

Types of Nods.

The polysemy of a social signal

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The work analyses the head nod, a down-up movement of the head, as a polysemic social signal, that is, a signal with a number of different meanings which all share some common semantic element. Based on the analysis of 100 nods drawn from the SSPNet corpus of TV political debates, a typology of nods is presented that distinguishes Speaker's, Interlocutor's and Third Listener's nods, with their subtypes (confirmation, agreement, approval, submission and permission, greeting and thanks, backchannel giving and backchannel request, emphasis, ironic agreement, literal and rhetoric question, and others). For each nod the analysis specifies: 1. characteristic features of how it is produced, among which main direction, amplitude, velocity and number of repetitions; 2. cues in other modalities, like direction and duration of gaze; 3. conversational context in which the nod typically occurs. For the Interlocutor's or Third Listener's nod, the preceding speech act is relevant: yes/no answer or information for a nod of confirmation, expression of opinion for one of agreement, prosocial action for greetings and thanks; for the Speaker's nods, instead, their meanings are mainly distinguished by accompanying signals.

Introduction

When people discuss or argue, they may express their agreement by signals in various modalities – words, gesture, intonation, face, gaze, posture, head movements. They may look at you while smiling, clap their hands, tell you “bravo!” or simply nod. Nodding, that is, moving head slightly up and then down, is a polysemic signal, since it may have various meanings. It has been studied in the context of other head movements (Hadar et al., 1985; Kendon, 2002; Mc Clave, 2000; Heylen, 2005; Cerrato, 2005; 2007). In this work we investigate the communicative functions of nodding and its use in debates. Based on the analysis of a corpus, we propose a typology of nods and specify the aspects that distinguish its different types in face-to-face interaction.

1. Polysemy and body signals

A typical aspect of signals, often analyzed in verbal language, is ambiguity: a signal (a perceivable stimulus produced by a Sender to convey some meaning) may correspond to more than one meaning. Sometimes the meanings of a signal have no relation with each other – like in homophony, e.g. *bear* and *bare* sound the same but convey very different meanings; but sometimes the different meanings share some semantic element – like in polysemy, e.g. *ring* as the square for a boxing match, and as a round jewel on your finger. The meanings of a polysemic signal are its “range of polysemy”. Like any kind of ambiguity (see figure-ground ambiguity in perception, or syntactic ambiguity of sentences), the polysemy of a word in a verbal language is generally overcome by considering context: I can tell which *ring* you are meaning now if you are talking of a boxing match. In polysemy there is something in common between the

two or more meanings, but one or the other is “triggered” by the context. Take *yes*, which is an information when the previous context is a *yes/no* question, a permission if it follows a permission request. In both cases the present speaker B by saying *yes* confirms some belief hypothesized by the previous speaker A; but in the former context the belief concerns some information that A hypothesizes as true, so *yes* confirms it is true; in the latter, the belief hypothesized is that B does like/want A to do action X. So, the polysemic signal provides a single piece of meaning – B's confirming some belief – while context adds another piece of meaning – whether the belief confirmed concerns some information or B's willingness to let A do some action.

This is generally how things go with polysemy in verbal languages, where a word must be uttered or written in precisely that way to be that word (i.e., to have that meaning). But a hand gesture or a head gesture generally mix up with simultaneous signals in other modalities, and this does make a difference; for example, in backchannel it is not the same if I nod while smiling or not (Bevacqua 2009). Moreover, nonverbal signals can be produced in a number of ways, depending on whether the movement is relaxed or tense, single or repeated; in the gesture “come here” (hand palm down with fingers flapping downward), it is not the same if I make it with a soft fluid movement or with hectic jerks (Poggi & Pelachaud, 2008). So what counts as context for words is something coming before or after the word itself, while for a smile or a nod, that are generally produced simultaneously with other signals, what counts as context may be the signals in other modalities. Consequently, if we want to disentangle the different meanings of the nod – its rich polysemy – but at the same time to understand what is common and what is different in them, we must

1. find out all the possible meanings of the nod, its “range of polysemy”;

2. analyze a number of cases for each meaning
3. for each case of each possible meaning, see what, in the preceding (mainly linguistic) and/or simultaneous (multimodal) context is recurrent or common with other cases where the nod assumes the same meaning;
4. for each possible meaning, single out the “constellation” of signals that together convey that particular complex meaning within the range of polysemy of the nod.

