Polar Questions in Sign Language of the Netherlands (NGT) and Dutch

MSc Thesis *(Afstudeerscriptie)*

written by

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under the supervision of **Dr Marloes Oomen** and **Dr Floris Roelofsen**, and submitted to the Examinations Board in partial fulfillment of the requirements for the degree of

MSc in Logic

at the *Universiteit van Amsterdam.*

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Acknowledgments

Abstract

This project examines polar questions in both Sign Language of the Netherlands (NGT) and Dutch.

The NGT part of the project aims at getting a better understanding of the use of (non-)manual markers in polar questions in NGT. The manual marker of PALMS-UP and the non-manuals markers − which are expressed by the torso, head, and face − of body position, eyebrows, eye gaze, eye shape, head, lip corners, nose, and shoulders are annotated in polar questions in the Corpus NGT. These annotations are in accordance with the annotator guideline which is created as part of this project. The annotated polar questions are grouped in clusters by applying both principal component analysis as dimension reduction technique and k-means as clustering method, on the coded data set. Based on the clustering result, global patterns of (non-)manual marking in polar questions in NGT are identified. This project also describes five syntactic structures, which each consists of a radical combined with one of the following tags: 'toch' (translation: 'right'), 'of niet' (translation: or not), hesitation, disbelief, and confirmation. For each of these tags the required (non-)manuals are determined. This project results in the formulation of the following generalisations, which are preliminary because they are essentially based on corpus data (which implies a lot of variation) and therefore they require further testing.

1. Polar questions in NGT are not necessarily expressed through marked − or specifically raised − eyebrows;
2. The use of lowered eyebrows and squeezed eye shape coincide, and wide eye shape only occurs when raised eyebrows are present;
3. The marker of nodding only occurs when the marker of chin in is present, and forward body position only occurs when the marker of chin out is present;
4. The syntactic structure which combines a radical and a 'toch' tag requires that no polarity is expressed at the radical, and that at the tag the markers of nodding and PALMS-UP are present;
5. The syntactic structure which combines a radical and an 'of niet' tag requires that the radical expresses no negative polarity, and that at the tag the markers of shaking, PALMS-UP, and no eyebrow marking are present;
6. The syntactic structure which combines a radical and a hesitation tag requires that no polarity is expressed at the radical, and that at the tag the markers of lip corners down, body position forward, chin out, shaking or neutral head movement, and PALMS-UP are present;
7. The syntactic structure which combines a radical and a disbelief tag requires that at

the tag the markers of shaking, chin in, and wide PALMS-UP are present;

8. The syntactic structure which combines a radical and a confirmation tag requires that at the tag the markers of nodding, shoulders up, wide PALMS-UP, and no eyebrow marking are present.

The part of the project which is concerned with polar questions in Dutch analyses the felicitous use of two types of biased questions: both questions consist of a declarative anchor followed by a *toch* or *hè* with rising intonation. The question types are named after their sentence final elements, the Dutch particle *toch* (*toch* questions) and the Dutch particle *hè* (*hè* questions). To accurately capture their felicity conditions the distinction in neutral, positive, and negative speaker's prior belief and contextual evidence is not sufficient. This project therefore proposes a distinction in two declarative anchor types: matter-of-fact and personal taste. The contextual evidence also needs a further specification: the evidence source (addressee or external), the evidence quality (direct or deduced), and to whom the evidence is new (addressee, speaker, or both) is specified. This project results in the formulation of the felicity conditions of both question types:

1. *A toch question q with declarative anchor $\alpha = P(x)$, that expresses a matter of fact, is felicitous if all following conditions are fulfilled:*
   (a) the speaker must have a positive prior belief in α
   (b) the speaker must consider it possible that the addressee might agree (potentially after some thought) about the truth of α
   (c) the speaker is not certain both participants agree about the truth status of α

2. *A toch question q with declarative anchor $\alpha = P(x)$, that expresses a personal taste, is felicitous if all following conditions are fulfilled:*
   (a) the speaker must be certain that α is true, independent of the judgement provided by the addressee
   (b) the speaker must consider it possible that the addressee agrees about the truth of α, independent of the judgement of the speaker
   (c) the speaker must initiate the experience of x or share her expectation that x will have property P

3. *A hè question q with declarative anchor $\alpha = P(x)$, that expresses a matter of fact or personal taste, is felicitous if all following conditions are fulfilled:*
   (a) the speaker must be certain that α is true, independent of the information or the judgement provided by the addressee
   (b) the speaker must consider it possible that the addressee agrees about the truth of α, independent of the information or judgement provided by the speaker

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1. Introduction

This project examines polar questions − which raise issues that can be resolved by either an affirming or a negative answer: yes or no − in both the Sign Language of the Netherlands (Nederlandse Gebarentaal, NGT) and Dutch. Research in spoken languages is much more developed compared to the research in sign languages (Zeshan 2004, p. 7). Imagine two parallel paths, one of which representing the research of sign languages and in particular NGT, and the other one covering the research in spoken languages and specifically Dutch. The current project consists of two separate studies which each have a different starting point. The study which is concerned with NGT starts at the beginning of its path, whereas this project's study in Dutch begins much further along its path. Where the Dutch part examines two types of biased questions in Dutch, it is not yet established whether such question types exist in NGT. The NGT part of this project is therefore rather an *exploratory* research on the use of polar question in NGT, whereas the Dutch part is already *focused*, on a specific polar question type (biased question). Both studies are further introduced in the following two sections: NGT (section 1.1) and Dutch (section 1.2).

1.1 Polar question types in NGT

The first study is an exploratory investigation on the use of polar question in NGT. In sign languages the same signs and order of signs could be used to express a polar question and a declarative. The difference between those sentence types is then only apparent through a distinct use of non-manual markers (Coerts 1992, p. 11; Klomp 2021, p. 265). Non-manual markers are elements that are not expressed by the hands but by the torso, shoulders, head, and face (Klomp 2021, p. 116; Pfau and Quer 2010, p. 381). Since non-manuals play a crucial role in polar questions, the focus of this study is primarily on the use of non-manual markers. The research question of the current project therefore is: which non-manual markers are necessary for asking polar questions? This project aims to formulate a preliminary answer to this question, rather than providing a definite conclusion.

Literature on polar questions in NGT (Coerts 1992, pp. 106 - 111; Klomp 2021, p. 265) and in sign language in general (Cecchetto 2012, p. 294; Zeshan 2004, p. 19) report that the non-manual markings of eyebrows raised, eye gaze directed at the addressee, and a head forward movement are cross-linguistically present, or even obligatory, when asking a polar question. However, de Vos, Kooij, and Crasborn (2009, pp. 316 and 324) show − in their study which focuses on the presence of eyebrow marking in NGT − that eyebrows could also be in a lowered state when a polar question in NGT is used. The variation between these studies could signal the presence of different syntactic structures within polar questions in NGT, which are marked with different non-manuals.

Many aspects of NGT are still unknown because the study field of NGT is a relatively young research area. The current project aims to contribute to a better understanding of the use of polar question in NGT. The data source of this project is the Corpus NGT (Crasborn, Zwitserlood, and Ros 2008; Crasborn and Zwitserlood 2008). This corpus consists of 2375 video files in which pairs of deaf signers have conversations in NGT. The video-recorded sessions come with corresponding annotation files. This project identifies both polar questions and a special type of alternative questions in the corpus data, based on their annotated translations. The special type of alternative questions (hereafter: negative alternative question) consists of a radical combined with a disjunction, and a 'not' that refers to the radical's negation: e.g., "do you support him, or not?". A negative alternative question is in semantic content equal to a polar question because it raises the same issue (Ciardelli, Groenendijk, and Roelofsen 2018, pp. 78 - 79), it is therefore decided to include this question type in this project. For each of the identified polar questions and negative alternative questions the manual question particle PALMS-UP and the non-manual marking of head, body position, eyebrows, eye gaze, eye shape, nose, lip corners, and shoulders are annotated. These annotations are made in accordance with the instructions that are provided by an annotation guideline, which is created as a part of this project. In an attempt to achieve the intended aim of this project, the presence of (non-)manual marking in the polar questions in NGT is analysed: both global patterns of (non-)manual marking as well as (non-)manuals in specific syntactic structures are identified.

1.2   Biased polar questions in Dutch

The second part of this project examines the felicity conditions of two types of biased questions in Dutch. Biased questions are characterised as non-canonical questions which are distinguished from canonical questions. Where canonical questions are formally simple interrogatives which are asked by an ignorant speaker with the aim of eliciting information, non-canonical questions are more complex than their canonical alternatives that express the same semantic content (Dayal 2016, p. 268). The use of a biased question shows that the speaker is not fully ignorant as it conveys − besides the information request − the speaker's bias about what the information is expected to be.

The two types of biased questions in Dutch that are examined in this project consist of a declarative anchor α followed by an interrogative element which is pronounced with a rising intonation: *toch* or *hè*. In this project is referred to such an interrogative element as a tag. Both *toch* and *hè* are particles in Dutch. *Toch* can be positioned within an utterance and as utterance final. The influence of *toch* on the meaning of the utterance depends on this position and its intonation. The particle *hè* can be used, on its own, to express the emotion of disgust or surprise. *Hè* can secondly be used as sentence final (Gaasbeek

2021). In this project these particles are only examined in their position as tag in the biased questions. The two biased question types are named after their possible tags: *toch* and *hè* questions. Both are polar interrogatives that not only raise the issue whether α is true but also convey a bias towards the truth of α. The anchor α is defined as an assignment of a property P to an object x: $P(x)$. The research question of this part of the project is: what are the felicity conditions of *toch* questions and of *hè* questions?

In previous studies on biased polar questions the notions of speaker's prior belief and contextual evidence were found to be of importance (Buring and Gunlogson 2000; Domaneschi, Romero, and Braun 2017; Farkas and Roelofsen 2017; Goodhue 2021; Sudo 2013). Both notions can be in a neutral, positive, or negative mode with respect to the declarative anchor. This distinction in prior belief and contextual evidence serves as the base of the current project. However, it is argued in this project that this distinction is not sufficient to accurately capture the felicity conditions of the two biased questions in Dutch. In this project, a further specification of the declarative anchor is first proposed:

1. The declarative anchor should be distinguished into two types, one expresses a matter of fact and the other a personal taste. The latter conveys the subjective judgement that x possesses property P, whereas at the former it is objectively determined that x has P.

This project shows that a matter-of-fact *toch* question is felicitous under different circumstances than a *toch* question that is based on a personal taste anchor. Because of this difference in felicity the distinction in declarative anchor types is made. To accurately capture the felicity conditions of both biased question types, this project secondly proposes a further specification of the contextual evidence:

2. The contextual evidence in situations in which biased questions with matter-of-fact declarative anchors are used, ought to be further distinguished in the evidence' source, its quality, and to which conversation participants the evidence is new.

Based on the different modes of speaker's prior belief and contextual evidence, and on the specification of the declarative anchor types and the contextual evidence aspect, three native speakers − including the author − analysed the use of *toch* and *hè* questions and determined their felicity conditions.

The study about the use of polar question types in NGT is described in chapter 2, while in chapter 3 the study of the two types of biased question in Dutch is presented. The conclusion of this project presents a synopsis of the results of both studies (chapter 4).

2.   Polar questions in NGT

This chapter presents an exploratory research which aims to obtain a better understanding of the use of one manual and eight non-manual markers in polar questions in NGT. The non-manual markers that are examined in this project are body position, eyebrows, eye gaze, eye shape, head, lip corners, nose, and shoulders. This choice is inspired by the non-manuals which Coerts (1992, pp. 31 - 49) describes: "alternation of the mouth", "eye musculature, movements of the brows, wrinkling of the nose", "eye gaze", "movement of face and head", and the movement of the body and in particular the shoulders. Since the manual marker PALMS-UP is seen as a potential question marker (Coerts 1992, p. 133), it is also incorporated. The NGT sentences in the Corpus NGT which were translated as polar or negative alternative questions form the data of this project. For each of these questions the presence of the manual and non-manual markers is annotated, based on the − in this project created − annotation guideline. As a consequence of working with corpus data − which implies variation[1] − this project does not provide definite conclusions but rather results in the formulation of preliminary generalisations.

The first section of this chapter (section 2.1) describes the corpus data. Section 2.2 then presents the original annotation guideline, its updates, and the inter annotator agreement rates for annotations made by three annotators following the updated guidelines. Based on the final version of the guideline the extracted questions from the corpus are annotated. These annotations are subsequently analysed by using a clustering technique. As a means to an optimal clustering performance, the data is corrected by coding the data and using a dimension reduction technique, prior to applying the clustering technique. This process is described in section 2.3. In the subsequent section (section 2.4) the clustering result is described and based on this result global patterns about the use of (non-)manuals in polar questions in NGT are identified. Subsequently, in section 2.5, the presence of (non-)manuals in five syntactic structures − which all consist of a question's radical and a unique tag − are examined, with a focus on their tag. In this project a tag is interpreted as an interrogative element which is connected to its precedent radical, despite this connection it is also a clear separate element which is positioned as sentence final. Based on the results in both sections 2.4 and 2.5, preliminary generalisations about the presence of (non-)manual marking in polar questions in NGT are formulated in section 2.6. The discussion section of this chapter (section 2.7) discusses methodological choices and proposes suggestions for further research and in this chapter's conclusion (sec-

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[1]Since the corpus data is not specifically created for this project's purpose the non-manual markers are not always clearly visible and the polar and negative alternative questions are not equally spread over the participants. Furthermore, this project is based on the translations of the videotaped signing conversations. These translations are annotated by different annotators which may result in variation.

tion 2.8) the contribution of this project and a synopsis of this project's results are provided.

2.1 Corpus data

The Corpus NGT − which consists of 2375 video files in which pairs of deaf signers have conversations − serves as the data source of this project. Many of the signed sentences in the corpus are annotated with translations in Dutch. The translated polar questions were identified by searching on '?' in the translation tiers and on TOCH in the gloss tier. The translated negative alternative questions − which present the choice between two options: the radical and its negation − were detected by searching on '?' and 'of' in the translation tiers and on OF in the gloss tier. The radical and the 'or not' part of the negative alternative questions were identified separately, because this question type is one of the five syntactic structures which are analysed in this project and the analysis is focused on the use of the (non-)manuals at their *tags* (see section 2.5). Contrary to the other four syntactic structures, the existence of negative alternative questions in NGT was already established prior to this project (Klomp 2021, pp. 266 - 268). The metadata of the 60 participants that all together signed the 448 identified questions[2] can be found in appendix A.

For each of these 448 questions, the states of the non-manual markers of eyebrows, eye shape, shoulders, body position, lip corners, head,[3] nose, eye gaze and the presence of the manual marker PALMS-UP were annotated by the author. The figures below represent video stills of the corpus which serve to give an impression of what the markers look like. Below each video still, the marker and one of its possible states is presented.

Figure 1. Eyebrows raised

Figure 2. Eye shape squeezed
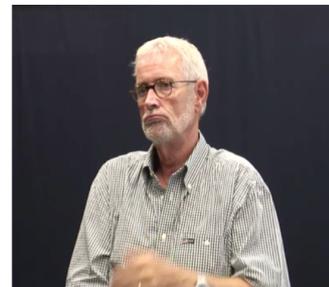
Figure 3. Lip corners down

Figure 4. Head: chin in
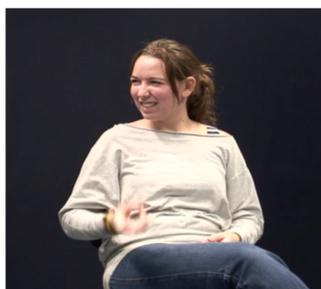
Figure 5. Nose wrinkled

Figure 6. PALMS-UP

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[2]By which is meant: the polar questions and the radical and the tag of negative alternative questions.
[3]The non-manual marker head is divided in $head_1$ which represents the movements of chin in and chin out and $head_2$ which captures the nod, nodding, shake, and shaking movements.

Figure 7. Body position forward   Figure 8. Shoulders up   Figure 9. Eye gaze in space

To preserve consistency, these annotations were made in accordance with the final version of the annotation guideline which can be found in appendix B. The process of creating this guideline is described in the next section (section 2.2), in which the possible states of each marker are also described.

2.2 Annotation guideline

In order to analyse (non-)manual marking of polar questions in NGT, the polar questions of the Corpus NGT need to be annotated systematically. To ensure consistency, an annotation guideline was developed. This guideline has been tested and updated accordingly, its final version can be found in appendix B. In this chapter the original guideline and its updates are first described and subsequently, the different updates are evaluated by comparing their inter annotator agreement rates per marker.

2.2.1 Original guideline

The foundation of the initial guideline were 100 of the identified questions in the corpus. These were examined with a focus on the markers of PALMS-UP, eyebrows, eye shape, eye gaze, shoulders, body position, chin, lip corners, head, and nose. Based on these 100 questions the different states each marker could be in were determined, these states are specified in table 1 below.[4] For each marker, its different states were described in the guideline and by way of illustration screenshots of some particular states were appended.

marker	states						
eyebrows	raised	low	neutral	uncertain			
eye shape	wide	squeezed	neutral	uncertain			
eye gaze	experimenter	other participant	space	uncertain			
shoulder	up_1	up_2	neutral	uncertain			
body position	leaning forward	leaning backwards	tilted	sideways	huddling	neutral	uncertain
chin	up	down	forward	backwards	neutral	uncertain	
lip corners	up	down	neutral	uncertain			
head	sideways	shaking	nodding	tilted	neutral	uncertain	
nose	wrinkled	neutral	uncertain				
PALMS-UP	yes	no	uncertain				

Table 1. (Non-)manual markers and their possible states

[4]The possible shoulders' states of 'up_1' and 'up_2' respectively capture the movement of a single shoulder going up, and both shoulders going up.

2.2.2 Guideline updates

This initial guideline was used by two annotators − who were both unfamiliar with NGT − to annotate ten sample polar questions. These questions were selected in such a way that every state of each marker was present at least once. Based on differences between the annotations, the original guideline was refined.

Some differences were due to one annotator annotating the combination of a neutral and a non-neutral state whereas the other only annotated the non-neutral state. In the guideline's second version it was therefore explicated that when the marker is in one state during the fragment that state should be annotated, and in case the marker is in a combination of states only the non-neutral states must be annotated. It was furthermore decided to remove 'huddling' as a possible state, because huddling is included in the leaning forward body position. It was further clarified that PALMS-UP can be signed with one and both hands. The meaning of raised eyebrows was described more extensively and lastly, it was explicated that the position of the chin is relative to the neck and head positions.

The annotations of the two annotators were adjusted in such a way that they were aligned with this updated version.[5] To better evaluate the guidelines, another annotator − who was proficient in NGT − annotated the same ten questions based on this second version. After comparing these three annotation sets, the guideline was updated to a third version.

The written part of the eye gaze marker was left untouched, there were nevertheless some screenshots added to this section because while analysing the annotations some variants of 'looking in space' became apparent.

In the shoulder section, the division between two and one shoulder up was removed: the shoulders should be annotated as 'up' in case they are raised (either one or both). The movements of one shoulder up and tilted body position are closely related, this was highlighted in the update. Most differences between the annotations of the body position were due to the fine line between a neutral and a tilted body position. To make the annotator (more) aware of it, this difference was described in both words and screenshots.

Some of the differences between the eye shape annotations seemed to be due to the influence of eyebrow movements: the eye shape is easier seen as squeezed when the eyebrows are low, or as wide when the eyebrows are raised. Also, it is harder to see one's eye shape when the eyebrows are low. Therefore, the influence of the eyebrows on the eye shape were pointed out. It was also suggested to add 'eyebrows' to the comment section in case one is uncertain about the eye shape's state due to the eyebrows' movement.

The differences in the annotations of the lip corners may be related to movements of

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[5]This meant that one annotator's annotations remained the same and the other annotator's annotations were slightly altered by replacing 'huddling' with 'leaning forward' and the combinations in which both neutral and non-neutral states were annotated, the neutral states were removed.

the mouth because the lip corners' state is influenced by it. In NGT, these movements are captured by mouth gestures and mouthings, which respectively refer to tongue and mouth actions that are not related to aspects of a spoken language and to mouth articulations that are derived from words in a spoken language. Both mouth actions are used to express sentences in NGT (Klomp 2021, pp. 116 - 118). A signer completes a sentence only if the parts that construct a sentence − which includes mouth gestures and mouthings − have been expressed. This may indicate that both mouth actions are less present as the sentence comes to an end. To minimize the differences in the lip corners' annotations, it was added to the lip corners section that only the lip corners' state at the end of the question should be annotated.

