rise to its response function (21c).

(21) A: Du hast nicht den Keks gestohlen? ('Did you not steal the cookie?')

    a. B: Ja. / ⌣ (B did not steal the cookie.)

    b. B: Nein. / ⌣⃗ (B did not steal the cookie.)

    c. B: Doch. / Doch + ⌣ (B stole the cookie.)

        # Doch + ⌣⃗ / # ⌣⃗ / # ⌣

The examples in (21) suggest that the binary form system of head shaking and nodding is restricted to a binary functional system, too, being (at least closely) equivalent to verbal 'Yes' and 'No'. The head nod may inherit the rejective force of *doch* when accompanying it. Interestingly, this does not seem to be possible for head shaking, further supporting the truth-based working of horizontal and vertical head movements.

4.2 (Alleged) Contradictions and dissociated uses

In using head shake or head nod as polar answer elements, the gesturer reacts to a previous question usually posed by an interlocutor. However, head movements can also be used by a speaker simultaneous to speech. An example is given in (22):

(22) I believe you
    ⌣⃗

The head shake in (22) is produced in the context of a positive proposition. According to a variant of *NoSem* which generalises over polar questions, the head shake negates that proposition—hence a contradiction arises. However, the contradictory flavour can be avoided if the head shake is likened to exophoric uses of verbal 'No' (cf. Sec. 1). In that case, it does not operate on some proposition, but expresses an attitude towards some external situation—in (22) that situation happens to be the belief state described by the speaker. The cranial movement can be interpreted in

a way that the speaker shakes her head about the very fact that she indeed believes the addressee (the addressee might, for example, be a person which is known for his untrustworthiness). Note that this reinterpretation restores coherence but requires that speech and accompanying head shake become *dissociated*—in contrast to simultaneous saying 'No' and shaking the head they do not refer to the same state of affairs. Such dissociations are an assumption argued for in some detail with respect to speech laughter by (Mazzocconi et al., 2020), hence they seem to constitute a general but seldomly reported pattern of multimodal communication.

If more context is added, disassociated uses can get more complex. Consider (23):

(23)   *(Context: Claims that B stole 500€)*

     a. B: They say I stole the money. I didn't.

     b. A: I believe you.
         ☺

One can understand A as both verbally expressing his belief in B's protestation of innocence, whereas the head shake affirms the negative proposition B makes ¬Stole(B, 500€) (when related to the second sentence uttered by B), or expresses that A is upset about what 'they' did (when related to B's initial uttered sentence— what we refer to as a *noetic* use).

4.3 Noetic uses

Noetic uses stand out since they appeal to expressing attitudes. The dissociated uses in previous section already provided examples since they involve the evaluation of a situation. Here we want to take a closer look on evaluative head shakes and argue that they can be triggered by both negative *and* positive appraisal. We then spell out a mood-based semantics for noetic head shake.

The negative use is verbally expressed by 'I can only shake my head at that' and is exemplified in (24).

(24)   (*A tennis player is throwing a ball at the ball kid*)
      Have you seen this? What a shame!
             ☺

The head shake in (24) signals that the speaker evaluates the observed situation in a negative way. Positive appraisal is exemplified in (25):

(25)   (*A tennis player serves the 7th ace in a row*)
      Wow! What a player!
           ☺

The head shake in (25) expresses amazement concerning the athletic achievement. So it can be understood as a way of signalling disbelief. Disbelief in turn is a notion which rests on some sort of negation, corroborating Kendon's (2002) conjecture that the head shake involves some sort of negative context at first glance. However, the disbelief in (25) is rooted in a rather positive mood. Both uses, positive and negative amazement, can be captured in a single lexical entry which operates on KoS' *mood* field and the *PleasantnessInc* updates (cf. (10) from Sec. 3; we simplify over power which does not seem to contribute much here):

(26)
$$
\begin{bmatrix}
\text{form : headshake} \\[4pt]
\text{dgb-params :}
\begin{bmatrix}
\text{spkr : } Ind \\
\text{vis-sit : } \begin{bmatrix} \text{foa : } Rec \end{bmatrix} \\
\delta : \mathbb{N} \\
\text{c2 : Arousal}(\delta, \text{form}) \\
\text{L : } Type \\
\text{p =} \begin{bmatrix} \text{sit = foa} \\ \text{sit-type = L} \end{bmatrix} : Prop
\end{bmatrix} \\[4pt]
\text{cont = Amaze(spkr, p, } \delta) : Prop
\end{bmatrix}
$$

Depending on the polarity of δ, the update of publicly displayed face according to (10) will be positive or negative. Thus, we ascribe the exophoric act of negating a situation to appraisal (an emotional stance towards that situation)—an account which is already implicit in analysing exophoric 'No' in Tian & Ginzburg (2016).

The basic treatment we have sketched here for head shaking applies to laughter, smiling, and related facial gestures. Ginzburg et al. (2020) argue that laughter and smiling have two basic meanings, one that expresses the incongruity of an event, the other that an event is pleasant for the speaker. From the noetic head shakes we can make the prediction that laughter will only co-occur with positive head shake— a testable prediction of the account of negation in discourse presented here.

Finally, it is noteworthy that the parallelism between 'No' and head shake breaks down with noetic uses: in examples such as (24) or (25) it seems to be possible to say 'No' *before* the amazed *What a . . .* interjection, but not *after* it. In speech the attitude seems to have to precede its object, while in multimodal interactions both can be uttered simultaneously.

5 Conclusion

We observed different uses of head shakes in dialogue which seem to be equivalent to verbal 'No'. Both can be used as answer particles to a polar question, a use of 'No' whose semantics has been spelled out by Tian & Ginzburg (2016). Like 'No', the head shake can also be used in an exophoric way, reacting to a real world

situation. We argue that the reaction consists in appraisal. We identify two polar variants: a positively and a negatively valenced head shake, both captured under the term *noetic* head shake. In future work also responses to positive and negative *assertions* have to be looked at, which are known to exhibit far more flexibility than polar questions, in particular in polarity-based answer systems (Karagjosova, 2001). Besides looking at further head shake uses (Kendon, 2002 identifies eight uses, most of which are distinguished by linguistic context and can be dealt with in our system), the issue of timing seems to be of genuine impact: communicating on different channels allows for the simultaneous production of signals. It seems as though simultaneous multimodal utterances can be 'translated' to serialized speech alone, but not in any order of words—a conjecture that needs to be investigated more carefully.

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