This is what we did in our work about nods. In this paper we outline a typology of nods by specifying, for each type, how its meaning differs from other nod types, and how this difference is revealed either by subtle cues in other modalities or by the way the nod itself is produced.

2. Method

We analysed 100 cases of nods taken from a corpus of 72 political debates broadcasted on a Swiss Tv Channel, Canal 9, from 2004 to 2006, collected by the research institute IDIAP of Martigny (Switzerland), and available on the website of the EU Network SSPNet (Social Signal Processing Network).

We used two combined methodologies: we first selected 100 nods without taking into consideration the audio context, and only afterwards we focused on the transcription of the verbal message occurring during these specific head movements, in order to perform an analysis of nods that took into account the linguistic context in terms of speech act.

The aim of this first study was one of qualitative analysis, i.e. to set the basis for an exhaustive typology of nods that considers their functions, meaning and signal features. For this reason the quantitative side of the analysis will be considered in future work.

Nevertheless, the present typology has been tested in order to verify its accuracy through a pilot study based on other political debates taken from the same corpus, and it has been proved to contain mutually exclusive and collectively exhaustive categories.

The nods of our corpus were analyzed through the annotation scheme presented in Table 1.

The first two columns of the annotation scheme contain the case number and time in the video, Col.3 states who is the Sender of the nod, and his/her role as Speaker, Listener, or Third Listener. 4 contains the concomitant verbal behaviour, whether of the nod Sender or not; 5, the description of how the nod is physically performed; 6, the concomitant gaze behaviour; 7, the meaning we attribute to the nod; 8 finally states the resulting type of nod.

Based on this analysis, we outlined a typology that distinguishes nods during debates according to whether they are produced by one who is speaking or one who is listening, and, within this, whether by the actual Addressee (Interlocutor) or a bystander (Third Listener). This distinction between Interlocutor and Third Listener seems relevant from the interactional point of view because, for example, a nod of agreement from direct Interlocutor may be motivated by politeness, while from Third Listener it may be more spontaneous. Moreover, the

Interlocutor’s nod may often be simply one of backchannel, not of true agreement, while one from the Third Listener is likely true agreement.

3. Interlocutor’s and third listener’s nod

To illustrate our typology we start from the Interlocutor’s nods (Table 2): the most “prototypical” ones, that include many subtypes; in fact, we must distinguish the nods produced after the previous Speaker has finished talking (cases A in Table 2.) from those performed while s/he is talking (cases B). The latter are nods of backchannel, while for the former the meaning of the nod depends on the linguistic context, i.e., the type of speech act performed by the Speaker in the previous turn.

In Table 2., lines contain the nod types; while for what concerns columns, column 1. mentions the type of speech act produced by the Speaker before the nod, col. 2 the name of the type at issue, and 3, its meaning. Col. 4 contains a description of the most characterizing features of the nod on the signal side, classified against parameters like direction of movement, amplitude, velocity and repetition. Moreover, often the concomitant gaze behaviour and other aspects of facial expression, like smile, are described.