The chin and head sections were the last sections which were altered in this update. Since movements of the chin are inherently movements of the head and vice versa, it was decided to merge these markers into one head marker. The 'tilted' and 'sideways' head state were removed, because they were hard to discriminate from one another and did not seem to be a relevant marker. Furthermore, the chin's states 'forward', 'up', 'down' and 'backwards' became part of the head marker. The head movement of a nod is the movement in which the chin goes down and then back up (to a neutral position). This head movement is a single variant of the continuous nodding movement. A shake is a single head movement from side to side, which is closely related to the continuous side-to-side movement of shaking. Based on the second guideline, these movements, nod and shake, would rather be annotated with − respectively − the states of 'chin down' and 'sideways'. To distinguish these states from the single head movements, the possible head states of 'nod' and 'shake' were added.

To test the third version of the guideline ten new sample polar questions were selected, with a focus on the markers that showed many differences between the previous annotations. These new questions were annotated by the same three annotators and their annotations were based upon the updated guideline.

A final update to the guideline was made after these annotations were analysed. The nose section was altered by adding more screenshots, and it was described that small wrinkle movements of the nose should also be annotated as 'wrinkled'. It was also stipulated that when the signing participant looks to both experimenters the eye gaze marker should be annotated as 'experimenter'.[6] It was highlighted in the eyebrow section to watch some seconds before the start of the question fragment to have a clearer view of the eyebrows' state.

Both the body position and the lip corners sections were altered in similar ways: it was added to both sections that these markers should only be annotated as being in a certain

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[6]In the Corpus NGT videos only the participants are visible. However, the participants also communicate with people who are positioned outside the scope of the camera, to these people is referred as the experimenters.

non-neutral state if some movement or action is involved. This is because it is likely that otherwise the non-neutral state is not a relevant marker. For example, if the body position is in a tilted state before the question starts, and it remains in this position during the signing of the question − so there is no body movement involved − the body position should be annotated as neutral.

In the head section the 'forward' and 'up' states, and the 'down' and 'backwards' states were merged, respectively into the states 'chin out' and 'chin in'. Also, the descriptions of 'nod' and 'shake' were more refined: in the previous version it was stated that a nod and a shake were respectively nodding and shaking that occur only once, however both can occur more than once, which was captured in the update.

This final version of the guideline was the base upon which the same three annotators were annotating ten new polar questions.

2.2.3   Inter annotator agreement rate

The guidelines were evaluated by comparing their inter annotator agreement rate (IAAR) for each marker. Only the last three versions of the guideline were evaluated with agreement rates, because between the guideline's first and the second version only minor adjustments were made and only two of the three annotators used the first guideline as a base for annotating ten sample questions. From the guideline's second version the same three annotators annotated ten sample questions, using the updated guidelines. Fleiss' kappa method (Fleiss 1971) was used to determine the agreement rate because this method can account for more than two annotators. It is based on several parameters: the events that need annotation, the mutually exclusive states which a marker can be in, and the annotators. The interpretation of the parameters is first described, then it is explained how the kappa was calculated and the results are subsequently presented.

The three annotators who annotated ten polar questions – that were altered with each update – are referred to as the annotators. The number of annotators was captured by n. The events that need annotation were captured by the number N, and k was the number of possible states the marker could be in.

The situation in which all annotators annotated a particular marker as being in a single state − and thus not in a combination of states − is referred to as the default situation. It could be the case that in such situation the state one annotator annotated differed from the state another annotator ascribed to the marker. The events that needed annotation in the default situation were the ten sample questions. The possible states the marker could be in differ from marker to marker and are explicated in the guideline (see appendix B).

It is possible that at a single sample polar question (i.e., a single event in the default situation) a marker was annotated as being in multiple states. If at least one of the

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annotators ascribed a combination of states C to the marker, then the polar question was not interpreted as a single event, but it was rather split into partial events. Each partial event represented one of the states that together constructed the annotated combination of states. If at least one of the other annotators observed the marker to be in a state which was different from the states in combination C, then another partial event was created that captured the annotation of this different state. Instead of the single polar question all partial events were added to the events that needed annotation. Since some annotators could fail to observe some of the combination's states, an 'unobserved' state was added to the possible states a marker could be in.

Table 2 represents the states that were ascribed to the body position marker by the three annotators. These annotations were based on the third version of the guideline. This table serves as an illustrative example of the possibilities which are described in the previous two paragraphs.[7] Polar question 4 (event 4) illustrates a default situation in which the three annotators ascribed the same single state to the marker: they all annotated the body position with 'tilted'. The other version of the default situation in which all annotators ascribed a single state to the marker but the state differed between the annotators is present at polar question 1 (event 1): two annotators annotated 'uncertain' and the other annotated 'neutral'. The situation in which all annotators annotated the same combination of states is the case at polar question 10. The three annotators all observed both a backwards lean (partial event: 10a) and a tilted position (partial event: 10b). In polar question 5 (events 5a and 5b) another situation is visible: one annotator annotated a combination of states (leaning forward and backwards), whereas the other two annotators only observed one of the states in this combination (leaning forward).[8] Lastly, polar question 8 (events 8a, 8b, and 8c) shows the situation in which one annotator observed a combination of states (tilted and leaning backwards) and at least one of the other annotators annotated the body position to be in a state that differed from the states in the combination (neutral).

events	N	leaning forward	neutral	tilted	uncertain	unobserved	leaning backwards	P_i
1	1	0	1	0	2	0	0	0.333
2	2	0	2	0	1	0	0	0.333
3	3	1	1	0	1	0	0	0
4	4	0	0	3	0	0	0	1
5a forward event	5	3	0	0	0	0	0	1
5b backwards event	6	0	0	0	0	2	1	0.333
6a tilted event	7	0	0	3	0	0	0	1
6b forward event	8	1	0	0	0	2	0	0.333
7a forward event	9	2	0	0	0	1	0	0.333
7b tilted event	10	0	0	2	0	1	0	0.333
7c backwards event	11	0	0	0	0	1	2	0.333
8a neutral event	12	0	1	0	0	2	0	0.333
8b tilted event	13	0	0	2	0	1	0	0.333
8c backwards event	14	0	0	0	0	2	1	0.333
9	15	0	0	3	0	0	0	1
10a backwards event	16	0	0	0	0	0	3	1
10b tilted event	17	0	0	3	0	0	0	1
total	17	7	5	16	4	12	7	9.333
p_j		0.137	0.098	0.314	0.078	0.235	0.137	

Table 2. Body position marker annotations based on the guideline's third version

[7]Other markers (at other guidelines) were analysed similarly.

[8]It was assumed that in case the annotators annotated the same state (in a combination), they were referring to the same moment in the fragment of the polar question.

Table 2 also serves as an illustration of the calculation of Fleiss' kappa (i.e. the inter annotator agreement rate) for a marker. The events that needed annotations are listed in the first column and in the second column the number of these events are tracked (the total number N is 17). The possible states the body position could be in is captured by column three to eight ($k = 6$). The three annotators ($n = 3$) ascribed for each sample question a certain (combination of) state(s) to the body position. Each row represents an event and at each state's column the number of annotators that annotated the event to be in that particular state is listed. For example, at the fifth event (5a; polar question 5) all annotators annotated 'leaning forward' and zero of the annotators annotated the other states. Furthermore, at the sixth event (5b; still polar question 5) one annotator annotated 'leaning backwards', since two annotators did not observe the backwards movement a '2' is placed in the 'unobserved' cell, and because none of the annotators annotated any other states the other cells at row six get a '0'.

To calculate Fleiss' kappa some numbers needed to be determined: p_j for each j, P_i for each i, $\bar{P}$, and $\bar{P}_e$. The p_j is represented at the last row and it captures the proportion of all annotations that were assigned to the jth state. $j = 1$ is at column three, and $j = k$ is at column eight. This p_j number was determined using the formula: $\frac{1}{Nn}\Sigma_{i=1}^N n_{ij}$. For example, p_1 represents the proportion of all body position's annotations that were to the 'leaning forward' state: 0.137.

The last column represents P_i, which captures for each event to what extent the annotators agree about the annotation. P_i for each i was determined by $\frac{1}{n(n-1)}[(\Sigma_{j=1}^k n_{ij}^2) - (n)]$. At event 1 − for example − the annotators agreed about their annotation for 0.333. Full agreement between the annotators would mean that the P_i is 1 and no agreement results in a P_i of 0.

For the kappa the mean of P_i's ($\bar{P}$) was calculated using $\frac{1}{N}\Sigma_{i=1}^N P_i$ ($\bar{P} = 0.549$). The sum of the square number of each p_j ($\bar{P}_e$) was required as well: $\Sigma_{j=1}^k p_j^2$ ($\bar{P}_e = 0.207$). The inter annotator agreement rate for this marker was then calculated using the formula $\kappa = \frac{\bar{P}-\bar{P}_e}{1-\bar{P}_e}$ ($\kappa = 0.431$).

The guidelines were evaluated by comparing their inter annotator agreement rates for all nine markers.[9] In the nine graphs below, the rates for body position, eye gaze, eye shape, eyebrows, head, lip corners, nose, PALMS-UP, and shoulders at the three guidelines are presented. The guidelines are stipulated on the x-axis and the rates on the y-axis.

The rate for almost every marker decreases from the second to the third guideline, only the markers of eye gaze and head increase. The last update results in the highest inter annotator agreement rates for most of the markers. The markers of body position and eyebrows are the only exception, as the rates of both markers decreased compared to

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[9]The chin marker has been left out of the results, because this marker was only present in guideline II and its rate could therefore not be compared with the other guidelines.

guideline II and the body position's rate is also lower than its rate at guideline III.
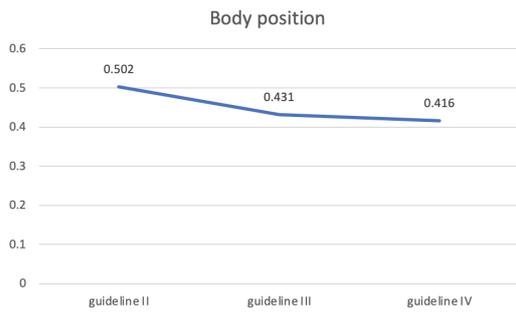
Figure 10. IAAR for body position

Figure 11. IAAR for eye gaze
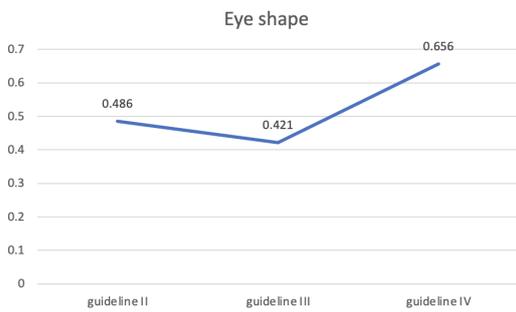
Figure 12. IAAR for eye shape
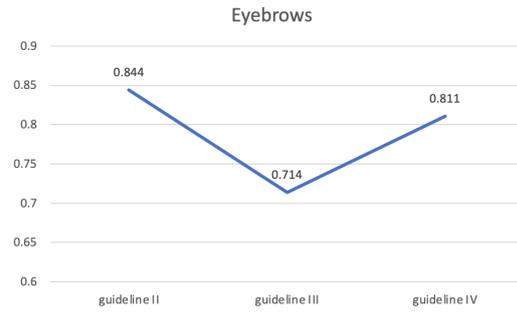
Figure 13. IAAR for eyebrows
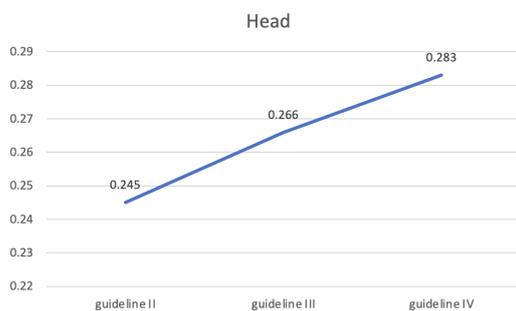
Figure 14. IAAR for head
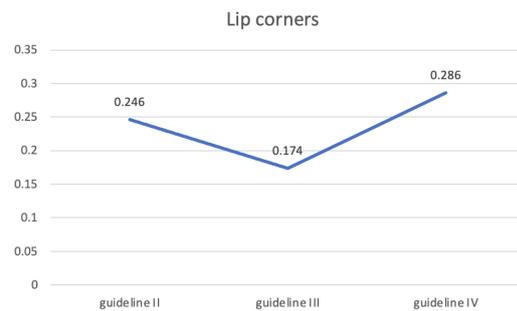
Figure 15. IAAR for lip corners
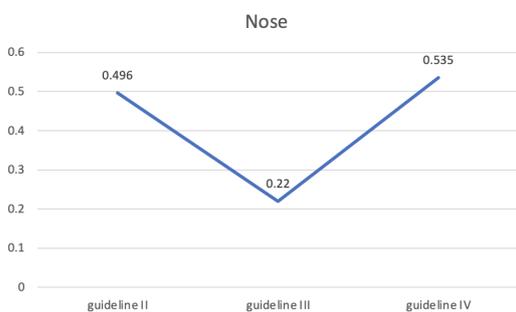
Figure 16. IAAR for nose
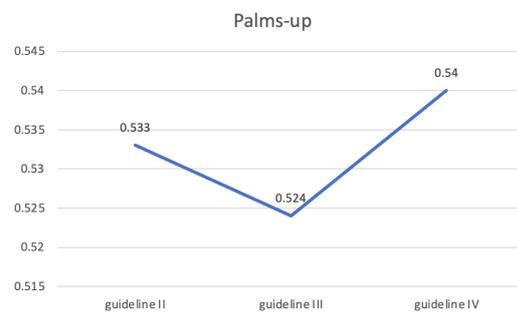
Figure 17. IAAR for PALMS-UP

Figure 18. IAAR for shoulders

Since most markers are most successful at the fourth guideline, this version is used as a foundation upon which the remaining annotations in this project are based.[10] In the graph below (figure 19) the rates (y-axis) of all markers (x-axis) at guideline IV are explicated. The different colours in the graph represent different interpretations (Landis and Koch 1977, p. 165): poor agreement (rate is < 0.00), slight agreement (rate is between $0.00 - 0.20$), fair agreement (rate is between $0.21 - 0.40$), moderate agreement (rate is between $0.41 - 0.60$), substantial agreement (rate is between $0.61 - 0.80$), and almost perfect agreement (rate is between $0.81 - 1.00$).
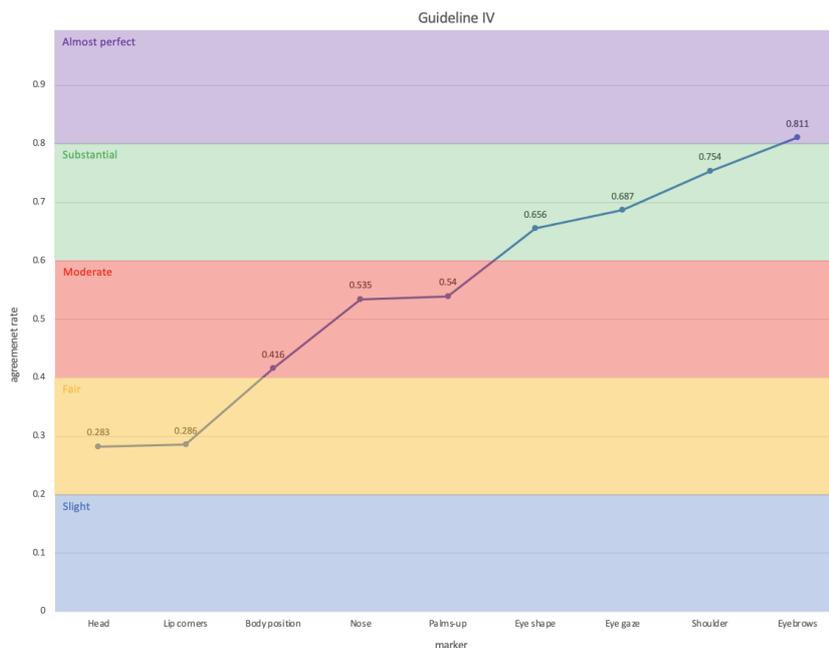
Figure 19. IAAR for each marker in guideline IV

Most markers are interpreted as being moderately or substantially agreed upon (moderate: body position, nose, PALMS-UP and substantial: eye shape, eye gaze, shoulders). The agreement on the eyebrows marker is even almost perfect. Only the markers of lip corners

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[10]The two markers that scored lower compared to the rates at the previous guidelines are body position and eyebrows. Despite their lower rates, the fourth version of those markers' sections is kept in the final guideline. For the eyebrows this is because it is expected that the decrease in rate is not due to the updates of the eyebrow section, because only minor adjustments were made. The adjustments in the body position section however might have influenced the decrease in rate, but since these adjustments are relevant for the potential meaning the body position marker conveys this version of the section is retained in the final guideline.

and head end up having a fair agreement, this means that there was quite some variance between the annotators' annotations of these markers. It is important to hold the markers' agreement rate in mind: state annotations of lip corners and head are less reliable than the annotations of the other markers, according to their rates.[11]

2.3   Data analysis

Based on the final version of the guideline (see appendix B), 448 identified questions were annotated by the author. The computer software ELAN Linguistic Annotator (Max Planck Institute for Psycho-linguistics 2022) and the template 'biased-question-time-subdivision' (Oomen 2022) were used to annotate. As a consequence of variation in corpus data, time was not further specified than the sequence in which different states of a marker occur within a question's fragment. This means that if within such fragment different non-neutral states of a marker were present these were annotated in the accurate order, however the precise time frames in which these different states occur were disregarded.

Figure 20 below represents the annotation of one of the annotated questions. At the question tier (the first row in figure 20) the scope of the question was determined. Within the question's scope, the states of one manual marker and of eight non-manual markers − which are described in the guideline − were annotated.[12]

Figure 20. Annotation in ELAN of the question which is translated as 'bent u slechthorend?' (translation: 'are you hard of hearing?')

The annotated questions were subsequently extracted from ELAN and displayed in rows

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[11]To align with parallel research on (biased) polar questions in NGT some changes are made to the states' names: 'low' → 'lowered', 'other participant' → 'addressee', 'experimenter' → 'researcher', 'uncertain' → 'other'. It is also decided to annotate the head movements of chin in and chin out in a separate tier (head$_1$) than the head movements of nod, nodding, shake, and shaking (head$_2$), as the head movements within the tier are more related to each other and less to the movements in the other tier.

[12]'NMM' refers to non-manual marker and 'MM' to manual marker. The non-manual marker 'head' is subdivided in 'head$_1$' and 'head$_2$', respectively to capture the chin and the nodding/shaking movements. The use of signs and the action of mouthing are potentially annotated in the corresponding tiers.

and columns. Each column represented a different marker and each row captured a different question. Each cell thus denoted the particular marker's states that occurred in the specific question. This is illustrated by table 3 below, which represents five of the annotated questions.

index	NMM.eyebrows	NMM.eye-gaze	NMM.body-position	NMM.head2	NMM.head1	NMM.eye-shape	NMM.nose	MM.PU	NMM.lip-corners	NMM.shoulders
0	raised	addressee	backward	neutral	chin in, chin out	neutral	neutral	yes	neutral	neutral
1	other	addressee	tilted, forward	neutral	chin out	squeezed	wrinkled	no	neutral	neutral
2	neutral	researcher	neutral	shaking	chin out	neutral	neutral	no	down	neutral
3	neutral	addressee	forward, backward	nodding	chin out, chin in	neutral	neutral	no	neutral	up
4	neutral	addressee	other	shaking	neutral	neutral	neutral	yes	neutral	other

index	Translation in Dutch	Translation in English
0	Dat van die 2, heb je dat begrepen?	That of those 2, do you understand that?
1	Bent u slechthorend?	Are you hard of hearing?
2	Maar dat betekent dat je met IVF niet het gen voor doofheid weg kunt halen?	But that means you cannot remove the gene for deafness with IVF?
3	Kun je dat tegenover jezelf wel maken?	Can you do that to yourself?
4	of niet?	or not?