The first relevant feature of our typology is that the Interlocutor’s and the Speaker’s nods are importantly different, because of the very status of a Speaker as against an Interlocutor. An Interlocutor is by definition a party who, in the interaction, does not have the initiative of the communicative exchange: his/her turn is necessarily seen as a response to a previous turn of another participant, so much so that the type of speech act performed in the second turn is the one “called for” by the speech act in the first turn. Thus for instance, if the preceding speech act is a *yes/no* question or an informative sentence concerning factual beliefs, the nod conveys a *requested confirmation* (1.A1.) or a *spontaneous confirmation* (1.A2.), respectively. In fact, it is not the same to confirm something you were asked to confirm, or something others simply told you, but not asking you to confirm. A confirmation following a bare information – not a *yes/no* question – is, so to speak, non-required, spontaneous. As one asks a *yes / no* question, he is putting forward a hypothesis and asks you to confirm or disconfirm it. But when you utter an informative sentence, it is not a hypothesis for you, it is a belief you are quite certain of, and you may expect an acknowledgement of it, but you don’t ask the other to confirm it. So a non-requested confirmation shows somewhat more of a commitment than one you are bound to give. Yet, in both cases the nod means “I have the same belief as you mentioned”, whether the belief was contained in a question or in a statement.

On the other hand, if the Speaker’s speech act is an evaluation or assessment (Col.1), a nod means “I agree” (Col.3), i.e. “I have the same opinion as you mentioned”, that is, “I agree with your judgement”: a case of *agreement* (1.A3). The agreement nod is usually a bit slower and more ample than that of confirmation (Col.4), and sometimes it is accompanied by a soft closing of the eyelids: a gaze signal that counts as an extenuated *yes*, but with a nuance of haughtiness, of showing that one

graciously consents, while still feeling superior. After a proposal, the nod may convey *approval* (1.A4). A proposal is an action request, that is, one in which one asks others to pursue some goal, characterized by two features: 1. that the proposed goal is not one of the Speaker's only, but it may be a goal also of the Addressee's; 2. that the proposer in asking to pursue that goal does not make appeal to his power over the Addressee: the Addressee is free to choose, and accepting implies that he approves the proposal, i.e. he also agrees it is good for his goals too. In sum, a proposal is a cooperative and symmetrical request for action, and its acceptance entails approval or agreement with the proposer's goals or evaluations.

In some types of interaction, the conversationalists' positions are asymmetrical in that the Listener has power over the Speaker. So if a request for permission comes, the nod counts as *permission* (1.A5).

To the opposite, sometimes one asks you to do something you would prefer not to do, but you are bound to that request of action because it comes from someone who has power over you. So, when answering a peremptory order, the nod is one of *submission* (1.A6), and it maintains its evolutionary meaning of "I submit to you", "I'll do what you want" (Col. 3).

The types of nod seen so far quite closely correspond to an answer "yes", and in fact they share the very same polysemy of this interjection. Actually, also "yes" can mean confirmation, agreement, approval, permission and submission. But here are now two *nods* that are not synonyms of *yes*. One is a greeting (1.A7), used by an Interlocutor (or Second Speaker), to answer a greeting of a First Speaker. The other typically follows a pro-social action of politeness or benevolence, like an offer or favour, and it is aimed to *thanking* (1.A8): it is an acknowledgement that you are indebted – hence temporarily submitted – to the other. In both greeting and thanking the *nod* is very similar – semantically – to a bow. When Speaker and Hearer are in a positive disposition to each other, they reciprocally show they give up any power over each other.

Coming to the nods during the Interlocutor's turn, three subtypes of them are backchannel signals that represent, in a sense, three increasing degrees of commitment. With nod 1.B1, "I confirm I am following", the Interlocutor simply assures s/he is understanding what the Speaker is saying. With the second type, 1.B2, the Interlocutor informs s/he is "taking note" of what the Speaker is saying. An example in our corpus occurs when the opponent of the nodder, strangely enough for a debate, has just said he agrees with her, and she makes fast and brief nods. Her nod implies not only that she understood what the Speaker is saying, but that she acknowledges the opponent's move is a relevant social one, that may in some way change their social relation (for instance, making it more cooperative). Finally the third backchannel nod expresses agreement ("I have the same opinion as you", 1.B3). These types of nod for backchannel, as well as the previous types, can be distinguished on the basis of the speech act presently performed by the present Speaker, whether factual information, social act, or finally evaluation, opinion, proposal.

In the *backchannel of confirmation*, the first nod may be ample, but then two or more nods follow brief and rhythmically repeated. The "*taking note*" nod is very short and fast. The *backchannel nods of agreement*, instead, are generally single, ample and stressed.

In some cases though, when the Interlocutor ironically smiles while nodding at the present Speaker, he is providing an *ironic backchannel* of agreement, that is, in fact showing strong disagreement (1.B4).

Then, in two types of nod the Interlocutor signals confirmation or agreement to oneself. Sometimes, we nod to the Speaker only because s/he is saying something we had previously said or thought, so we are nodding not just to him but to ourselves (*back-agreement*, 1.B5). This nod may be accompanied by a smile or a sigh, as if saying: "Well, you finally see I was right!".

Sometimes, finally, nodding is like saying *yes* to ourselves while reasoning on the other's turn or planning our response, or while confirming to ourselves that we understood what exactly the Speaker means ("*processing nod*", 1.B6). So this is not strictly speaking a communicative nod, in that it is not directed to the other, but to oneself. In a sense, whether one's reasoning was aimed at planning what to say or at making the right inferences about what the other said, with this nod one is somehow approving of his own reasoning. This nod is repeated and accompanied by a frowning of concentration, which differs from the "*back-agreement*" nod above because in this case we do not gaze to the Speaker, but possibly look downward.

Also the Third Listener's nods (Table 3.) may convey *confirmation* (2.1., after an information), *agreement* (2.2., after evaluative opinion), *acknowledgement* or *thanks* (2.3., after a prosocial act). Obviously, there is no *greeting* nod. But, symmetrically to the interlocutor's self-agreement nods, also in the third listener we found this particular category, which includes *back-agreement* and *processing nod* (2.4 and 2.5).

5. The Speaker's nods

Within the Speaker's nods (Table 4) we may distinguish two broad families: in the former the semantic core is one of importance, in the latter one of confirmation.

Emphasis, baton and listing. Nods of importance.

A first case in which we nod while holding the turn is when we want to emphasize what we are saying (3.1., *emphasis*). As to the signal side (col.3), such a nod is characterized by the fact that head does not only go up and down but slightly forward: the typical movement of an emphatic nod is forward – downward in correspondence with a stressed syllable, with gaze toward the Interlocutor. And the meaning is: "this part of my sentence or discourse is particularly important". Here we do not distinguish between "focus" and "emphasis", like does Cerrato (2007), because focusing can be seen as a way to emphasize a word or part of discourse. A person nodding to stress her words is like a charging bull: head goes forward, and gaze is pointing the Interlocutor, as if ready to fight. (After all, in arguing you are fighting for your ideas!).

A particular case of emphasis is when we nod

simultaneously with all the stressed syllables of our sentence (2.2, *baton*): here the head nod can be compared (Cerrato, 2005) to batonic gestures (Ekman & Friesen, 1969), which impress to or accompany the rhythm of our words. This might be seen as a non-communicative movement, simply used to help ourselves to maintain the right rhythm. But rhythm itself – that is, the choice of which syllables to stress – is determined by the choice of which words to select as important. Thus, if this nod is not strictly speaking communicative per se – we cannot say it “means” “this syllable is important” –, it is anyway functional to our communicative goals.

A special case of this nod is used to highlight the items in a list (3.3, *list*), where it generally accompanies the metadiscursive gestures (Poggi, 2007) produced to enumerate. In this case the nod parallels the downward movement of the hand, and by doing so directs attention to it.

This stressing movement also has a core meaning “this is important”. What is important in this case is that the mentioned item is a general and abstract concept, thus more important than the specific cases it subsumes.

Nods of request for confirmation

Other nods of the Speaker are connected to the concept of confirmation. A nod while looking at the Interlocutor and frowning, or with oblique head, slightly tilted sidewise (3.4., interrogative nod) is a request for confirmation, as if saying “yes?” with an interrogative intonation.