Table 3. Five annotated questions: first five rows capture the (non-)manual markings and the latter five rows display the questions' translations in Dutch and English

In order to analyse the annotated data it was necessary to first convert the categorical values into numbers, this conversion and further coding of the data is described in the next subsection (subsection 2.3.1). Subsequently, the dimension reduction and clustering techniques − which were also used for the data analysis − are discussed in subsections 2.3.2 and 2.3.3.

2.3.1 Coding of data

The annotated data was converted from categorical to numerical values. The rows of the resulting conversion still represented the identified questions, whereas the columns were replaced by new columns that each represented a unique marker-state combination (e.g., eyebrows_raised) and the columns together captured all possible marker-state combinations. A cell was marked with a 1 if the cell's question (specified by row) was annotated with the particular marker-state combination (specified by column) and a 0 otherwise.[13]

Because the technique which was used to analyse the data (see subsections 2.3.2 and 2.3.3) works better with a lower number of columns, some less relevant columns were disregarded. The columns that represented markers combined with 'neutral' or 'other' states were removed, respectively because this project is interested in which *non-neutral* states are used when polar questions are asked and because this project bases its analysis on the states that were annotated with certainty, which are the *non-other* states. The no

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[13]With this conversion some details were lost. The occurrence of states − which is still captured after the conversion − is in this project of more importance than the sequence in which the states occur. The states' order was no longer apparent after the conversion. The number of occurrence of a state could have been captured. However, when the questions would then be compared to each other this would result in an undesirable difference between a question in which a particular state occurred only once (e.g., $head_2$: nod → $head_2$_nod: 1) and a question in which the same state occurred more often (e.g., $head_2$: nod, nod, nod → $head_2$_nod: 3): the absolute difference at these coordinates between these questions would be 2. Because a state's occurrence is considered to be of more importance than how often the state occurred, the difference between questions in which equal marker-state combinations occur was required to be minimized: an absolute difference of 0. Therefore, a 1 was assigned in case a state was present regardless of how often it occurred. The state's number of occurrences within a question was thus lost.

PALMS-UP column was also removed because not using the PALMS-UP sign was fully captured by the zeros in the PALMS-UP column.

The researcher in the Corpus NGT videos is positioned higher than the participants (a standing versus sitting position). Since this potentially leads to non-manual marking which is not due to asking a polar question, the questions in which the participant's eye gaze is at the researcher were removed. Since the sideways body position mostly occurred in combination with looking at the researcher the column that corresponded with this marker-state combination was discarded. Since the questions were primarily asked by looking at the addressee, the column that captured this marker-state combination did not convey much information and was therefore removed.[14]

The columns that represented the head movements of nod and nodding were merged together and so were the columns of the shake and shaking head movements, because these markings are closely related: the head movement of nod and shake are single variants of the continuous movements of − respectively − nodding and shaking. The cells in the resulting nodding column consisted of a 1 at the rows in which a nod, nodding or both were present and the same was the case for the shaking column where a shake, shaking, or both were present.

All marker-state combinations were given equal weight in the current representation. However, literature on questions in sign language (Cecchetto 2012; Zeshan 2004) associates only particular markers with asking questions. To account for the dominance of these markers, the evident question markers (and their states) received a value of 4 instead of 1.

Cecchetto (2012, p. 294) argues that for sign languages in general raised eyebrows are crucial in polar questions, which is supported by Coerts (1992, pp. 107 - 111) for polar questions in NGT. Although lowered eyebrows are generally associated with content questions (Cecchetto 2012, p. 294), Vos, Kooij, and Crasborn (2009) observed that the combination of *lowered* eyebrows with an inner and outer brow raise also occurs in polar questions. This particular brow marking is in this project interpreted as lowered eyebrows (see appendix B.1). From these studies it follows that raised and lowered eyebrows are both relevant markers for polar questions. These markers therefore both received the value 4.

According to Coerts (1992, p. 107) head forward is also a polar question marker in NGT. The markers that most accurately capture the head forward marking in the current project are the markers of chin out and chin in. 'Chin out' captures the chin forward movements and 'chin in' the chin down movements (the upper head is moving forward as the chin moves down). However, both markers also include head backward movements: 'chin in' captures the chin backward movements and 'chin out' includes chin up movements

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[14]After the questions in which the eye gaze was at the researcher were removed 328 of the 448 questions remain. Only in 16 of these remaining questions the eye gaze is not directed at the addressee.

which entail a head backwards tilt.[15] Since the head forward marking was not accurately captured by any of this project's markers, no other markers than eyebrows received the value 4.

This project focuses on the (non-)manual marking of polar questions in NGT, therefore most weight was given to the markings which are known to be of importance when using polar questions in NGT. Since questions are not asked in isolation but in the course of a conversation, markers which have conversational impact may also influence the question's form and meaning. In this project the weight of the markers which are known to have a conversational function was therefore increased, but to a lesser extent than the weight of known question markers. In human behaviour in general, the head movements of nodding and shaking are known for their conversational function (Heylen 2006, pp. 245 - 249): they, for instance, convey respectively confirmation and negation. In sign language, and more specifically NGT, changing or highlighting the polarity of a sentence, providing positive or negative feedback, giving empathetic stress, and marking a boundary of a phrase are some of the conversational roles which the markers of nodding and shaking fulfil (Pfau and Quer 2010, pp. 387 - 388; Klomp 2021, pp. 135, 144, and 288). In this project, a value 2 instead of 1 was assigned to these markers, because of their known conversational role.[16]

The coding file 'convert_data.py' presents the algorithm which was used to convert the annotated data from categorical into numerical values. This algorithm was also used to remove the less relevant columns. The file 'del_row_res.py' captures the code which was used to remove the rows in which the participant's eye gaze is at the researcher. The coding of the data resulted in 328 questions (rows) and 17 marker-state combinations (columns). The five annotated questions of table 3 were converted into the questions that are captured by table 4 below.

index	lowered_eyebrows	raised_eyebrows	space_eye-gaze	forward_body-position	backward_body-position	tilted_body-position	chin out	chin in	squeezed_eye-shape
0	0	4	0	0	1	0	1	1	0
1	0	0	0	1	0	1	1	0	1
3	0	0	0	1	1	0	1	1	0
4	0	0	0	0	0	0	0	0	0

index	wide_eye-shape	wrinkled_nose	PALMS-UP	up_lip-corners	down_lip-corners	up_shoulders	nodding	shaking
0	0	0	1	0	0	0	0	0
1	0	1	0	0	0	0	0	0
3	0	0	0	0	0	1	2	0
4	0	0	1	0	0	0	0	2

Table 4. Four converted questions which correspond to the annotated questions in table 3. The eye gaze was at the researcher in the second question of the five annotated questions in table 3, therefore this question was removed in the converted data set.

2.3.2 Dimension reduction

The coded data set was interpreted by using the distance-based clustering technique of k-means, which ideally groups the related questions in the data set together and separates

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[15]The differences between marker's states are very subtle, especially in unconditioned corpus data. The movements of chin up and forward, and chin backward and down are more similar to one another than the different head forward and head backward movements. To best guarantee the inter annotator reliability, the distinction between chin_out and chin_in was made instead of the distinction between head_forward and head_backward.

[16]The value 4 was not assigned to these markers, because they are not typically associated with polar questions.

the questions that are less related (Assent 2012, pp. 340 - 341). The data set consisted of 17 dimensions: the marker-state combinations. A high number of dimensions results in ineffective distance-based clustering, because similar and dissimilar data points can no longer be discriminated from each other based on their closeness in distance (Assent 2012, p. 342). Dissimilar data points are then inaccurately clustered together, because based on different dimensions they could both have their minimum distance to the same cluster. Distance-based clustering techniques could still be suitable for the analysis of the data set when its dimensions are reduced. In the current project the dimension reduction technique of principal components analysis (PCA) was applied to the data set. This subsection describes this technique and discusses its limitations.

Principal component analysis is a technique which reduces the dimensions of a data set while retaining as much of its information as possible (Jolliffe and Cadima 2016, p. 1). Since in the context of a large data set information is seen as variation between data points, PCA aims at preserving the highest degree of variance in the data set (Ringnér 2008, p. 303). This is realised by finding principal components that successively maximize variance (Jolliffe and Cadima 2016, p. 2). The components that are less significant − because they do not express much variance − are removed: the number of dimensions is reduced.

In order to explain the procedure of the dimension reduction technique, a simplified version of the actual data set − to which PCA was applied − is used as an illustrating example. The actual data set consisted of 328 rows and 17 columns and the simplified version captures the first ten questions of this data set and three of its features (see table 5 below). To these features of raised eyebrows, forward body position, and nodding is referred as the variables x, y, and z.

index	eyebrows_raised	body-position_forward	nodding
0	4	0	0
1	0	1	0
3	0	1	2
4	0	0	0
5	0	0	2
7	4	1	2
8	4	0	2
9	4	1	2
10	4	1	2
11	0	1	0

Table 5. Simplified data set

The first step in the procedure is to calculate the covariance matrix of the three variables (see figure 21 below). This covariance matrix illustrates the relation between those variables: a positive outcome means that the two variables move in the same direction whereas a negative covariance indicates that they move in opposite direction (Schulz and Schaffner 2016, p. 33).

The subsequent step is to find the principal components which are linear combinations of the existing variables formed in such a way that they preserve as much information

$$\begin{bmatrix} Var(x) & Cov(x,y) & Cov(x,z) \\ Cov(y,x) & Var(y) & Cov(y,z) \\ Cov(z,x) & Cov(z,y) & Var(z) \end{bmatrix} = \begin{bmatrix} 4.444 & 2.46e{-}17 & 0.889 \\ 2.46e{-}17 & 0.267 & 0.089 \\ 0.889 & 0.089 & 1.067 \end{bmatrix}$$

Figure 21. Covariance matrix

as possible. All components are orthogonal positioned to one another which results in no overlapping information between the components. Eigenvectors and eigenvalues are linear algebraic concepts which satisfy the above described properties. Eigenvectors present the directions of the variance and the associated non-zero eigenvalues present how much variance is carried in each eigenvector (Tzeng and Berns 2005, (p. 86)). To find the principal components the eigenvectors (v_1, v_2, v_3) and eigenvalues ($\lambda_1, \lambda_2, \lambda_3$) of the covariance matrix need to be calculated (see figure 22 below).

$$v_1 = \begin{bmatrix} 4.040 \\ 0.020 \\ 1 \end{bmatrix} \qquad v_2 = \begin{bmatrix} -0.248 \\ 0.150 \\ 1 \end{bmatrix} \qquad v_3 = \begin{bmatrix} -0.212 \\ -7.02 \\ 1 \end{bmatrix}$$
$$\lambda_1 = 4.66 \qquad\quad \lambda_2 = 0.859 \qquad\quad \lambda_3 = 0.254$$

Figure 22. Eigenvectors and eigenvalues of the covariance matrix

The principal components are represented by the eigenvectors. The first component v_1 captures 80% of the information, the second principal component v_2 captures 15%, and the rest of the information is captured by the last principal component v_3. The first two components capture 95% of the simplified data set's information, by discarding the last component the dimension would be reduced from three to two.

This procedure was followed for the actual data set, which consisted of 17 variables. The number of principal components that were kept in this case was decided by determining at which point an extra component does no longer result in significantly more variance. The knee locator algorithm Kneedle was used to find that point (Satopää et al. 2011). This algorithm was applied on the data, that is expressed by the graph which displays the number of principal components on the x-axis and the cumulative covered variance on the y-axis (see figure 25). The algorithm first created a difference curve which was based on the perpendicular distances from the data points to the diagonal that connected the first data point to the last (Satopää et al. 2011, p. 168). Then, local maxima were detected, which are the points on the difference curve such that both its former and its subsequent point lay lower on the curve, and for each of these maxima a threshold was set (Satopää et al. 2011, p. 169). Finally, when a difference value (point on the difference curve) was below the threshold before the next local maximum was reached, the desired number of components was determined to be the x-value attached to the corresponding local maximum. In this project it was decided that the minimum covered variance should be 85 per cent, therefore the Kneedle algorithm was applied to the data that consisted only of the principal components that cumulatively represented at least 85 per cent of the

variance.

PCA has some limitations, one of which is that the data set requires standardisation which might be inappropriate as with standardisation the data points are adjusted. This standardisation seems necessary because columns with a wider range of values are more dominant in PCA. Applying PCA to an unstandardised data set could lead to biased results. Since in this project the range of some columns was increased on purpose[17] − to give them priority − it was abstained from standardisation.

Another constraint of PCA is that it works most accurately on linear data because PCA represents the original data by creating principal components that are *linear* combinations of the dimensions in the original data set. Whether a data set is linear can intuitively be explained by considering the graphs below which represent two simplified data sets that consist of two dimensions. The data that is expressed by figure 23 is said to be linear because a straight line through the data points would quite accurately represent the data, as the projected points are close to the actual data points. In contrast, the data in figure 24 cannot be accurately captured by a line, because the position of the actual data points differ a lot from where the projected points are situated. This data is therefore said to be non-linear.
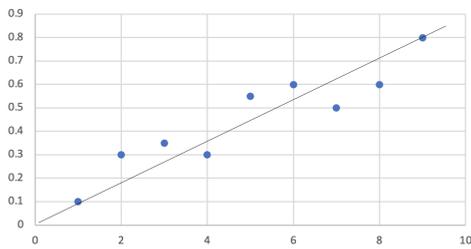
Figure 23. Example of linear data
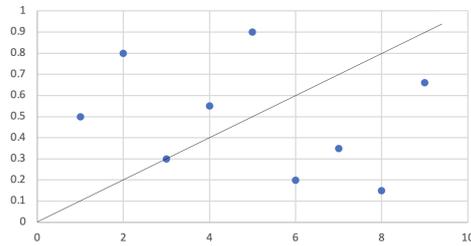
Figure 24. Example of non-linear data

To test whether a data set with higher dimensionality is linear the scatter-coefficient metric was used. The intuition behind this measure is that the hyper-volume of the data set decreases when there is an increase of correlation between the data points: a value close to zero[18] indicates that there is enough correlation within the data such that it can be expressed by fewer dimensions (Toledo 2022). For this project's data the coefficient returned the value of 0.0082: the data satisfied PCA's linearity condition.[19]

A third limitation of PCA is that the number of remaining principal components needs to be manually determined. In this project a minimum percentage of covered variance was set and the Kneedle algorithm was used to optimally select the number of remaining components, given this limitation.[20]

An additional disadvantage of PCA is that the application of PCA results in columns

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[17]The columns of lowered-eyebrows, raised-eyebrows, nodding, and shaking.
[18]The maximum value is the number of dimensions, which is 17 in this project.
[19]Relevant coding file: pca_test.py.
[20]Relevant coding file: pca_converter.py.

consisting of real numbers which are not straightforward to interpret. However, in this project this PCA-converted data was solely used to apply the clustering method k-means to. The result of this clustering is analysed by using the data set prior to its PCA transformation.

A final shortcoming of PCA is that it cannot detect the data set's outliers. Outliers are data points that are different from the other data points because they are positioned at a further distance. The outliers were detected prior to applying PCA. For each data point the distance to every other data point was calculated and the distance to its ten closest neighbours was summed. The outliers were then detected by determining the data's spread using the measure of first quartile (25th percentile of the data), third quartile first 75th percentile of the data), and interquartile range (IQR: difference of the 75th and 25th percentiles of the data). The data points that lay $1.5 \times$IQR below the first quartile or $1.5 \times$IQR above the third quartile were identified as the data set's outliers (Grech 2018, p. 56). Twelve outliers[21] were detected of which eight were at closest distance to other outliers, this may indicate that these eight data points will be clustered together.[22] They were characterised as having both lowered and raised eyebrows, and since such data points are relevant in this project, it was decided to keep all outliers in the data set to which PCA is applied.

With awareness of PCA's limitations, its algorithm (Pedregosa et al. 2011a) was applied on this project's coded data set. The knee locator algorithm was then applied to the graph of which the leftmost data point referred to the first principal component that had a cumulative covered variance above 0.85. The number of principal components was determined to be 12 with a cumulative covered variance of 0.953 (see figure 25 below). Subsequently, the PCA algorithm − with its parameter set at 12 − converted the coded data set.[23]
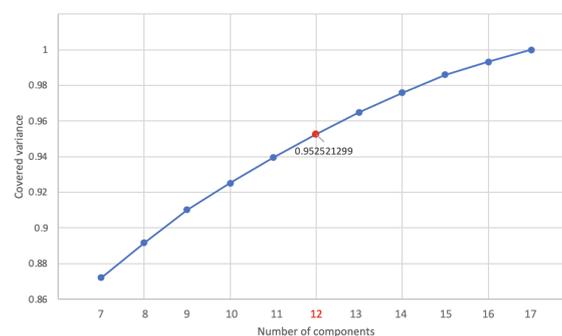
Figure 25. Principal components and the covered variance

2.3.3 Clustering

The PCA-converted data set was clustered using the technique of k-means. In this technique distances from data points to clusters' centers are essential for assigning similar data

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[21]The indices that refer to these outliers are 24, 30, 58, 71, 100, 125, 129, 190, 195, 196, 298, and 425.

[22]Relevant coding file: detect_outlier.py.

[23]Relevant coding file: pca_converter.py.

points to the same cluster, and those that are unrelated to different clusters (Likas, Vlassis, and Verbeek 2003). This clustering technique and its limitations are further explained in the current subsection.

The technique of k-means creates k distinct new data points as the initial clusters' centers, the value of k is set beforehand. For each data point x, the distances to each of the k centers c is calculated, using the Euclidean distance measure (in the current project this means that each row in the PCA-converted data set was represented by x, and for each x $\delta = \sqrt{(\Sigma_{i=0}^{11}(x_i - c_i)^2)}$ was calculated).[24] Each data point is then assigned to its nearest cluster. Subsequently, the means of the newly created clusters are calculated and set as the new clusters' centers. The entire process is then repeated: calculating the distances from data points to new centers, reassigning the data points to the (potentially) new nearest cluster and creating the new centers by calculating the clusters' means. The clustering is finished when each data point is assigned to the same cluster as in the last iteration.

One of the limitations of this method is that the number of clusters k should manually be determined and set prior to the use of the algorithm. Since data sets with more than three dimensions are hard to visualise it is not always obvious what number k should be. In this project, the optimal number for k is determined by using the elbow method (Nainggolan et al. 2019) and the knee locator algorithm (see subsection 2.3.2). Given a range of potential values for k the elbow method determines for each k the sum of squared errors (SSE). Based on the different markers and polar question forms, the number of clusters was expected to be between 10 and 30, in the current project the range was therefore set a bit wider: between 2 and 35. For each k in the fixed range, the squared distance from each data point x to the cluster center c that is closest to x was calculated by $\Sigma_{i=0}^{11}(x_i - c_i)^2$, and these distances were summed to form the SSE. The k values and their corresponding SSE scores were represented in a graph. The same knee locator algorithm that has been used to determine the remaining number of principal components was applied to the graph to select the optimal number of clusters.[25]

A second shortcoming of k-means is that its results are dependent on initial values, one of which is the number of clusters that is discussed in the former paragraph. k-means also depends on the randomly selected initial centroids because different initial clusters' centers may lead to very different clustering results. Whether particular initial centroids are a good choice can be evaluated by analysing the results which are based on these centers. Since analysing the entire clustering is very time consuming, another measure was needed. In this project the clustering that has the lowest SSE given the optimal number

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[24]Each data point and each center consists of 12 elements. The difference between the i-th number of x and the i-th number of c ws calculated and squared. The results for all i's were summed and by taking the square root of this sum the distance between the data point and the center was obtained.

[25]Relevant coding file: elbowmethod_pca.py.

of clusters k was therefore viewed as the optimal result. Random_state is a parameter in the k-means algorithm which makes the clustering results reproducible (Pedregosa et al. 2011b). By assigning an integer to this parameter the result of k-means corresponding to this integer is saved. In this project each integer in the range from 0 to 4000 was assigned to the parameter random_state. For each random_state value the optimal k was determined and the SSE value at this optimal k was saved. The value of random_state that returned the lowest SSE at the selected k was set to be the random_state value based on which the k-means algorithm was executed.[26]

Another limitation of k-means is the inadequate performance as the number of dimensions increases which is discussed in the previous section (subsection 2.3.2) and was responded to by applying PCA to reduce the data set's dimension.

Similar to PCA, another constraint of k-means is that it does not detect outliers. Prior to executing k-means, outliers in the PCA-converted data set were detected using the same method that has been used for outlier detection in the pre-PCA-converted data set. Fourteen outliers[27] were detected of which twelve were the data points that corresponded to the outliers in the pre-PCA-converted data set.[28] The outliers are kept in the data set to which k-means is applied, for the same reason as was given in subsection 2.3.2.

A last limitation of k-means is that it is less suitable for non-spherical shaped clusters with varying sizes and densities. It is not clear to what extent this limitation influenced the current project because it is unknown what shape the data has as the data points which consist of more than three dimensions cannot be visualised.

Prior to executing k-means on the PCA-converted data set, the best integer for the parameter random_state was determined at 3785 which gives the lowest SSE score of 595.43. Also, the optimal number of clusters was determined by using both the elbow method and the knee locator algorithm: 15 (see figure 26 below).[29] By applying the k-means algorithm to the PCA-converted data $-$ with its parameters random_state and number of clusters set at 3785 and 15 $-$ each of the data set's questions was assigned to a cluster.[30]

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[26]Relevant coding file: elbowmethod_pca.py.

[27]The indices that refer to these outliers are 24, 30, 58, 71, 100, 125, 129, 190, 195, 196, 298, 393, 414, and 425.

[28]Relevant coding file: detect_outlier.py.

[29]Relevant coding file: elbowmethod_pca.py.

[30]Relevant coding files: clustering.py, cluster_spread.py, append_trans.py, and order_clusterdfile.py.
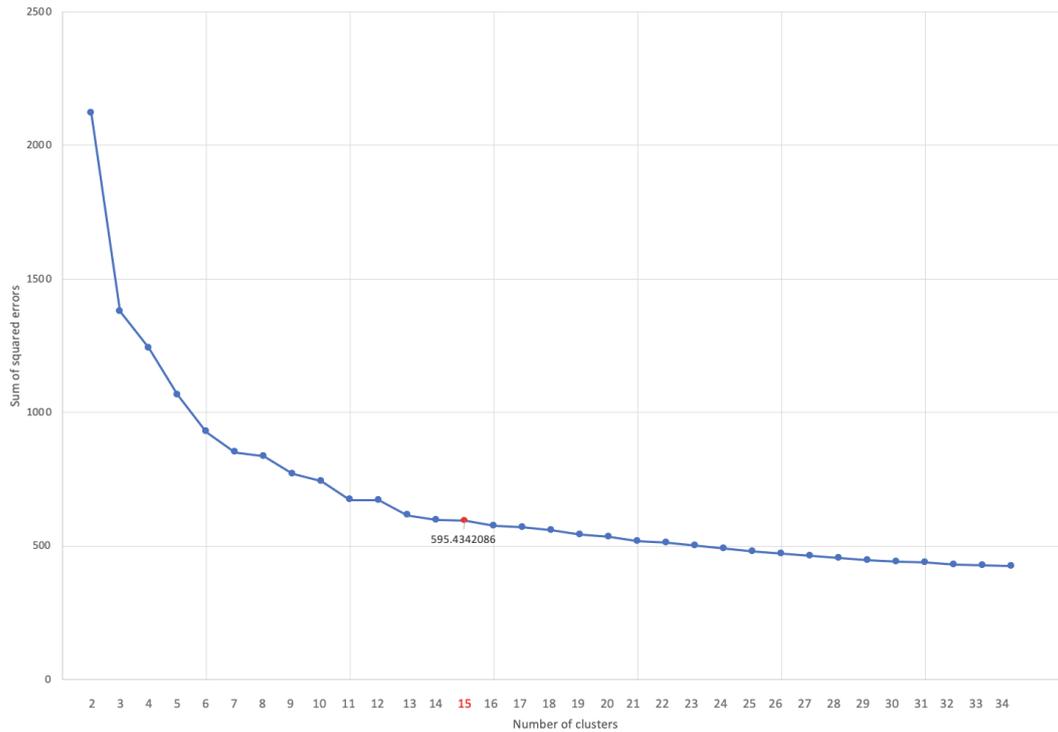
Figure 26. Optimal number of clusters

2.4 Results

This section presents an analysis of the use of (non-)manual markers in polar questions of the Corpus NGT, based on the clustering result. In subsection 2.4.1 the clustering result is first described by characterising the fifteen clusters in terms of the (non-)manuals that are used in the data points within each of these clusters, and secondly by analysing the cluster spread. Subsequently, subsection 2.4.2 reflects upon the clustering result, by identifying global patterns in the use of (non-)manuals.

2.4.1 Clustering result

All fifteen clusters are characterised by the presence of specific marker-state combinations in the cluster's data points. The tables below capture which marker-state combinations are present to what degree in each cluster. In this project, a marker is interpreted as an important feature to a cluster in case the marker is present in half or more of the cluster's data point, because the marker then occurs in the majority of the cluster's data points. Below each table the number of data points within the cluster are stated.

The data point that describes the cluster's properties best is referred to as the cluster's characterising data point. The right most column at each table shows which features are present at such a data point. These characterising data points are further specified: below each table the translation (in Dutch and English), its gloss, and the corresponding video fragment in stills is presented.[31] For most clusters their characterising data point is the

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[31]To each of the 328 data points is referred by an index from 0 to 327, the characterising data points are labeled by the indices to which they correspond.

data point which is at closest distance to the cluster's centroid.[32] However, for clusters 7, 10, 11, and 13 another data point better describes the cluster's features. Below, at the descriptions of these clusters, it is argued in a footnote why such other data point is a better fit.

Characteristics of cluster 0

0%	1 − 24%	25 − 49%	50 − 74%	75 − 99%	100%	characterising data point: 38
eyebrows_raised	eyes_wide (7)	body-position_backward (29)	eye-gaze_space (57)	chin_in (86)		chin_in
eyebrows_lowered	nose_wrinkled (7)	eyes_squeezed (29)	shoulders_up (64)			shoulders_up
nodding	lip-corners_up (14)	PALMS-UP (29)				eye-gaze_space
shaking	body-position_tilted (21)	lip-corners_down (29)				
	chin_out (21)	body-position_forward (36)				

Table 6. 14 data points

Table 6 illustrates that the most prominent feature of this cluster is chin in, as this feature is present in 86% of the data points in this cluster. Other important marker-state combinations are shoulders up and eye gaze in space, because they both occur in more than half of the cluster's data points. All these features are present in the characterising data point.[33] Figure 27 represents this data point in stills.

Dutch translation: 'Je mag er maar een kiezen, toch?'
English translation: 'You can only choose one, right?'
Gloss: no gloss present

Figure 27. The first frame captures the beginning of the fragment, at which the participant's chin is down (chin in). In the second frame the participant is looking in space, and the subtle movement of the shoulder going up is captured in the last frame.

Characteristics of cluster 1

0%	1 − 24 %	25 − 49 %	50 − 74 %	75 − 99 %	100%	characterising data point: 286
eyebrows_raised	body-position_tilted (8)	eyes_squeezed (35)	PALMS-UP (54)		nodding	nodding
eyebrows_lowered	nose_wrinkled (8)	body-position_forward (46)	shoulders_up (62)			chin_in
eyes_wide	lip-corners_down (8)	lip-corners_up (46)	chin_in (73)			shoulders_up
shaking	body-position_backward (12)					PALMS-UP
	eye-gaze_space (15)					squeezed_eyes
	chin_out (15)					

Table 7. 26 data points

Cluster 1 is mainly characterised by the marker of nodding (present in 100% of its data points). The markers of PALMS-UP, shoulders up, and chin in are also influential as they

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[32]The prototypical data points for clusters 0, 1, 2, 3, 4, 5, 6, 8 ,9, 12, and 14 are data points that are closest to their centroids. The relevant coding file for identifying the data points that are closest to the centroids is 'closest_dp.py'.

[33]The ELAN file that captures the characterising data point of cluster 0 is 'CNGT1466.eaf'.

all occur in over 50% of the data points. These marker-state combinations are all captured by the prototypical data point.[34] In this data point the marker of squeezed eyes is also present. Figure 28 represents the characterising data point in stills.

Dutch translation: 'Doven kunnen goed liplezen, toch?'
English translation: 'Deaf people are can read lips well, right?'
Gloss: DOOF-B KUNNEN-A GOED-A ORAAL-B PO

Figure 28. In the first frame the beginning of the fragment is represented. The second frame shows that the participant's chin is down, and eyes are squeezed. In the last frame the PALMS-UP sign is clearly visible. In this third frame, the participant also moves her right shoulder up. The nodding is hard to capture in stills.

Characteristics of cluster 2

0%	1 − 24 %	25 − 49 %	50 − 74 %	75 − 99 %	100%	characterising data point: 12
eyebrows_raised	eyes_wide (2.5)	PALMS-UP (25)	lip-corners_down (50)	eyes_squeezed (87.5)	eyebrows_lowered	eyebrows_lowered
nodding	body-position_tilted (12.5)	shaking (40)	chin_in (55)			eyes_squeezed
	body-position_backward (15)	eye-gaze_space (45)	body-position_forward (60)			chin_out
	lip-corners_up (15)	nose_wrinkled (47.5)	chin_out (62.5)			body-position_forward
	shoulders_up (15)					chin_in

Table 8. 40 data points

The markers of lowered eyebrows and squeezed eyes are most characteristic to cluster 2 (respectively present in 100 and 87.5% of the data points). The markers that occur in 50% or more of this cluster's data points are chin out, body position forward, chin in, and lip corners down. In cluster 2's characterising data point all these features, except lip corners down, are present.[35,36] Figure 29 represents video stills of this data point.

Dutch translation: 'Zeg maar gehandicapt'
English translation: 'Say disabled'
Gloss: AANHALINGSTEKENS GEHANDICAPT-B

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[34]The ELAN file that captures the characterising data point of cluster 1 is 'CNGT0058.eaf'.

[35]The ELAN file that captures the characterising data point of cluster 2 is 'CNGT0814.eaf'.

[36]In this project the radical and the 'or not' part of negative alternative questions are analysed separately, this data point represents a radical of a negative alternative question and it not a question on its own.
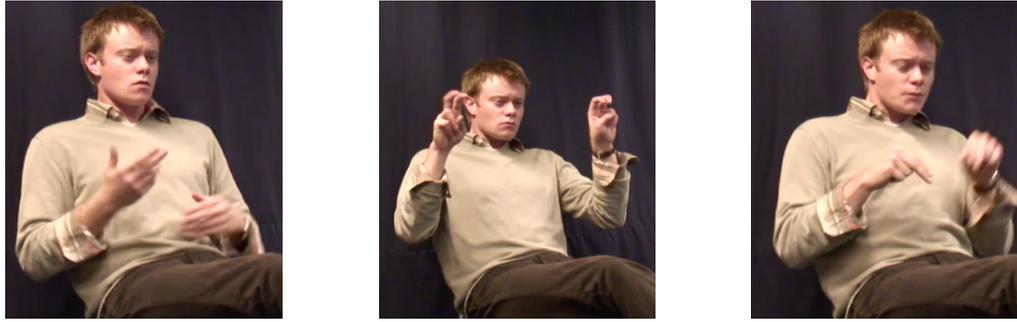
Figure 29. The first frame captures the beginning of the fragment in which the participant's eyebrows are lowered and eyes are squeezed. The participant's chin is down (chin in) and forward (chin out) in the second frame. In the last frame the forward movement of the upper body is represented.

Characteristics of cluster 3

0%	1 − 24 %	25 − 49 %	50 − 74 %	75 − 99 %	100%	characterising data point: 423
eyebrows_lowered	wide_eyes (5)	lip-corners_down (27)	body-position_forward (59)	PALMS-UP (82)	shaking	shaking
eyebrows_raised	nose_wrinkled (5)	nodding (27)	chin_in (59)	chin_out (86)		chin_out
	body-position_backward (9)	lip-corners_up (32)				PALMS-UP
	eyes_squeezed (18)	shoulders_up (32)				chin_in
	body-position_tilted (23)	eye-gaze_space (36)				lip-corners_up

Table 9. 22 data points

Table 9 illustrates the prominence of the shaking, chin out, and PALMS-UP features in cluster 3. The markers of forward body position and chin in are also important because they occur in more than half of the cluster's data points. Apart from the forward body position, the characterising data point consists of all these features.[37,38] The marker of lip corners up is also present in this data point. The video stills in figure 30 represent the prototypical data point.

Dutch translation: 'of niet?'

English translation: 'or not?'

Gloss: PO

Figure 30. The first frame is the beginning of the fragment, it captures the shaking movement as well as the chin in position. The second frame shows the participant's chin up position (chin out). In the last frame, PALMS-UP and lip corners up are also visible.

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[37]The ELAN file that captures the characterising data point of cluster 3 is 'CNGT0012.eaf'.

[38]This data point represents the 'or not' part of a negative alternative question and is not a question on its own.

Characteristics of cluster 4

0%	1 − 24 %	25 − 49 %	50 − 74 %	75 − 99 %	100%	characterising data point: 14
	nose_wrinkled (7)	body-position_backward (29)	eye-gaze_space (50)		eyebrows_lowered	eyebrows_lowered
	lip-corners_up (14)	eyes_wide (29)	eyes_squeezed (57)		eyebrows_raised	eyebrows_raised
	body-position_tilted (14)	lip-corners_down (29)	nodding (57)			body-position_forward
	shaking (21)	PALMS-UP (43)	chin_in (64)			shoulders_up
			chin_out (64)			chin_out
			shoulders_up (64)			chin_in
			body-position_forward (71)			nodding
						eyes_squeezed

Table 10. 14 data points

The most prominent features of cluster 4 are lowered and raised eyebrows. Other important features − which occur in 50% or more of the cluster's data points − are forward body position, shoulders up, chin out, chin in, nodding, squeezed eyes, and eye gaze in space. In the characterising data point these features are present, apart from the eye gaze in space marker.[39] Figure 31 presents video stills of the characterising data point.

Dutch translation: 'Maar dit thema gaat toch om het testen zelf?'
English translation: 'But isn't this theme about testing itself?'
Gloss: PT-1hand ONDERWERP-C GAAN TOCH-A TEST ZELF-A PT-1hand

Figure 31. The first frame captures both lowered eyebrows and squeezed eyes and in the second frame it is also visible that the chin is moved backwards (chin in). The third frame captures the state of raised eyebrows. The body position forward, shoulders up, and chin out is shown in the last frame. The nodding movement is hard to capture in video stills.

Characteristics of cluster 5

0%	1 − 24 %	25 − 49 %	50 − 74 %	75 − 99 %	100%	characterising data point: 442
eyebrows_lowered	body-position_backward (12.5)	eye-gaze_space (25)	chin_in (62.5)	body-position_forward (75)	raised_eyebrows	raised_eyebrows
nose_wrinkled	eyes_squeezed (12.5)	body-position_tilted (37.5)	PALMS-UP (62.5)	chin_out (75)	nodding	nodding
	lip-corners_down (12.5)	lip-corners_up (37.5)	shoulders_up (62.5)	eyes_wide (75)	shaking	shaking
						body-position_forward
						chin_out
						eyes_wide
						shoulders_up
						PALMS-UP
						body-position_tilted

Table 11. 8 data points

The most prominent markers in cluster 5 are raised eyebrows, nodding, and shaking as they are present in all its data points. The other important markers occur in over half of the cluster's data points: forward body position, chin out, wide eyes, shoulders up, PALMS-UP, and chin in. Apart from the marker of chin in, all these features are present in the characterising data point.[40] In this data point the marker of tilted body position is also

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[39]The ELAN file that captures the characterising data point of cluster 4 is 'CNGT0431.eaf'.
[40]The ELAN file that captures the characterising data point of cluster 5 is 'CNGT0429.eaf'.

captured. Figure 32 below represents this prototypical data point in video stills.

Dutch translation: 'Maar wordt er dan ook uitgelegd waarom dat de woordvolgorde is?'
English translation: 'But is it also explained why the word order is like that?'
Gloss: MAAR #W #ER DAN OOK-A UITLEGGEN WAAROM
                     WOORDVOLGORDE PO

Figure 32. The first frame is taken from the beginning of the fragment, in which the right shoulder is up and the eyebrows are raised. The eyes are characterised as being wide. The second frame shows the body in a tilted position. In the last frame both the chin and the body are forward, and the shoulders and palms are up. The shaking and nodding movements are hard to capture in stills.

Characteristics of cluster 6

0%	1 − 24 %	25 − 49 %	50 − 74 %	75 − 99 %	100%	characterising data point: 189
eyebrows_lowered	lip-corners_up (5)	PALMS-UP (26)	eye-gaze_space (58)		nodding	nodding
eyebrows_raised	nose_wrinkled (11)	body-position_tilted (32)	chin_out (68)			chin_out
shaking	shoulders_up (16)	body-position_forward (37)				eye-gaze_space
	body-position_backward (16)	eyes_squeezed (37)				body-position_tilted
	chin_in (16)	lip-corners_down (47)				chin_in
	eyes_wide (16)					

Table 12. 19 data points

The main characteristic of cluster 6 is nodding, because this marker is present in all cluster 6's data points. Two other prominent markers are present in more than half of the data points: chin out and eye gaze in space. This cluster's prototypical data point captures, besides these three markers, also the features of chin in and tilted body position.[41] Figure 33 represents the characterising data point in stills.

Dutch translation: 'Kan dat wel?'
English translation: 'Is that possible?'
Gloss: ECHT-B KUNNEN-A

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[41]The ELAN file that captures the characterising data point of cluster 6 is 'CNGT0284.eaf'.

Figure 33. The beginning of the fragment is captured by the first frame: the participant looks in space and her chin is in. In the second frame the participant's tilted body position is visible. Although the nodding movement is hard to capture, the head movement in the last frame is due to a nodding movement, in this frame the chin is also pushed forward (chin out).

Characteristics of cluster 7

0%	1 − 24 %	25 − 49 %	50 − 74 %	75 − 99 %	100%	characterising data point: 356
eyebrows_lowered	body-position_backward (6)	body-position_tilted (26)	body-position_forward (52)		eyebrows_raised	eyebrows_raised
eyes_squeezed	nose_wrinkled (6)	chin_in (32)			nodding	nodding
shaking	lip-corners_up (10)	lip-corners_down (35)				body-position_forward
	shoulders_up (16)	eye-gaze_space (39)				chin_in
	PALMS-UP (23)	eyes_wide (42)				
		chin_out (48)				

Table 13. 31 data points

The most prominent features of cluster 7 are raised eyebrows and nodding. The feature of body position forward also occurs in more than half of cluster 7's data points. These features are all present in the characterising data point, and so is the marker of chin in.[42,43] Figure 34 represents this data point in stills.

Dutch translation: 'Vind jij dat de vijf gebarentalen moeten opgaan in een gebarentaal?'

English translation: 'Do you think the five sign languages should merge into one sign language?'

Gloss: VINDEN PT-1hand DUS-B 5 VERANDEREN-A PT-1hand 1-A TAAL-B VINDEN-A PT-1hand

Figure 34. The beginning of the fragment is captured by the first frame: the participants eyebrows are raised and the chin is down (chin in). The subtle forward movement of the participant's chest is captured in the second frame. The last frame captures the end of the fragment. The nodding movement is hard to capture in stills.

[42]The data point that is closest to cluster 7's center is 22. In this data point, looking-in-space and wide eye shape are present, but these marker-state combinations occur − respectively − only in 39% and 42% cluster 7's data points. In data point 356, these marker-state combinations are not present, but the marker of chin in is (which occurs in 32% of cluster's data points). Since data point 22 has two features that are not characteristic to cluster 7 and data point 356 only has one, the latter describes cluster 7 better and is therefore considered to be its prototypical data point.

[43]The ELAN file that captures the characterising data point of cluster 7 is 'CNGT1684.eaf'.