This interrogative nod can also be used as a rhetorical question (3.5. *Rhetorical interrogative nod*), when you want the other to definitely confirm, instead of asking him if he confirms or not. Sometimes, finally, nodding with an interrogative expression is a request for backchannel (3.6. *backchannel request*): you want the other to confirm or not if he is following and understanding.

5. Conclusion

Nodding is a signal that may convey several different meanings. In this work we have tried to disentangle the rich polysemy of this head movement by distinguishing nods of different possible senders, Interlocutor, Third listener and Speaker. The nods differ for their amplitude, velocity and repetition, and for their previous and concomitant context: preceding speech acts and simultaneous facial and gaze signals. We singled out many different meanings of nods: confirmation, agreement, approval, submission and permission, greeting and thanks, backchannel, emphasis, ironic agreement and others. We also found some differences in the communicative import of the nods, seeing for instance that the so called *processing nod* (among the interlocutor’s nods) and the *batonic* one (among the speaker’s nods) are not strictly communicative, but simply help and accompany cognitive and communicative processes.

Notwithstanding these differences in meaning and function, in the first four types of nod of the Speaker we find a common semantic core of importance, while for the Interlocutor’s and Third Listener’s nods, and for the Rhetorical interrogative nod and backchannel request of

the Speaker’s, we can still find the semantic core of “acceptance” seen by Darwin (1872): acceptance of information, opinions, proposals, but mainly acceptance of a social relationship.

What is the point of these detailed and articulated analyses of such a subtle signal as a nod? On the application side, they can be of use to construct devices for the automatic processing of social signals. Actually, in a subsequent work we will propose a procedure for nod detection and interpretation. On the theoretical side, discovering the subtleties of apparently trivial signals gives us deep insights into the human nature

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5. References

- Bevacqua, E. (2009). Computational model of listener behavior for Embodied Conversational Agents. Phd thesis, unpub. Phd thesis.
- Cerrato, L. (2005) Linguistic functions of head nods. In Allwood, J. & Dorriots, B. (Eds.), *Gothenburg papers in Theoretical Linguistics 92: Proc. from The Second Nordic Conference on Multi-modal Communication*, Gothenburg University, Sweden: 137-152.
- Cerrato, L. (2007). Investigating Communicative Feedback Phenomena across Languages and Modalities, KTH, Stockholm, unpub. Phd thesis.
- Darwin, C. (1872). *The Expression of the Emotions in Man and Animals*. New York and London: Appleton and Company.
- Ekman, P., Friesen, W. (1969). The repertoire of nonverbal Behavior: Categories, origins, usage and coding. *Semiotica* 1, 1, 49-98.
- Hadar, U., Steiner, T., Rose, C.F.: (1985). Head movement during listening turns in conversation. *Journal of Nonverbal Behavior* 9, 214–228
- Heylen, D. (2005). Challenges Ahead. Head movements and other social acts in conversations. In *Proceedings of the 5th International Conference on Interactive Virtual Agents*. Kos, Greece, 2005.
- Kendon, A. (2002). Some uses of the head shake. *Gesture*, 2, 2, 147-182.
- McClave, E.Z. (2000). Linguistic functions of head movements in the context of speech. *Journal of Pragmatics*, 32, 855-878. Oxford University Press, 298-311.
- Poggi, I. (2007). *Mind, hands, face and body. A goal and belief view of multimodal communication*. Berlin: Weidler.
- Poggi, I., & Pelachaud, C. (2008). Persuasive gestures and the expressivity of e-cas. In I. Wachsmuth, M. Lenzen, G. Knoblich (Ed.), *Embodied communication in humans and machines*. Oxford: Oxford University Press

Table 1. An annotation scheme to analyse nods

<i>1. n.</i>	<i>2. Time</i>	<i>3. S</i>	<i>4. Verbal</i>	<i>5. Nod description</i>	<i>6. Gaze</i>	<i>7. Meaning</i>	<i>8. Type</i>
5	3.41 - 3.42	SR Sp	SR: Strictement, rien du tout = strictly, nothing at all	Moves head forward-downward	Gaze fixed to the interlocutor	I want to stress this	Emphasis
10	6.52	HR L	M: les mesures d'économie que sont proposé = the economic maneuvers that are proposed	Lowers head fast and briefly	Looks down	I see what you mean	Backchannel "I'm following"