Characteristics of cluster 8

0%	1 − 24 %	25 − 49 %	50 − 74 %	75 − 99 %	100%	characterising data point: 62
eyebrows_lowered	eyes_squeezed (6)	body-position_forward (29)	PALMS-UP (53)		eyebrows_raised	eyebrows_raised
body-position_backward	eye-gaze_space (18)	lip-corners_up (29)			shaking	shaking
nodding	body-position_tilted (18)	chin_in (47)				chin_out
	nose_wrinkled (18)	chin_out (47)				eyes_wide
	lip-corners_down (18)	eyes_wide (47)				
	shoulders_up (18)					

Table 14. 17 data points

Table 14 illustrates the prominence of raised eyebrows and shaking in cluster 8, because these markers are present in all its data points. The manual PALMS-UP is present in more than half of the cluster's data points. The characterising data point captures the markers of raised eyebrows and shaking.[44] Besides these markers wide eye shape and chin out are also present at this data point, however, the PALMS-UP sign is not used. In figure 35 the characterising data point is illustrated by video stills.

Dutch translation: 'Alles samen?'
English translation: 'Everything together?'
Gloss: no gloss present
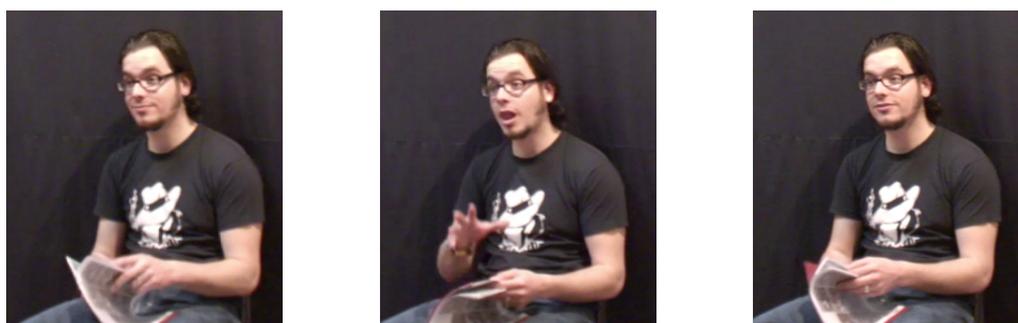
Figure 35. The first frame is taken at the beginning of the fragment, the chin is slightly pushed forward (chin out). The second frame also shows raised eyebrows and wide eyes. The last frame captures the end of the fragment. The shaking movement is hard to capture in stills.

Characteristics of cluster 9

0%	1 − 24 %	25 − 49 %	50 − 74 %	75 − 99 %	100%	characterising data point: 81
eyebrows_lowered	nose_wrinkled (6)	eye-gaze_space (31)		body-position_forward (75)		body-position_forward
eyebrows_raised	shoulders_up (13)	eyes_squeezed (31)		chin_out (75)		chin_out
body-position_backward	body-position_tilted (19)	chin_in (38)				
eyes_wide		lip-corners_up (38)				
PALMS-UP						
lip-corners_down						
nodding						
shaking						

Table 15. 16 data points

Table 15 illustrates that the most prominent features in cluster 9 are chin out and body position forward: they both occur in 75% of all cluster 9's data points. These marker-state combinations are the only features that are present in the characterising data point.[45] Figure 36 represents this data point.

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[44]The ELAN file that captures the characterising data point of cluster 8 is 'CNGT1885.eaf'.

[45]The ELAN file that captures the characterising data point of cluster 9 is 'CNGT0018.eaf'.

Dutch translation: 'Uit Frankrijk?'

English translation: From France?'

Gloss: #F

Figure 36. The first frame represents the beginning of the fragment, in the second frame both features (forward body position and chin out) are present, and the last frame shows the end of the fragment.

Characteristics of cluster 10

0%	1 − 24 %	25 − 49 %	50 − 74 %	75 − 99 %	100%	characterising data point: 310
eyebrows_raised	body-position_backward (11)	lip-corners_up (29)	chin_in (50)		eyebrows_lowered	eyebrows_lowered
	body-position_tilted (11)	body-position_forward (39)	eyes_squeezed (68)		nodding	nodding
	eyes_wide (11)	shoulders_up (39)				chin_in
	shaking (18)	eye-gaze_space (43)				
	nose_wrinkled (21)	chin_out (43)				
	lip-corners_down (21)	PALMS-UP (46)				

Table 16. 28 data points

The features which occur in all cluster 10's data points are lowered eyebrows and nodding. Squeezed eyes and chin in are other prominent features as they occur in 50% or more of the data points. In the characterising data point the features of lowered eyebrows, nodding, and chin in are present.[46,47] This data point is represented in video stills at figure 37.

Dutch translation: 'Bedoelt hij dat iemand met CI zich de moeite wil besparen om geluid waar te nemen met het oor?'

English translation: 'Does he mean that someone with CI wants to spare himself the effort of perceiving sound with the ear?'

Gloss: MISSCHIEN-A BEDOELEN-A CI-A VORM-A OPNEMEN-A MEER GEBAREN-A

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[46] Data point 419 is closest to cluster 10's center but at this data point chin_in (50 %) is absent and both the markers of PALMS-UP and lip corners up are present (respectively 46% and 29%). Although data point 310 lacks the marker of squeezed eyes (which is present in 68% of the cluster's data points), it fits cluster 10 better because it has the chin in marker and lacks the markers of PALMS-UP and lip corners up.

[47] The ELAN file that captures the characterising data point of cluster 10 is 'CNGT0529.eaf'.

Figure 37. In this data point nodding, lowered eyebrows, and chin in are present and it is uncertain whether the squeezed eye shape is. The first frame captures the lowered eyebrows (and potentially the squeezed eyes), in the second frame the chin down movement (chin in) is visible, and the last frame is the end of the fragment. The marker of nodding is hard to capture in stills.

Characteristics of cluster 11

0%	1 − 24 %	25 − 49 %	50 − 74 %	75 − 99 %	100%	characterising data point: 266
eyebrows_lowered	eyes_squeezed (7)	body-position_tilted (29)	shoulders_up (50)	chin_in (86)	eyebrows_raised	eyebrows_raised
body-position_backward	nose_wrinkled (21)	eye-gaze_space (36)	body-position_forward (71)	PALMS-UP (93)	nodding	nodding
shaking	lip-corners_down (21)	lip-corners_up (43)	chin_out (71)			PALMS-UP
			eyes_wide (71)			eyes_wide
						chin_out
						chin_in
						body-position_forward

Table 17. 14 data points

The most prominent features of cluster 11 are raised eyebrows, nodding, PALMS-UP, and chin in: they occur in respectively 100, 100, 91, and 86% of cluster 11's data points. Shoulders up, forward body position, chin out, and wide eyes are other important features, as they occur in 50% or more of the data points. Apart from shoulders up, all and only these features are present in this cluster's characterising data point.[48,49] Figure 38 represents this data point in video stills.

Dutch translation: 'Ben je het er mee eens?'

English translation: 'Do you agree?'

Gloss: PT-1hand MEE-EENS-A PT-1hand PO

Figure 38. The first frame captures the beginning of the fragment in which the participant's eyes are wide, eyebrows are raised, and the chin is in. The body is moving forward in the second frame. The last frame shows the the chin out and PALMS-UP markers. The movement of nodding is hard to capture in video stills.

[48]The data point which is closest to the center of cluster 11 is 202, however in this data point the wrinkled nose feature is present (which only occurs in 21% of the cluster's data points). Although data point 266 lacks the marker of shoulders up, it also lacks the wrinkled nose marker and it therefore fits the cluster better.

[49]The ELAN file that captures the characterising data point of cluster 11 is 'CNGT0128.eaf'.

Characteristics of cluster 12

0%	1 − 24 %	25 − 49 %	50 − 74 %	75 − 99 %	100%	characterising data point: 145
eyebrows_lowered	body-position_backward (9)	eyes_wide (27)	chin_out (55)	PALMS-UP (82)		PALMS-UP
eyebrows_raised	chin_in (9)	lip-corners_down (27)				chin_out
shoulders_up	nose_wrinkled (9)	eye-gaze_space (45)				
nodding	lip-corners_up (9)					
shaking	body-position_tilted (18)					
	body-position_forward (18)					
	eyes_squeezed (18)					

Table 18. 11 data points

Table 18 illustrates that PALMS-UP is the main characteristic of cluster 12. The marker of chin out also occurs in more than half of cluster 12's data points. Both markers are captured in the characterising data point.[50] This data point is presented in video stills by figure 39

Dutch translation: 'Ja?'

English translation: 'Yes?'

Gloss: PO

Figure 39. The beginning of the fragment is captured by the first frame: the participant's chin is forward (chin out). In the second frame the PALMS-UP sign is visible, and the last frame captures the end of the fragment.

Characteristics of cluster 13

0%	1 − 24 %	25 − 49 %	50 − 74 %	75 − 99 %	100%	characterising data point: 65
eyebrows_lowered	eyes_wide (6)	PALMS-UP (28)			shaking	shaking
eyebrows_raised	body-position_backward (11)	lip-corners_up (28)				
nodding	body-position_forward (11)	eyes_squeezed (39)				
	lip-corners_down (11)	chin_in (44)				
	chin_out (17)					
	nose_wrinkled (17)					
	eye-gaze_space (22)					
	body-position_tilted (22)					
	shoulders_up (22)					

Table 19. 18 data points

Apart from shaking − which is present in all data points − cluster 13 is characterised by the lack of markers. Shaking is the only marker present in the prototypical data point of this cluster.[51,52,53] This data point is illustrated in stills at figure 40.

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[50]The ELAN file that captures the characterising data point of cluster 12 is 'CNGT0295.eaf'.

[51]Data point 316 is closest to the center of cluster 13, however in this data point not only shaking but also eyes squeezed (39%) is present. Data point 65 is a better fit because only the shaking marker is present at this data point.

[52]The ELAN file that captures the characterising data point of cluster 13 is 'CNGT1885.eaf'.

[53]In this project the radical and the 'or not' part of negative alternative questions are analysed separately, this data point represents the 'or not' part of a negative alternative question.

Dutch translation: 'of niet?'

English translation: 'or not?'

Gloss: OF

Figure 40. Shaking is the only marker that is present at the prototypical data point, however this movement is hard to capture in video stills. The first frame captures the beginning of the fragment, the second captures the middle, and the last captures the end.

Characteristics of cluster 14

0%	1 − 24 %	25 − 49 %	50 − 74 %	75 − 99 %	100%	characterising data point: 152
eyebrows_lowered	eyes_squeezed (4)	eye-gaze_space (26)	chin_out (54)		eyebrows_raised	eyebrows_raised
nodding	nose_wrinkled (4)	PALMS-UP (26)	chin_in (68)			chin_out
shaking	body-position_backward (6)	body-position_forward (44)				chin_in
	body-position_tilted (14)	eyes_wide (46)				
	lip-corners_down (18)					
	lip-corners_up (20)					
	shoulders_up (24)					

Table 20. 50 data points

Cluster 14's prominent features are raised eyebrows, chin in, and chin out. They respectively occur in 100, 68, and 54% of this cluster's data points. These three markers are the only markers that are present in the characterising data point.[54] This data point is illustrated in stills at figure 41.

Dutch translation: 'Gebaart jouw dochter met jou?'

English translation: 'Does your daughter sign with you?'

Gloss: DOCHTER GEBAREN-A PT-1hand

Figure 41. In this prototypical data point the markers of raised eyebrows (first frame), chin out (first frame), and chin in (second frame) are present. The last frame captures the end of the fragment.

In line with the expectations (see sections 2.3.1 and 2.3.2), the marker-state combinations

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[54]The ELAN file that captures the characterising data point of cluster 14 is 'CNGT0134.eaf'.

of raised eyebrows and lowered eyebrows − to which the most weight was assigned when they were present at a data point[55] − are most influential in forming the clusters. Their influence is apparent because for both marker-state combinations it is the case that in each cluster the marker-state combination is either present in all of the cluster's data points or in none. The presence value of nodding and shaking is lower than the eyebrows and higher than the other marker-state combinations: 2 compared to respectively 4 and 1. The dominance of nodding and shaking is therefore less compared to the eyebrow marking but it is still present: for both markers it is the case that in most clusters the marker is either present in all data points or absent in all data points of the cluster.[56] However, there are a few clusters in which one of the markers is not present, or not absent in *all* the cluster's data points.[57] The other marker-state combinations are less influential because in most clusters they are present in some of the data points and absent in others.

By analysing which of the markers are to what extent present in each cluster it became clear that the clusters are not equally related to each other. Based on the sum of squared distance measure, the distances between each cluster's center was calculated.[58] Table 21 below represents these distances. What stands out is that the clusters which have the same eyebrow markings are grouped together and are distanced from the clusters with different eyebrow markings. For example, the clusters in which all data points have raised eyebrows − and lack another eyebrow marking − are positioned together. These clusters are separated from the clusters with other eyebrow markings (no eyebrow marking, only lowered eyebrows, and both raised and lowered eyebrows).

	cluster 0	cluster 1	cluster 2	cluster 3	cluster 4	cluster 5	cluster 6	cluster 7	cluster 8	cluster 9	cluster 10	cluster 11	cluster 12	cluster 13	cluster 14
cluster 0	0	4.41	17.74	5.27	33.96	25.32	5.02	20.84	20.9	1.27	20.63	21.45	1.48	4.58	16.66
cluster 1	4.41	0	22	6.92	33.6	21.15	1.46	17.16	24.75	5.13	16.56	17.27	5.47	8.49	20.75
cluster 2	17.74	22	0	18.84	18.01	39.41	21.3	37.86	34.82	17.58	4.57	38.74	18.1	18.45	33.89
cluster 3	5.27	6.92	18.84	0	35.4	18.75	6.88	22.88	16.84	5.17	21.44	22.73	4.92	1.34	20.95
cluster 4	33.96	33.6	18.01	35.4	0	19.85	33.61	17.66	20.63	34.36	17.03	17.8	34.76	36.76	18.15
cluster 5	25.32	21.15	39.41	18.75	19.85	0	21.45	4.83	4.63	25.32	35.87	4.21	25.48	21.65	8.58
cluster 6	5.02	1.46	21.3	6.88	33.61	21.45	0	16.33	24.73	4.72	16.69	17.84	4.47	8.73	20.75
cluster 7	20.84	17.16	37.86	22.88	17.66	4.83	16.33	0	8.3	20.65	32.92	1.24	20.58	24.68	4.19
cluster 8	20.9	24.75	34.82	16.84	20.63	4.63	24.73	8.3	0	20.9	39.33	8.77	20.44	16.48	4.15
cluster 9	1.27	5.13	17.58	5.17	34.36	25.32	4.72	20.65	20.9	0	20.91	21.87	1.36	4.87	16.67
cluster 10	20.63	16.56	4.57	21.44	17.03	35.87	16.69	32.92	39.33	20.91	0	33.45	20.93	23.05	36.84
cluster 11	21.45	17.27	38.74	22.73	17.8	4.21	17.84	1.24	8.77	21.87	33.45	0	21.5	25.92	4.81
cluster 12	1.48	5.47	18.1	4.92	34.76	25.48	4.47	20.58	20.44	1.36	20.93	21.5	0	4.82	16.86
cluster 13	4.58	8.49	18.45	1.34	36.76	21.65	8.73	24.68	16.48	4.87	23.05	25.92	4.82	0	20.6
cluster 14	16.66	20.75	33.89	20.95	18.15	8.58	20.75	4.19	4.15	16.67	36.84	4.81	16.86	20.6	0

Table 21. Distances between clusters' centers

The positions of the clusters can be visualised by reducing the dimensions of the clusters' centers to two. Principal component analysis − which is discussed in subsection 2.3.2 − was used to reduce the centers' dimensions and its result is represented in figure 42 below.[59] The super clusters that can be distinguished are titled 'lowered and raised eyebrows', 'lowered eyebrows', 'raised eyebrows', and 'no eyebrow marking'.

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[55] The highest value a marker-state combination received in this project is 4.

[56] For nodding: cluster 0, 1, 2, 5, 6, 7, 8, 9, 10, 11, 12, 13, and 14. For shaking: cluster 0, 1, 3, 5, 6, 7, 8, 9, 11, 12, 13, and 14.

[57] For nodding: clusters 3 and 4. For shaking: clusters 2, 4, and 10.

[58] Since the clusters in k-means are spherical the cluster's center is an accurate point to use as the cluster's reference. The coding file that is used to calculate the distances is 'dis_cent.py'.

[59] The coding file which is used to reduce the dimensions is '2columns.py'.

Clusters 5, 7, 8, 11, and 14 are all located within the super cluster of raised eyebrows. Within this super cluster, the clusters 8 and 14 are grouped together and so are the clusters 5, 7, and 11. This distinction in two subclusters is probably due to clusters 8 and 14 lacking the property of nodding, whereas 5, 7, and 11 fully capture this feature. Cluster 7 and 11 are positioned closer together within the subcluster of 5, 7, and 11. This is potentially because cluster 5 has the property of shaking, which both clusters 7 and 11 lack.

The other super cluster in which some clusters are located considerably closer to each other than to the rest is the super cluster of no eyebrow marking, which consists of the clusters 0, 1, 3, 6, 9, 12, and 13. Within this super cluster, clusters 1 and 6 are grouped together, probably because they both capture the feature of nodding. Clusters 0, 9, and 12 are also positioned close together, as they all lack the property of nodding and shaking. Cluster 13 is positioned quite close to this subcluster, potentially because it also lacks the property of nodding, but shaking is fully present in this cluster. Cluster 3 is positioned separate from the rest of the clusters in this super cluster, because this is the only no eyebrow marking cluster which has shaking as its characterising feature and in which nodding is present at some data points.
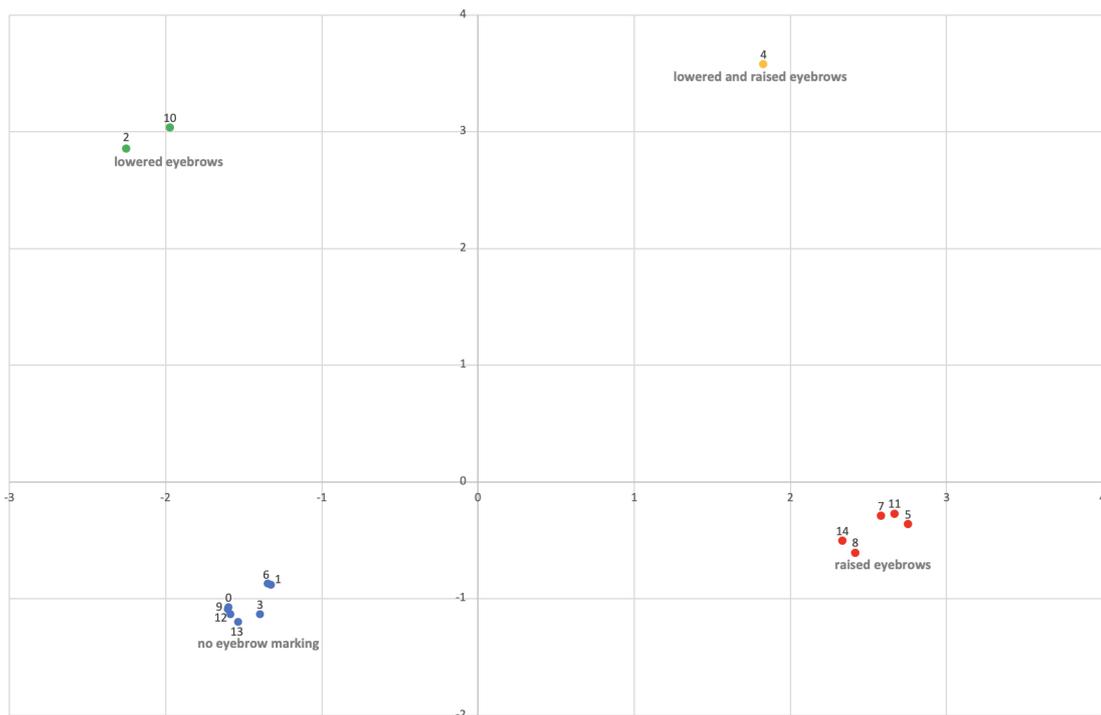
Figure 42. Cluster spread

2.4.2 Global patterns of (non-)manual marking

The interpretation of this clustering result leads to an understanding of potential global patterns in the use of (non-)manuals in polar questions in NGT. The following patterns stand out, considering that in this project features are important to a cluster when they occur in at least 50% of the cluster's data points.

Literature on polar questions in NGT report the importance of the presence of marked eyebrows, specifically raised eyebrows (Cecchetto 2012, p. 294; Coerts 1992, pp. 107 - 111; Vos, Kooij, and Crasborn 2009, p. 324). However, this project's clustering result shows that marked eyebrows is not a necessary feature when asking a polar question in NGT: the super cluster of no eyebrow marking contains 38% of the analysed polar questions, which is similar to the presence percentage of raised eyebrows (41%).

The clustering result also shows that lowered eyebrows coincide with squeezed eye shape, because in all clusters in which all data points contain lowered eyebrows (cluster 2, 4, and 10) the marker of squeezed eyes is also a prominent feature of the cluster (i.e., the feature occurs in half or more of the cluster's data points). Furthermore, squeezed eyes is no prominent feature in any other cluster.[60]

Another reason why the eye shape's state seems to be closely related to the state of the eyebrows is that wide eyes is a prominent feature in only two clusters (clusters 5 and 11) and in all data points of these clusters the eyebrows are raised. The other clusters in the super cluster of raised eyebrows do not have wide eyes as an important feature, which indicates that if wide eyes are used the eyebrows need to be raised as well, but not vice versa.

In six clusters the marker-state combination of forward body position is a prominent feature and in five of those clusters, one of the cluster's other prominent features is the marker of chin out. In five of the seven clusters in which nodding is a prominent marker, the marker of chin in is also of importance to the cluster. The occurrence of forward body position and nodding may indicate the presence of respectively the markers of chin out and chin in, although it is difficult to conclude that these markers coincide as the markers are not always present in all the relevant clusters' data points.

It is lastly noteworthy that both the markers of chin in and chin out are often a prominent feature: respectively in seven and eight of the fifteen clusters. Based on these clusters they are not particularly connected to other markers.[61] Their prominence therefore only indicates a regularly usage of these markers when polar questions are expressed, without clarity about the specific conditions under which they are used.

2.5   (Non-)manual marking in syntactic structures

Besides identifying global patterns of (non-)manuals in polar questions in NGT, this project also examines the use of (non-)manuals in specific syntactic structures. Five syntactic structures are distinguished, each structure is equal in form: a question radical followed by a tag. This section presents an analysis of the presence of (non-)manual markers in each of the five tags.

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[60]In these other clusters the presence of squeezed eyebrows is between 0 and 39%.

[61]In the previous paragraph it is described that nodding often co-occurs with chin in and that a forward body position often co-occurs with chin out, the reversed cases are not visible through the clustering result.

The radical of each syntactic structure captures the question's content. The tag is positioned after the radical and is expressed through clear signs or mouthing, which are potentially combined with face and body expressions. The five distinguished tags are referred to as 'toch' (translation: 'right'), 'of niet' (translation: 'or not'), hesitation, disbelief, and confirmation.

The 'toch' tag is classified as such when at the end of the question TOCH is signed or 'toch' is mouthed. A tag is identified as being 'of niet' when after the radical 'of niet' is clearly expressed through mouthing ('of' or 'of niet') or signs (OF, NIET, or their combination), which are potentially combined with a shaking head movement. The last three categories are less apparent through mouthing and signs. The hesitation marker is identified as such when it follows the question's content with either a HESITATION or a PALMS-UP sign. This tag is typically accompanied with the lip corners pushed down. The tag of disbelief is expressed through a wide PALMS-UP sign and a shaking head movement. In this project the PALMS-UP sign is interpreted as having a wide shape in case the participant uses PALMS-UP and the participant's hands are positioned further than shoulder width distance from one another. The confirmation tag is conveyed through a wide PALMS-UP sign in combination with a nodding head movement. The five tags are classified by the author who is not proficient in NGT, further empirical work with language experts is therefore needed to confirm this classification.

The tables 22, 23, 24, 25, and 26 below show for each of the tags in how many and which data points the tag is used,[62] the cluster in which each of its data points is grouped, the mouthing and signs which are used to express the tag, some features that are visible in most of its data points, and the polarity of the radical. The positive, negative, or neutral polarity at the radical is determined by − respectively − the presence of a nodding movement, of a shaking movement, or the absence of such a head movement. Below each table the presence of specific (non-)manual markers at the tag is described and some video stills from the corpus NGT are attached to illustrate these markers.[63]

Patterns in usage of 'toch' tag

index	cluster	sign(s)	mouthing	nodding	PALMS-UP	polarity at radical
15	6	TOCH + PALMS-UP		0	1	nodding
97	10	TOCH	'toch'	1	0	nodding
129	4	PALMS-UP	'toch'	1	1	neutral
209	7	TOCH + PALMS-UP		1	1	neutral
286	1	PALMS-UP	'toch'	1	1	neutral
326	1	PALMS-UP	'toch'	1	1	neutral

Table 22. 'toch' tag − 6 data points

[62] For each of the tags its data points are represented in appendix C.

[63] Although for most tags a shaking or nodding movement is important, these are not represented in the attached screen shots as these movements are difficult to capture in video stills. For each of the data points the corresponding ELAN file is presented in appendix C.

By using 'toch' (translation: 'right') as the tag of a polar question the signer seems to convey the expectation that the addressee's answer to the question will be a confirmation of the question's radical's content.[64] The five clusters in which the polar questions with 'toch' as its tag are clustered all have nodding as a prominent feature: in four of the cluster all their data points have the nodding marker and in one cluster nodding is present in at least 50% of its data points. Thus, the importance of the marker of nodding in this syntactic structure − particularly, in its tag − is highlighted. In all data points nodding is present: one data point captures the marker of nodding only at the question's radical, nodding is present at both the radical and the tag in another data point, and in the four remaining data points nodding is present only at the tag. In four of the six data points there is no polarity expressed at the radical and in five of the six data points the PALMS-UP sign is used at the tag. The other non-manual markers show much variation among the data points.

Figure 43. The first frame shows the participant at the beginning of the fragment in which a 'toch' tag is used. The second frame illustrates the presence of PALMS-UP at the 'toch' tag.

Patterns in usage of 'of niet' tag

index	cluster	sign(s)	mouthing	eyebrows marking	PALMS-UP	shaking	polarity at radical
4	13	NIET + PALMS-UP	'of niet'	none	1	1	nodding
13	3	OF+NIET		none	1	1	neutral
17	8	OF+NIET+PALMS-UP		raised	1	1	neutral
65	13	OF		none	0	1	neutral
144	8	OF		raised	1	1	neutral
147	3		'of niet'	none	0	1	nodding
149	13	OF+NIET		none	1	1	shaking
181	13	NIET PT-1hand PALMS-UP	'of niet'	none	1	1	nodding
246	8	OF	'of'	raised	1	1	nodding
249	8	OF		raised	1	1	neutral
263	13	NIET	'of niet'	none	0	1	nodding
365	8	OF	'of'	raised	1	1	nodding
392	13	PT-1hand	'of niet'	none	0	1	nodding
394	3	PALMS-UP	'of niet'	none	1	1	neutral
423	3	PALMS-UP	'of niet'	none	1	1	nodding

Table 23. 'of niet' tag − 15 data points

The syntactic structure in which a radical is combined with an 'of niet' (translation: 'or not') tag is a special type of alternative question which expresses a choice between two alternatives: the radical and the radical's negation. The latter alternative is introduced by 'of niet'. The fifteen datapoints which represent the 'of niet' tags are spread out over

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[64]The meaning of this polar question form corresponds to its potential counterpart in Dutch: a *toch* question. This *toch* question conveys, besides a request for information, the speaker's expectation about what the information will be. The next chapter (chapter 3) presents the analysis of the use of this question type in Dutch.

three clusters which are all characterised by the marker of shaking. This marker is crucial for this tag, as in all of the 'of niet' data points it is present. The role of an 'of niet' tag (introducing a negative alternative) and the presence of shaking at this tag is confirmed by Oomen and Roelofsen (2023). In eleven of the data points the marker of PALMS-UP is used and the marking of eyebrows is absent in eleven of the data points. About half of the data points, which represent the radicals that correspond to the 'of niet' tags, expresses a positive polarity through nodding and six of these data points express no polarity.

Figure 44. The first frame shows the participant during the fragment in which an 'of niet' tag is used. The second frame illustrates the presence of PALMS-UP at the 'of niet' tag. Both frames show the absence of marked eyebrows.

Patterns in usage of hesitation tag

index	cluster	sign	chin out	forward body position	lip corners down	head movement	polarity at radical
5	3	HESITATION	1	0	1	shaking	nodding
23	14	PALMS-UP	0	1	1	neutral	neutral
52	14	PALMS-UP	1	1	1	neutral	neutral
92	11	PALMS-UP	1	1	1	nodding	neutral
111	11	PALMS-UP	0	0	1	neutral	nodding
118	0	HESITATION	0	0	1	neutral	neutral
308	14	PALMS-UP + HESITATION	0	0	1	neutral	neutral
332	3	PALMS-UP	1	1	0	shaking	neutral
355	1	PALMS-UP	1	1	0	nodding	neutral
413	2	PALMS-UP	1	1	1	shaking	neutral
442	5	PALMS-UP	1	1	0	shaking	nodding
443	3	PALMS-UP	1	1	1	shaking	neutral

Table 24. hesitation tag − 12 data points

A hesitation tag is used when the signer seems to express hesitation about the truth of the content of the question's radical. This means that when − for example − the polar question 'is it better than before?' is asked with a hesitation tag, the uncertainty about the truth of 'it is better than before' is expressed. It is noteworthy that most often no polarity is visible at the question's radical (nine of the twelve data points). In the hesitation tag, shaking and no head movement both occur in five of the twelve data points, in the other two data points a nodding movement is present. Oomen and Roelofsen (2023) also report the presence of a shaking head movement when a hesitation tag is used. The participant's chin is out at the tag in eight of the data points and the body position is forward in also eight of the data points and these markers coincide in seven of the data points. The lip corners are down in nine of the twelve data points. The other non-manual markers show too much variation in the data points to seem of importance to this tag.

Figure 45. The first frame shows the participant during the fragment in which a hesitation tag is used. The second frame illustrates the presence of PALMS-UP, body position forward, chin out, and lip corners down at the tag of hesitation.

Patterns in usage of disbelief tag

index	cluster	PALMS-UP	sign property	chin in	lowered eyebrows	squeezed eye shape	shaking	polarity at radical
46	10	1	wide	1	1	1	1	nodding
196	4	1	wide	1	0	0	1	nodding
348	2	1	wide	1	1	1	1	neutral

Table 25. disbelief tag − 3 data points

When the question ends with a tag of disbelief, it is conveyed that the signer judges the content of the question's radical as being unbelievable. Only three of the data points of this project's polar questions contain such a tag. It is noteworthy that in all those data points a wide PALMS-UP sign is gestured, the participant's chin is in, and the marker of head shaking is used. In all three data points the participant's eyebrows are lowered at the question's radical, at two of them they are also lowered at the tag and at the same two data points the eyes are also squeezed at the tag. The polarity of the radical is in two data points positive, and in one it is neutral.
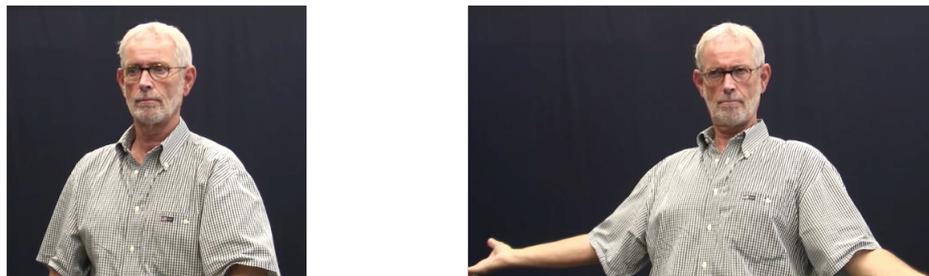
Figure 46. The first frame shows the participant at the beginning of the fragment in which a tag of disbelief is used. The second frame illustrates the presence of the chin in marker and the wide PALMS-UP sign at this tag.

Patterns in usage of confirmation tag

index	cluster	PALMS-UP	sign property	eyebrows marking	head movement	shoulders up	polarity at radical
107	1	1		none	nodding	1	neutral
253	3	1	wide	none	nodding	1	shaking
267	1	1	wide	none	nodding	0	neutral
325	3	1		none	shaking	1	nodding
347	3	1	wide	none	nodding	0	neutral
351	1	1	wide	none	nodding	1	nodding
368	5	1	wide	raised	nodding	1	shaking
444	1	1	wide	none	nodding	0	neutral

Table 26. confirmation tag − 8 data points

The tag of confirmation is similar to the 'toch' tag in what it conveys: the signer seems to have a degree of certainty in the truth of the question's radical and by using the confirmation

tag she seems to expect an affirmative answer.[65] All eight data points with the confirmation tag show a PALMS-UP sign and six of those are wide. The head movement of nodding is also present in all data points: one only at the radical, six only at the tag, and one at both. The data points are grouped in three clusters of which two have the marker of nodding as their characteristic. The eyebrow marking is absent in seven of the data points and in five data points the participant's shoulders are up. Lastly, in half of the data points its radical expresses no polarity, in the other half the polarity is either positive or negative.
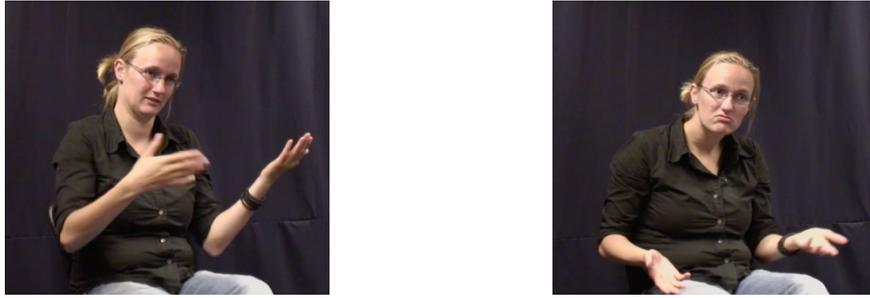

Figure 47. The first frame shows the participant during the fragment in which a confirmation tag is used. The second frame illustrates the presence of PALMS-UP, neutral eyebrows and shoulders up at this tag.

2.6 Preliminary generalisations

The clustering result led to the identification of global patterns of (non-)manual marking in polar questions in NGT. Based on these global patterns and the analysis of (non-)manuals in five syntactic structures − which each consists of a radical and a specific tag − preliminary generalisations about the use of (non-)manual markers in polar questions in NGT are formulated in this section. The generalisations are preliminary because this project is an exploratory research which is based on corpus data (see introduction of chapter 2), in order to form more definite conclusions these generalisations need to be tested further.

Almost 40% of the analysed polar questions are clustered within clusters that are characterised as lacking the feature of marked eyebrows. This result indicates that marked eyebrows are not required when polar questions in NGT are used. The clustering result also showed that wide eyes is only prominent when eyebrows are raised, and lowered eyebrows coincide with squeezed eyes. Furthermore, some markers (nodding and forward body position) were often prominent to a cluster when other markers (respectively, chin in and chin out) were prominent to that cluster as well. The markers of nodding and chin in, and the markers of body position forward and chin out therefore seem to co-occur.[66] These results lead to the first three preliminary generalisations.

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[65]It is noteworthy that seven of the eight questions that end with a confirmation tag are translated − by an annotator who is not involved in the current project − with a 'toch' in the translated question, see table 35 in appendix C.

[66]Although the clustering result also shows the importance of the markers of chin out and forward body position to about half of the clusters, this is insufficient ground for formulating a generalisation, because it could at most be concluded that a forward body position and the marker of chin out often occur in a polar question in NGT.

Preliminary generalisation 1 *Polar questions in NGT are not necessarily expressed through marked − or specifically raised − eyebrows.*

Preliminary generalisation 2 *The use of lowered eyebrows and squeezed eye shape coincide, and wide eye shape only occurs when raised eyebrows are present.*

Preliminary generalisation 3 *The marker of nodding only occurs when the marker of chin in is present, and forward body position only occurs when the marker of chin out is present.*

The previous section (section 2.5) analyses the features that are important when using a polar question with a syntactic structure in which a radical is combined with a 'toch' tag, an 'of niet' tag, a tag of hesitation, a tag of disbelief, or a tag of confirmation. Based on this analysis five preliminary generalisations are formulated.

Preliminary generalisation 4 *The syntactic structure which combines a radical and a 'toch' tag requires that no polarity is expressed at the radical, and that at the tag the markers of nodding and* PALMS-UP *are present.*

Preliminary generalisation 5 *The syntactic structure which combines a radical and an 'of niet' tag requires that the radical expresses no negative polarity, and that at the tag the markers of shaking,* PALMS-UP, *and no eyebrow marking are present.*

Preliminary generalisation 6 *The syntactic structure which combines a radical and a hesitation tag requires that no polarity is expressed at the radical, and that at the tag the markers of lip corners down, body position forward, chin out, shaking or neutral head movement, and* PALMS-UP *are present.*

Preliminary generalisation 7 *The syntactic structure which combines a radical and a disbelief tag requires that at the tag the markers of shaking, chin in, and wide* PALMS-UP *are present.*[67]

Preliminary generalisation 8 *The syntactic structure which combines a radical and a confirmation tag requires that at the tag the markers of nodding, shoulders up, wide* PALMS-UP, *and no eyebrow marking are present.*

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[67]Since this tag occurs in just three data points, only the markers that occur in all these three data points are included in the generalisation about this tag.

2.7 Discussion

In this section some of this project's methodological choices are first discussed and subsequently a suggestion for future research is provided.

In section 2.2 the updates of the annotation guideline and their inter annotator agreement rates are discussed. These rates were determined using the measure of Fleiss' kappa. A disagreement between annotators about markers' states at a polar question is a strict difference at this measure: gradations of differences are not considered. For example, the difference between raised eyebrows in one annotation and lowered eyebrows in the other is interpreted as the same difference as the distinction between a raised eyebrows annotation and a neutral eyebrows annotation. The latter annotations seem closer related compared to the former because only at the former the eyebrows are in opposite states. To account for gradations in difference in future research, it would be an option to use an inter annotator agreement measure that allows for assigning weights.[68]

The initial annotated corpus data consisted of categorical values which were converted into unweighted numerical values: 1 if a specific marker-state combination was present at the particular polar question, and 0 otherwise (see subsection 2.3.1). The presence of typical question and conversational markers was given a higher value than 1: the question markings of raised eyebrows and lowered eyebrows were marked with a 4 and the conversational markers of nodding and shaking received a 2. Although this project explains why these markers received higher values than others, the specific numbers (4 and 2) could have been chosen differently as long as some requirements are met. The lowest values need to be given to the marker-state combinations that are both non-question and non-conversational markers, the question markers need to receive the highest value, and the conversational markers need to be marked with a value between the two. To emphasize the presence of marker-state combinations (and highlight the difference between presence and absence more strongly), an alternative would be to use $-$ instead of the value $0-$ a negative value in case marker-state combinations are absent.

A final methodological choice is the use of particular dimension reduction and clustering techniques in this project. In subsections 2.3.2 and 2.3.3 the techniques of PCA and k-means are explained and their limitations are discussed. Different researchers may have chosen different techniques and choosing different techniques would most likely result in different clustering, as different parameter settings already result is different clustering. Since the formulated preliminary generalisations are partly based on the clustering results, choosing different techniques may also lead to different hypotheses for further research.

To arrive at more definite conclusions, the formulated preliminary generalisations in this project could serve as hypotheses in future research, which should be tested experimentally.

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[68]Krippendorff's α is such weighted measure (Artstein 2008).

The aims of such research would be (1) to determine whether the identified syntactic structures and their tags are truly used in NGT, (2) to examine whether the (combinations) of (non-)manual markers invariably occur in the polar question (forms), and (3) to determine under what circumstances the identified syntactic structures (if they exist in NGT) are used. The first two objectives are mostly concerned with syntax, whereas the last is more focused on meaning.

The first three preliminary generalisations are about polar questions in NGT in general (polar questions which do not have to match a specific form). An experiment in which a general context description is provided, which only requires the participant to respond with a polar question in NGT, would suffice to test these generalisations. However, the final five generalisations consider specific polar question forms, which may only be asked naturally within certain circumstances. At the analysis of each tag in section 2.5 suggestions are provided of what the tag expresses, these suggestions could serve as a starting point based on which suitable contexts are designed. For example, the context in which the confirmation tag is tested, should be specified in such a way that the participant believes the truth of the question's radical and expects an affirmative answer to the to be asked question. After the context description, the participant could be asked to formulate a polar question in NGT which fits the context best. Then it should be analysed whether the participant used a particular tag, and which (non-)manuals were present in the used question.