Sp = Speaker; L = Listener; M = Moderator

Table 2 Interlocutor's nods

	1. Previous turn	2. Type	3. Meaning	4. Signal features
Speaker finished	Yes/no question	1.A1. Requested Confirmation	I confirm that what you hypothesize is true	Single nod, head first goes upward and then downward
	Information	1.A2. Spontaneous Confirmation	I confirm that what you say is true	Head movement downward
	Assessment	1.A3. Agreement	I agree with your judgement	Single nod downward, with head movement of high amplitude and tension. Gaze generally directed to Speaker, sometimes with a slow closing of the eyelids
	Proposal	1.A4. Approval	I approve	Nod downward single or repeated, with head movement of high amplitude. Gaze possibly directed to Speaker, often with eyebrow frowning
	Permission request	1.A5. Permission	I allow you to do this, I confirm that you may do this	
	Dominant request	1.A6 Submission	Yes, sir, I submit to you	
	Prosocial (communicative) action	1.A7. Greetings	I take a bow to you	Slow, generally accompanied by a smile and a closing of the eyes
		1.A8. Thanks	I thank you	Generally accompanied by a smile
Speaker continued	Backchannel	1.B1. Backchannel "I understand"	I confirm I am following you	Brief fast repeated downward movement
		1.B2. Backchannel "I take note"	I record your communicative act consider it relevant for our social relationship	short, repeated nods, gaze to speaker
		1.B3. Backchannel "I agree"	I confirm I agree	Brief fast repeated downward movement, frowning and gazing to Speaker, possibly smile
	Disagreement	1.B4. Ironic backchannel	I do not agree at all	Possibly asymmetrical (i.e. ironic) smile
	Self-agreement	1.B5. Back-agreement	I agree with you (but just) because you are repeating my previous statements. Do you acknowledge that I was right?	Possibly ironic smile, sometimes a sigh. Gaze to Speaker
		1.B6. Processing Nod	I am reasoning on what the speaker means and what he is aiming at, or, I am planning my response, and I approve of my reasoning	Repeated brief and slow downward movement, generally accompanied by frowning and possibly by a smile. Not gazing to Speaker

Table 3. Third Listener's nods

1. Speaker's Turn	2. Type	3. Goal or meaning	4. Signal features
Information	2.1. Confirmation	I confirm the belief you mentioned	Not emphatic, often done in extenuated form by simply closing eyelids
Assessment	2.2. Agreement	I agree with you	
Prosocial (communicative) action	2.3. Acknowledgment Or Thanks	I am grateful	Gaze downward
Self-agreement	2.4. Back-agreement	I agree with you (but just) because you are repeating my previous statements	
	2.5 Processing nod	I am reasoning on what speaker and interlocutor are saying and I approve of my reasoning	Repeated brief and slow downward movement, generally accompanied by frowning and possibly by a smile. Not gazing to Speaker

Table 4. Speaker's nods

1. Type	2. Goal or meaning	3. Signal features
3.1. Emphasis	This (part of my) sentence (discourse) is important	Head moves forward-downward over one stressed syllable Gaze to Interlocutor
3.2. Batonic	I stress syllables to help myself keeping rhythm	Repeated head movements downward in correspondence of more than one stressed syllable
3.3. List	This (part of my) sentence (discourse) is important because here starts an item of my list	Stresses the items in a list, often parallel with enumerating gestures
3.4. Interrogative nod	I ask you if you confirm or not my hypothesis	Gazes at Int. with oblique head, slightly tilted sideways. Or Eyebrow frowning like in interrogative sentences
3.5. Rhetorical interrogative nod	Isn't it so? I want you to confirm	
3.6. Backchannel request	I ask you if you confirm or not that you understand what I mean	(sometimes) accompanied by open hand palm up gesture