2.8   Polar questions in NGT: Conclusion

The aim of this chapter was to get a better understanding of the use of polar questions in NGT. The clustering result shows the regular presence of unmarked eyebrows in polar questions in NGT. This is in contrast with former literature on polar questions in NGT, which report the requirement of marked eyebrows (Coerts 1992; Vos, Kooij, and Crasborn 2009). The current project contributes to sign linguistic research by distinguishing five polar question forms (each consisting of a radical and a tag), and by identifying the (non-)manual marking which was typically present at the tag when the question forms were used. This project resulted in the formulation of generalisations (see section 2.6). Since the Corpus NGT served as this project's data source and corpus data implies much variation, the generalisations are only preliminary and require further testing.

3.   Two types of biased polar questions in Dutch

This chapter presents the analysis of the felicity conditions of two types of biased questions in Dutch. As described in the introduction (section 1.2), biased questions convey − besides an information request − the speaker's bias about what the information is expected to be. The speaker's intention to elicit information is a minimum requirement for a felicitous use of biased questions, cases of irony or hidden statements in the form of questions are therefore in this project interpreted as infelicitous. The two types of biased questions that are examined in this chapter are referred to as *toch* questions and *hè* questions. *Toch* and *hè* questions both consist of a declarative anchor α followed by a tag with a rising intonation, which corresponds to the specific particle in Dutch: respectively *toch* and *hè*. The anchor α is defined as an assignment of a property P to an object x: $P(x)$.

The introduction (section 1.2) also described the importance of the notions of speaker's prior belief and contextual evidence in previous studies on the use of biased questions. The current project argues that the distinction in neutral, positive, and negative prior belief and contextual evidence is insufficient to accurately capture the felicitous use of the two biased questions in Dutch. This project therefore proposes a distinction of two declarative anchor types and a further specification of contextual evidence:

1. The declarative anchor is distinguished into two types, one expresses a matter of fact and the other a personal taste. The latter conveys the subjective judgement that x possesses property P, whereas at the former it is objectively determined that P is assigned to x.

2. Regarding contextual evidence − in situations in which biased questions with matter-of-fact declarative anchors are used − more fine-grained distinctions are relevant: in the evidence source, its quality, and to which conversation participants the evidence is new.

In the first section of this chapter (section 3.1) the distinction of declarative anchor types is described. In section 3.2 the felicitous use of *toch* and *hè* questions with a declarative anchor that expresses a matter of fact is examined. The different aspects of contextual evidence are also discussed within this section. Subsequently, in section 3.3 the biased questions that have a declarative anchor which expresses a personal judgement are described. Their felicitous use is analysed within the same section. The discussion section 3.4 compares the felicitous use of *toch*, *hè*, and English tag questions. This chapter concludes with section 3.5, which presents both an overview of the felicity conditions of *toch* and *hè* questions, and this project's contribution to biased question research in general.

3.1 Distinction between two declarative anchor types

This section motivates this project's distinction of the declarative anchor into matter-of-fact and personal taste anchor types. Based on the analysis of the use of the biased questions by three native speakers, it is evaluated that depending on the anchor type the *toch* question is felicitous under different circumstances. The two examples below illustrate that despite the same state of prior belief and of contextual evidence, the natural use of the *toch* question is different in the two situations.

Matter of fact I:[1] At a student meeting, A is the student representative and knows who will be present today. B is another student, who believes more students are coming. A: We are all here now, shall we begin the meeting? A to B:

(i) Er   komen   meer studenten, toch?
     There come.3pl more students   TOCH
     'There are more students coming, right?'

(ii) #Er   komen   meer studenten, hè?
      There come.3pl more students   HÈ
      'There are more students coming, right?'

Personal taste I:[2] A and B are on a holiday and A read in a brochure that the sunset at the beach is highly recommended. She asks B to join her on a sunset beach walk. Once they walk at the beach, A is very disappointed by the view. A to B:

(i) #Het is   mooi,   toch?
     It   are.3sg beautiful TOCH
     'It is beautiful, right?'

(ii) #Het is   mooi,   hè?
      It   are.3sg beautiful HÈ
      'It is beautiful, right?'

In both examples the speaker has a positive prior belief in the declarative anchor: she, respectively, believes that more students are coming and that the sunset will be beautiful. Also, in both examples the provided evidence is negative. In the first example the addressee notes that everyone is present and in the second example the speaker experiences a sunset which she thinks is not beautiful. Thus, the states of prior belief and of contextual evidence are the same in the matter-of-fact and the personal taste situation. Where the *hè* question is infelicitous with both anchor types, the felicity of the *toch* question differs between the two anchor types: it is felicitous in the first example and infelicitous in the second. The

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[1]This student meeting situation and its variants further on are paraphrased from Sudo (2013, p. 287).
[2]This sunset situation and its variants further on are paraphrased from Farkas and Roelofsen (2017, p. 240).

following two examples also highlight this difference in felicitous use of the *toch* question:

Matter of fact II: A and B are walking in a city they never been to before. Across the street they see a store, to which they are heading. At the store, B tries to open the door while A is watching her, but it happens to be locked. A to B:

(i) #De winkel is   dicht, toch?
    The store are.3sg closed TOCH
    'The store is closed, right?'

(i) De winkel is   dicht, hè?
    The store are.3sg closed HÈ
    'The store is closed, right?'

Personal taste II: A never tasted or made a Lebanese dish before, she now prepared one for B and herself. Before eating she is still ignorant about the taste. During dinner, A likes the taste of it. A to B:

(i) Het is   lekker, toch?
    It are.3sg tasty   TOCH
    'It is tasty, right?'

(ii) Het is   lekker, hè?
     It are.3sg tasty   HÈ
     'It is tasty, right?'

In both examples the speaker has a neutral prior belief state about the declarative anchor. In the first case this means that the speaker is ignorant about whether the store is open or closed and in the second case it is expressed through the speaker not knowing whether a Lebanese dish is tasty. The provided evidence in both examples is positive: respectively, the store's door being locked, and the pleasant taste of the Lebanese dish. The hè question is felicitous in both the matter-of-fact and the personal taste example. Despite the correspondence in prior belief and in contextual evidence states between both examples, the *toch* question is not felicitous in the former example but in the latter it is.

It is because of this discrepancy in the felicitous use of the *toch* question − when it is based on two different anchor types − that the distinction between matter-of-fact and personal taste declarative anchor types is proposed.

3.2   Matter-of-fact questions

This section presents the analysis of *toch* and *hè* questions, that are based on α which expresses a matter of fact. The possible states of prior belief and this project's specification of contextual evidence are first described in subsection 3.2.1. Subsequently, in subsection 3.2.2 a table is presented which illustrates under which combinations of prior belief and

contextual evidence *toch* and *hè* questions are correctly used. Their felicity conditions are explained in the final two subsections 3.2.3 and 3.2.4.

3.2.1 Prior belief and contextual evidence

The speaker's prior belief in α refers to the level of belief the speaker has in α before the situation in which the biased question − with α as its anchor − is uttered. The possible levels of belief are positive, neutral, or negative. This respectively means that the speaker believes α is the case, is ignorant about α, or believes that α is false.

The contextual evidence for α that is provided within the situation − in which the biased question is used − can be either positive, negative, or no evidence is available. It is − for simplicity reasons − assumed that there are only two participants in a conversation: the speaker and the addressee. The contextual evidence is assumed to be available to both participants and for that reason it should be provided within the course of the usage of the biased question.[3] When "contextual evidence" appears before such a situation, to the speaker only, it is in this project interpreted as an update of the speaker's prior belief rather than contextual evidence. Solely based on these distinctions in speaker's prior belief and contextual evidence the (in)felicity of *toch* and *hè* questions cannot be fully captured. Examples 1.1 and 1.2 below illustrate this for *hè* questions and examples 2.1 and 2.2 for *toch* questions.

Example 1.1: A visits a vintage store, which usually only sells vintage furniture. Once she arrives at the store, A spots a department in which vintage clothing is displayed for sale. A to salesman B:

> Jullie verkopen ook vintage kleding, hè?
> You   sell.2pl   also vintage clothes HÈ
> 'You also sell vintage clothes, right?'

Example 1.2: A and B are often going on a stroll in the same park. Since A never saw a rose garden within the park, she believes there is none. A and B meet in front of the park for their walk. B proposes to A: "Let's go to the park's rose garden." A to B:

> #Er   is   een rozentuin in het park, hè?
> There are.3sg rose garden   in the park HÈ
> 'There is a rose garden in the park, right?'

In both examples, the speaker has negative prior belief about α: respectively, A believes that clothes are not for sale at the vintage store, and A believes there is no rose garden in the park. Furthermore, in both examples positive contextual evidence is provided: respectively,

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[3]In the remainder of this paper 'situation' refers to the situation in which a biased *toch* or *hè* question is used.

the presence of a clothing department in the store and the addressee proposing to go to the rose garden in the park. Despite the same states of prior belief and of contextual evidences, there is a difference in felicitous use of the *hè* questions: in example 1.1 it is felicitous and in example 1.2 it is not.

Example 2.1: A is visiting the zoo today with friend B. A often goes there and based on her previous visits she believes that there are no zebras. While at the zoo, A and B are both looking at a cage in which some zebras are living. A to B:

> #Er zijn geen zebras, toch?
> There are.3pl no zebras TOCH
> 'There are no zebras, right?'

Example 2.2:[4] A believes there is a movie playing at 19:00, because she checked the cinema's playing schedule. Once she arrives at the cinema a couple minutes before 19:00 the cinema clerk B announces that the next playing movie is at 19:30. A to B:

> Er is een film om 19:00, toch?
> There are.3sg a movie at 19:00 TOCH
> 'There is a movie at 19:00, right?'

In examples 2.1 and 2.2, the speaker has a positive prior belief about α and in the situation evidence against α is provided. However, in the example 2.1 the *toch* question is not natural to use whereas in example 2.2 it is. Since the current distinction in prior belief and contextual evidence cannot capture the difference in felicitous use, this project proposes further specifications of the contextual evidence: not only the distinction of positive, negative, and no evidence is relevant, but so are the evidence source, its quality, and the specification to whom the evidence is new. These specifications are explained in the coming paragraphs, below each of the specifications − except for the last − examples are presented that illustrate that further distinctions in specific properties of contextual evidence are required.

This project views the evidence source as the way the contextual evidence is provided: either externally or by the addressee. When the addressee is the evidence source, the evidence can only be in a *spoken* form. Other forms of relevant evidence that involve the addressee are − in this project − interpreted as external evidence.[5] This is decided because in determining whether a biased question is felicitous it was observed that

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[4]This cinema example is paraphrased from Kiss (2022, p. 212).

[5]The addressee who wears wet rain clothes could for example be contextual evidence in favour of the anchor "it is raining". Despite the addressee's role in this evidence, it is characterised as external. Whereas the addressee saying "it is wet outside" is evidence in favour of the anchor with the addressee as its source.

non-spoken addressee evidence does not necessarily convey the addressee's thoughts about the declarative anchor whereas spoken addressee evidence does. Furthermore, non-spoken evidence which involves the addressee corresponds more closely to external evidence than to spoken addressee evidence.[6] The speaker is not characterised as a possible evidence source, because it is unnatural to first provide evidence and then truthfully ask the question to which the speaker's provided evidence is a resolution. The examples below illustrate that the additional contextual evidence type of the evidence source is not sufficient to accurately capture the behaviour of the *toch* question:

Example 3.1: A has been looking at this week's sale products at the convenience store. Once she is doing her groceries at this store, she only picks products she believes to be discounted. At the checkout cashier B is scanning her products, the total amount displayed on the screen is way higher than expected. Before paying A asks B:

> Deze producten zijn in de aanbieding, toch?
> These products are in the sale TOCH
> 'These products are on sale, right?'

Example 3.2:[7] A has been cycling to work in heavy rain. At work she sits in a windowless office, after some time she walks with colleague B to the canteen to get some coffee. They pass a window and the sky is completely blue. A to B:

> #Het regent, toch?
> It rain.3sg TOCH
> 'It is raining, right?'

In both examples the prior belief is positive, the contextual evidence is negative, and its source is external, however in example 3.1 the *toch* question is felicitous but in example 3.2 it is not. Therefore, a distinction in contextual evidence quality is proposed.

Hengeveld and Hattnher (2015, pp. 486-487) present different evidence qualities, two of which are relevant for the current project: the contextual evidence can either be observed *directly* or it needs to be *deduced*. The former means that the evidence is perceived through one of the senses, e.g. seeing lots of roses is direct contextual evidence

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[6]The following situation and its alterations illustrate that non-spoken evidence which involves the addressee differs from spoken addressee evidence, and is closer related to external evidence: A is working at a windowless office and is ignorant about the weather status. Colleague B arrives wearing a wet rain coat. In this situation non-spoken evidence which involves the addressee is provided and it is natural for A to ask 'het regent, hè?' (translation: 'it is raining, right?'). In case the situation is slightly altered such that external evidence is provided: B is not wearing a wet rain coat and both A and B hear the ticking of rain on the roof of their office, it remains natural for A to ask the *hè* question. When the situation is slightly altered such that spoken addressee evidence is provided: colleague B is not wearing a wet rain coat but utters 'the sky is full of grey clouds today', the *hè* question becomes unnatural to use.

[7]This rain example and its variants further on are paraphrased from Farkas and Roelofsen (2017, p. 273).

in favour of "there are a lot of roses". The latter indicates that the evidence needs to be deduced from the perceived information, e.g. seeing a box of cigarettes in someone's purse is deduced contextual evidence in favour of "the purse's owner smokes". The examples below illustrate that despite the distinction in evidence quality, the felicitous use of *toch* questions is not accurately captured. In both examples the speaker has positive prior belief and there is positive external direct evidence provided, however in example 4.1 the *toch* question is not natural to ask, whereas in example 4.2 it is.

Example 4.1: B is A's friend and is getting married. Some time before the wedding B told A she would love to have a lot of roses at the wedding. Before the ceremony A and B are visiting the venue which is covered with roses. A to B:

   #Er   zijn   veel rozen op de trouwlocatie, toch?
    There are.3pl many roses at the venue   TOCH
    'There are a lot of roses at the venue, right?'

Example 4.2: Salesman A prepares a box that contains four camera's which customer B wants to buy. Before the payment A shows the box to B, to check the order. A to B:

   Dit   zijn   de vier camera's, toch?
   These are.3pl the four camera's TOCH
   'These are the four camera's, right?'

The final contextual evidence type that is distinguished in this project captures to whom of the conversation participants the contextual evidence is new. The provided evidence can be new to both, to just the addressee, or to the speaker only. The latter is the case when the addressee is the evidence source, as only the addressee is aware of her thoughts before sharing them. Evidence is new to the addressee only in cases in which the speaker is aware of the external evidence beforehand and conveys it to the addressee during the situation in which the biased question is used (e.g., example 4.2). It is unnatural for the speaker to share external evidence that conflicts with the state of the speaker's prior belief. Therefore, the only cases that are examined when the evidence is new to just the addressee are those in which there is an alignment between the state of the speaker's prior belief and the state of the evidence the speaker is about to share. This concretely means that the speaker can show *negative* external evidence for α only when she has a *negative* prior belief in α and external evidence in *favour* of α only if she has a *positive* prior belief in α. All other forms of external evidence are interpreted as being new to both.[8]

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[8]Although the addressee could also show external evidence of which she was aware beforehand (by wearing a wet rain coat for example), this evidence is interpreted as external evidence that is new to both because such a situation does not result in a different use of the biased questions and because the speaker can still doubt whether the addressee is aware of this evidence.

3.2.2 A table capturing matter-of-fact questions

The table below represents the possible combinations of prior belief and contextual evidence. The 'Toch' and 'Hè' columns present whether − respectively − the *toch* and the *hè* questions are felicitous given the specific combinations of prior belief and contextual evidence. These combinations are determined by the first five columns. The 'Prior Belief' column presents the possible states of the speaker's prior belief: positive, negative, or neutral. Per prior belief state, positive, negative, or no contextual evidence can be present. These possibilities are stated in the 'Contextual Evidence' column. The possible sources (addressee or external) of the positive and negative evidence are shown in the 'EvSource' column. The 'EvQuality' column provides the evidence quality (direct or deduced) and the 'EvRecipient(s)' column states to whom the evidence is new (addressee, speaker, or both). The two columns named 'Ex' provide numbers of examples which are linked to examples in appendix D. These examples illustrate a *toch* and *hè* question in a context that satisfies the characteristics of the particular combination of prior belief and contextual evidence.

Prior Belief	Contextual Evidence	EvSource	EvQuality	EvRecipient(s)	Toch	Ex	Hè	Ex
Positive	Positive	External	Direct	Both	no	(1)	no	(2)
				Addressee only	yes	(3)	yes	(4)
			Deduced	Both	?	(5)		(6)
				Addressee only	yes	(7)		(8)
		Addressee	Direct	Speaker only	no	(9)	no	(10)
			Deduced	Speaker only	?	(11)	yes	(12)
	Negative	External	Direct	Both	no	(13)		(14)
			Deduced	Both	yes	(15)	no	(16)
		Addressee	Direct	Speaker only	yes	(17)		(18)
			Deduced	Speaker only		(19)		(20)
	None	NA	NA	NA	yes	(21)	yes	(22)
Negative	Positive	External	Direct	Both	no	(23)	yes	(24)
			Deduced	Both		(25)		(26)
		Addressee	Direct	Speaker only		(27)	no	(28)
			Deduced	Speaker only		(29)		(30)
	Negative	External	Direct	Both		(31)	no	(32)
				Addressee only		(33)		(34)
			Deduced	Both		(35)		(36)
				Addressee only		(37)		(38)
		Addressee	Direct	Speaker only		(39)		(40)
			Deduced	Speaker only		(41)		(42)
	None	NA	NA	NA		(43)		(44)
Neutral	Positive	External	Direct	Both	no	(45)	yes	(46)
			Deduced	Both		(47)		(48)
		Addressee	Direct	Speaker only		(49)	no	(50)
			Deduced	Speaker only		(51)		(52)
	Negative	External	Direct	Both		(53)	no	(54)
			Deduced	Both		(55)		(56)
		Addressee	Direct	Speaker only		(57)		(58)
			Deduced	Speaker only		(59)		(60)
	None	NA	NA	NA		(61)	no	(62)

Table 27. Felicity of matter-of-fact *toch* and *hè* questions given specific combinations of prior belief and contextual evidence

In the next two sections some of the examples are used to explain the (in)felicitous use

of the two biased question types. Since the numbering of the examples is based on their order in the table (and in appendix D) the example numbers that are used in the next two sections are not successive.

3.2.3   The felicitous use of matter-of-fact toch questions

This subsection describes the felicitous use of matter-of-fact *toch* questions, based on judgements from three native speakers of Dutch. Based on this assessment it is determined that when a *toch* question is used, the speaker is biased towards the truth of the declarative anchor α and wants to find out whether the addressee agrees with her. The 'Toch' column in table 27 shows whether the *toch* question is felicitous given specific combinations of prior belief and contextual evidence. The following felicity conditions are extracted from this analysis.

Felicity Conditions (Matter-of-Fact Toch Question). *A toch question q with declarative anchor $\alpha = P(x)$, that expresses a matter of fact, is felicitous if all following conditions are fulfilled:*

1. the speaker must have a positive prior belief in α
2. the speaker must consider it possible that the addressee might agree (potentially after some thought) about the truth of α
3. the speaker is not certain both participants agree about the truth status of α

The speaker's bias towards the truth of α stems from the speaker's positive prior belief in α, which is captured by the first felicity condition. Regardless of the specific contextual evidence that is provided during the situation, when the speaker has a neutral or negative prior belief in α the *toch* question is infelicitous. The examples below are situations in which the speaker has respectively a negative and a neutral prior belief.[9]

> **PriorBelief** = neg, **ContEvidence** = pos, **EvSource** = ext, **EvQual** = di, **EvRec** = both[10]
>
> **Context:** On a Saturday A wants to walk through a park where she often walks on Saturdays. She therefore expects the park to be freely accessible. When she arrives at the park she sees security guard B standing in front of a closed gate. They both look at the fenced park. A to B:

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[9]The following examples (in appendix D) illustrate other combinations of specific contextual evidence and non-positive prior belief: (25), (27), (29), (31), (33), (35), (37), (39),(41), (43), (45), (47), (49), (51), (55), (57), (59), (61).

[10]These abbreviations refer to a prior belief and contextual evidence combination in table 27. Each bold abbreviation represents one of the first fives columns and the abbreviation after the equal sign shows the column's specific state: e.g., '**PriorBelief** = neg' means that the speaker has a negative prior belief in α.

(23) #Het park is   niet open, toch?
     The park are.3sg not open TOCH
     'The park is not open, right?'

PriorBelief = neu, **ContEvidence** = pos, **EvSource** = ext, **EvQual** = di, **EvRec** = both

Context: A and B are walking in a city they never been to before. Across the street they see a store and are heading towards it. At the store, B tries to open the door while A is watching her, but it happens to be locked. A to B:

(45) #De winkel is   dicht, toch?
     The store are.3sg closed TOCH
     'The store is closed, right?'

Even if the speaker has positive prior belief in α, combinations with some contextual evidence types still result in an infelicitous use of a *toch* question. This project's definition of a biased question is violated when positive prior belief is combined with direct positive external evidence or direct positive addressee evidence. In these cases the answer to the question is already out in the open and the speaker can no longer ask the *toch* question sincerely, because the desire to elicit information is fulfilled. The situation below illustrates a situation in which direct positive addressee evidence is present.[11]

PriorBelief = pos, **ContEvidence** = pos, **EvSource** = addr, **EvQual** = di, **EvRec** = sp

Context: B organizes a student meeting. Among other students, B and A are present. A believes that more students are coming. B utters "let's wait a little longer, not all students are here yet." A to B:

(9) #Er   komen meer studenten, toch?
    There come.3pl more students   TOCH
    'There are more students coming, right?'

The *toch* question is also infelicitous when the speaker has a positive prior belief in α and direct external evidence against α is provided within the situation. Such situation is captured by example (13). The speaker no longer believes the truth of α. The second condition is violated because the speaker no longer considers it possible that the addressee will believe that α is true, as they both perceive the opposite of α.

PriorBelief = pos, **ContEvidence** = neg, **EvSource** = ext, **EvQual** = di, **EvRec** = both

---

[11]Example (1) in appendix D illustrates the infelicitous use of a *toch* question when positive prior belief is combined with direct external evidence.

Context: A has been cycling to work in heavy rain. At work she sits in a windowless office, after some time she walks with colleague B to the canteen to get some coffee. They pass a window and the sky is completely blue. A to B:

(13) #Het regent, toch?
　　　It　rain.3sg TOCH
　　　'It is raining, right?'

In the table, a case is marked with a '?' when both 'no' and 'yes' could be argued for. Example (5) illustrates a borderline case in which positive prior belief is combined with positive external deduced evidence.[12] On the one hand the *toch* question seems infelicitous because the positive answer is (potentially) already known by both participants, which could result in a violation of the third condition. On the other hand, the available evidence needs to be deduced to confirm the declarative anchor, the speaker might be uncertain whether the addressee derives the same conclusion and therefore the *toch* question seems legitimate.[13]

PriorBelief = pos, **ContEvidence** = pos, **EvSource** = ext, **EvQual** = de, **EvRec** = both

Context: Some weeks ago A saw B smoking, therefore she believes that B smokes. Now, both A and B are looking at a box of cigarettes in B's bag. A to B:

(5) ?Jij rookt, 　　toch?
　　You smoke.2sg TOCH
　　'You smoke, right?'

The *toch* question is felicitous in case the speaker has a positive prior belief in α which is combined with either no evidence, negative evidence that is not both external and direct, or positive evidence that is new to the addressee only. These felicitous combinations are accurately captured by the felicity conditions.

In case the speaker's positive prior belief in α (first condition) is combined with no evidence (see example (21)), there is no evidence which could result in the speaker no longer considering it possible that the addressee might agree with her about the truth of α (second condition). Also, no evidence is provided that results in the speaker being certain that she and the addressee agree about α (third condition).

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[12] In appendix D the other borderline case (example (11)), in which positive prior belief is combined with positive deduced addressee evidence, is illustrated.

[13] In this project these question marked cases are interpreted as being felicitous because this felicity follows from the felicity conditions: the speaker believes in the truth of α and the speaker considers it possible that the addressee came to the same conclusion as she did. However, since the answer needs to be deduced the speaker is not certain whether the addressee came to the same conclusion, and the speaker is therefore not certain whether they agree about the truth status of α.

PriorBelief = pos, **ContEvidence** = none, **EvSource** = NA, **EvQual** = NA, **EvRec** = NA

Context: A is at an outdoor concert with B. A heard there are fireworks planned as well. The singer just started performing. A to B:

(21) Er   komt   straks ook vuurwerk, toch?
     There come.3sg later   also fireworks TOCH
     'There will also be fireworks later, right?'

In case the positive prior belief in α is combined with provided negative evidence which is not both external and direct, then the first condition is satisfied and either negative external deduced evidence or negative addressee evidence is present. Since the evidence is negative, the third condition is satisfied, because there is no reason for the speaker to be sure that the addressee agrees about the truth of α. The second condition is also satisfied. When the evidence is external it is deduced by the speaker and since such deduction is not unmistakably true the speaker can still consider it possible that the addressee eventually agrees about the truth of α (see example (15) below). When the addressee is the negative evidence source it could be the case that she has forgotten about something or has made another mistake and the speaker can therefore still consider it possible that the addressee will agree with her, because by asking the *toch* question the addressee might revise her negative belief or become aware of α. In example (17) positive prior belief is combined with negative direct addressee evidence.[14]

PriorBelief = pos, **ContEvidence** = neg, **EvSource** = ext, **EvQual** = de, **EvRec** = both

Context: A has been looking at this week's sale products at the convenience store. Once she is doing her groceries at this store, she only picks products she believes to be discounted. At the checkout cashier B is scanning her products, the total amount displayed on the screen is way higher than expected. Before paying A asks B:

(15) Deze producten zijn in de aanbieding, toch?
     These products   are in the sale   TOCH
     'These products are on sale, right?'

PriorBelief = pos, **ContEvidence** = neg, **EvSource** = addr, **EvQual** = di, **EvRec** = sp

Context: A and B are invited to a mutual friend's birthday party. A believes the party starts at 13:00. A and B are talking about the party and then B utters: "The birthday party starts at 12:00 tomorrow." A to B:

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[14]Example (19) in appendix is an illustration of a situation in which positive prior belief is combined with negative deduced addressee evidence.

(17)   Het begint   om 13:00, toch?
         It   start.3sg at   13:00 TOCH
         'It is starting at 13:00, right?'

In case positive prior belief in α is combined with positive external evidence which is new to the addressee only, the first condition is satisfied and the external evidence is shared by the speaker. The second and third felicity conditions are satisfied because the speaker seeks agreement about the state of α and is not yet sure the addressee agrees. Positive prior belief is combined with direct positive external evidence which is new to the addressee only, in example (3) below.[15]

PriorBelief = pos, **ContEvidence** = pos, **EvSource** = ext, **EvQual** = di, **EvRec** = addr

Context: Salesman A prepares a box that contains four camera's which customer B wants to buy. Before the payment A shows the box to B, to check the order. A to B:

(3)   Dit   zijn   de vier camera's, toch?
       These are.3pl the four camera's TOCH
       'These are the four camera's, right?'

3.2.4   The felicitous use of matter-of-fact hè questions

The felicitous and infelicitous use of *hè* questions with a matter-of-fact declarative anchor α are discussed in this subsection. In this project three native speakers provided judgements that point toward an analysis that the use of a *hè* question implies that the speaker is biased towards the truth of α and seeks confirmation about this state of α. The 'Hè' column in table 27 shows in which combinations of prior belief and contextual evidence the *hè* question is felicitous and in which it is not. The following felicity conditions are obtained from this analysis.

Felicity Conditions (Matter-of-Fact Hè Question). *A hè question q with declarative anchor $\alpha = P(x)$, that expresses a matter of fact, is felicitous if all following conditions are fulfilled:[16]*

1. the speaker must be certain that α is true, independent of the information provided by the addressee

2. the speaker must consider it possible that the addressee agrees about the truth of α,

---

[15]Example (7) in appendix D captures a situation in which positive prior belief is combined with deduced positive external evidence which is new to the addressee only.

[16]In both conditions the notion of independence is of importance. In this project the source of the speaker's *prior* belief state (which is potentially the addressee) is ignored. The independence in the conditions therefore only apply to the cases in which the certainty in the truth of α is (partly) based on the evidence provided in the situation in which the biased question is uttered.

independent of the information provided by the speaker[17]

Prior to analysing the (in)felicitous use of a *hè* question based on these felicity conditions, a *hè* question can also be infelicitous because this project's biased question definition is violated. This is the case when the speaker believes in the truth of α and the answer to the *hè* question is clear through the context, because in such case the information request of the biased question is no longer sincere. Example (2) below illustrates such situation, in which positive prior belief is combined with positive direct evidence which is new to both.[18]

> **PriorBelief** = pos, **ContEvidence** = pos, **EvSource** = ext, **EvQual** = di, **EvRec** = both
>
> **Context:** B is A's friend and is getting married. Some time before the wedding B told A she would love to have a lot of roses at the wedding. Before the ceremony A and B are visiting the venue which is covered with roses. A to B:

(2) #Er   zijn   veel rozen op de trouwlocatie, hè?
    There are.3pl many roses at the venue   HÈ
    'There are a lot of roses at the venue, right?'

The first condition captures the speaker's bias towards the truth of the declarative anchor α. Her certainty can be derived from positive prior belief or positive evidence. However, if the speaker has no positive prior belief and the source of the provided evidence is the addressee, the first condition is not satisfied as the certainty in the truth of α is not derived independently from the addressee. The *hè* question is thus infelicitous. Example (28) confirms this infelicity for the combination of negative prior belief and positive direct addressee evidence.[19]

> **PriorBelief** = neg, **ContEvidence** = pos, **EvSource** = addr, **EvQual** = di, **EvRec** = sp
>
> **Context:**[20] Math teacher A presents a problem to pupil B: $\sqrt{9} + 3$. B utters that the answer to the problem must be 5, because the square root of 9 is 2 and 2 plus 3 is 5. A to B:

(28) #De wortel van 9 is 2,   hè?
     The square root of 9 are.3sg 2   HÈ

---

[17]In section 3.2.1 it is argued that in this project the speaker is no possible source of contextual evidence, therefore the only information a speaker provides is the biased question she utters.

[18]Example (10) in appendix D is another illustration of such situation, in that case positive prior belief is combined with positive direct addressee evidence.

[19]Examples that capture the *hè* question's infelicity when other combinations of non positive prior belief and positive addressee evidence apply can be found in appendix D: (30), (50), (52).

[20]This square root example is paraphrased from Farkas and Roelofsen (2017, p. 269).

'The square root of 9 is 2, right?'

The first condition is also violated if the speaker has no positive prior belief and no positive evidence is provided. The use of the *hè* question is therefore incorrect in such situation. In example (32) the *hè* question is infelicitous because the speaker cannot be certain of α as both *negative* prior belief and *negative* evidence are present.[21]

PriorBelief = neg, **ContEvidence** = neg, **EvSource** = ext, **EvQual** = di, **EvRec** = both

Context: A and B are waiting for the train to Amsterdam. A believes the train will depart at 12:55. Then an announcement is made which they both clearly hear: "time change: the train to Amsterdam will now leave at 13:00". A to B:

(32) #De trein vertrekt om 12:50, hè?
      The train leave.3sg at 12:50 HÈ
      'The train is leaving at 12:50, right?'

The use of *hè* questions requires that more weight is given to the contextual evidence compared to the use of *toch* questions. Contrary to *toch* questions, *hè* questions are infelicitous when a positive prior belief is combined with any type of negative evidence. This infelicity is captured by both felicity conditions. In case the provided evidence is externally available to the speaker, the speaker cannot be certain about the truth of α anymore and the first condition is thus violated. Example (16) below illustrates a situation in which negative deduced external evidence is provided. If the addressee is the source of the negative evidence, the addressee expresses that x is not assigned to P. Therefore the speaker knows that the addressee disagrees about the truth of α and the second condition is then violated. A situation in which the addressee provides direct negative evidence is captured by example (18) below.[22]

PriorBelief = pos, **ContEvidence** = neg, **EvSource** = ext, **EvQual** = de, **EvRec** = both

Context: A has been looking at this week's sale products at the convenience store. Once she is doing her groceries at this store, she only picks discounted products. At the checkout cashier B is scanning her products, the total amount displayed on the screen is way higher than expected. Before paying A asks B:

---

[21]In appendix D other examples are listed in which non-positive prior belief is combined with non-positive evidence: (34) (36), (38), (40), (42), (44), (54), (56), (58), (60), (62).

[22]In appendix D examples (14) and (20) illustrate examples in which positive prior belief is combined with negative evidence.

(16)   #Deze   producten zijn in de aanbieding, hè?
       These products   are in the sale   HÈ
       'These products are on sale, right?'

PriorBelief = pos, **ContEvidence** = neg, **EvSource** = addr, **EvQual** = di, **EvRec** = sp

Context: A and B are invited to a mutual friend's birthday party. A believes the party starts at 13:00. A and B are talking about the party and then B utters: "The party starts at 12:00 tomorrow." A to B:

(18)   #Het begint   om 13:00, hè?
       It   start.3sg at   13:00 HÈ
       'It is starting at 13:00, right?'

This dominance of contextual evidence also becomes clear when non-positive prior belief is combined with positive external evidence. The *hè* question is felicitous when such combination applies. Consider example (24) in which the prior belief is negative.[23] The positive external evidence licenses the speaker's certainty of α. Since this certainty is established without the addressee's influence, the first condition is satisfied. The second condition is also satisfied because the provided evidence is available to all conversation participants and therefore the speaker considers it possible that the addressee − independently of the speaker − also believes in the truth of α.

PriorBelief = neg, **ContEvidence** = pos, **EvSource** = ext, **EvQual** = di, **EvRec** = both

Context: On a Saturday A wants to walk through a park where she often walks on Saturdays. She therefore expects the park to be freely accessible. When she arrives at the park she sees security guard B standing in front of a closed gate. They both look at the fenced park. A to B:

(24)   Het park is   niet open, hè?
       The park are.3sg not open HÈ
       'The park is not open, right?'

In case the speaker has positive prior belief in α and no evidence is provided the speaker is certain that α is true. This certainty is solely based on her positive prior belief and therefore the first condition is satisfied. The speaker also considers it possible that the addressee − independently from the speaker − might agree with her about the truth of α, since in case no evidence is provided there is no evidence against the truth of α available (see example (22)).

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[23]Examples of other combinations of non-positive prior belief and positive external evidence are to be found in appendix D: (26), (46), (48).

PriorBelief = pos, **ContEvidence** = none, **EvSource** = NA, **EvQual** = NA, **EvRec** = NA

Context: A is at an outdoor concert of C with B. A heard there are fireworks planned as well. C just started performing. A to B:

(22)　Er　　komt　　straks ook vuurwerk, hè?
　　　There come.3sg later　also fireworks　HÈ
　　　'There will also be fireworks later, right?'

It could also be the case that positive prior belief is combined with positive evidence. In case the source of this evidence is the addressee and its quality is 'direct', or if it is direct external evidence which is new to both, the *hè* question is not felicitous because no sincere information request can be made.[24] The other forms of positive evidence do result in a felicitous use of the *hè* question. In case the addressee is the source (and the quality is 'deduced'), the first condition is satisfied because the speaker is certain about α due to her positive prior belief and the second condition is met because it is trivial that the addressee might agree about α when she provides positive evidence (see example (12)). In case the positive evidence is external and not both direct and new to all conversation participants, the first condition is met because the speaker is certain about the truth of α based on both her prior belief and the external evidence. The second condition is also satisfied because the positive external evidence is also available to the addressee and with that the speaker considers it possible that the addressee agrees with her (see example (6)).[25]

PriorBelief = pos, **ContEvidence** = pos, **EvSource** = addr, **EvQual** = de, **EvRec** = sp

Context: B organizes a student meeting. Among other students, B and A are present. A believes that more students are coming. B utters "let's wait for a little longer." A to B:

(12)　Er　　komen　　meer studenten, hè?
　　　There come.3pl more students　　HÈ
　　　'There are more students coming, right?'

PriorBelief = pos, **ContEvidence** = pos, **EvSource** = ext, **EvQual** = de, **EvRec** = both

Context: Some weeks ago A saw B smoking, therefore she believes that B smokes. Now, both A and B are looking at a box of cigarettes in B's bag. A to B:

---

[24]Examples (1) and (10) in appendix D illustrate the infelicity of the *hè* question when such combinations apply.

[25]Example (4) in appendix D illustrates the felicitous use of a *hè* question when positive prior belief is combined with positive direct external evidence which is new to the addressee only.

(6) Jij   rookt,   hè?
     You smoke.2sg HÈ
     'You smoke, right?'

3.3   Personal taste questions

This project proposed the distinction between matter-of-fact and personal taste declarative anchors. This section describes the analysis of *toch* and *hè* questions with this second anchor type.[26] The felicitous use of these questions depend on specific types of contextual evidence and speaker's prior belief, these are explained in the first subsection 3.3.1. The last subsection 3.3.2 describes the felicity of both questions.

3.3.1   Contextual evidence and prior belief

From the evaluation of three native speakers followed that when a speaker uses a personal taste *toch* or *hè* question, the speaker's bias towards the truth of her opinion that x has property P is conveyed. It is also evaluated that the provided contextual evidence is separated in objective and subjective. The only relevant objective contextual evidence − that is present in situations in which a personal taste biased question is used − is the information about whether the participants experience x or not. In this project it is assumed that this evidence is available to both, this at least means that the speaker is aware whether the addressee has experienced x during the situation in which the biased question is uttered. The felicitous use of a personal taste biased question differs depending on who of the participants did not yet experience x, therefore the cases in which the speaker did not experience x and in which the addressee did not experience x are analysed as distinct evidence possibilities. The provided evidence which is characterised as subjective are the conversation participants' personal judgements about x. Since their opinions can differ from one another a distinction between speaker's judgement and addressee's judgement is made. The relevant speaker judgement possibilities are: positive judgement (assigning P to x), and negative judgement (assigning $\neg P$ to x).[27] These possibilities are also relevant to the addressee and so is the possibility of unknown judgement, which means that the addressee experienced x but not yet expressed her judgement about it.[28]

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[26]In this project, the predicate P in personal taste declarative anchor $\alpha = P(x)$ is a personal taste predicate and when the speaker uses α it means that the speaker subjectively judged x to be P: e.g., α is 'the diner is tasty' or 'the roller coaster is fun'. It is beyond the scope of this project to further clarify personal taste predicates. See Lasersohn (2005) for such clarification.

[27]For simplicity reasons the judgement possibilities are not finer grained than positive or negative.

[28]Traditionally, the contextual evidence is distinguished into three states: no evidence, positive evidence, and negative evidence (which is mentioned at the introduction of this chapter (3)). Although the current contextual evidence is distinguished in further subcategories, it is essentially still no evidence, positive evidence, and negative evidence, but then relative to the different conversation participants. Therefore, the current contextual evidence distinction is not mentioned as a contribution to biased question research in general. This is also because the distinction of declarative anchor types is already highlighted and the current contextual evidence distinction is due to the specific declarative anchor type, which involves *personal* judgements that could differ among the conversation participants.

The possible levels of prior belief are the same as when α expresses a matter of fact: positive, neutral, or negative. However, for the personal taste anchor a further distinction is made: in case the speaker has a negative prior belief about x which is combined with a positive speaker's judgement and an unknown judgement of the addressee, then the speaker's negative prior belief can be either strong or weak. The speaker's negative prior belief is characterised as strong when the belief is about x and the same x is judged in the situation. A weak negative prior belief occurs when the speaker's prior belief is based on x and during the situation y is judged which falls within the same category as x does, but it is not the exact same matter. The examples below illustrate this difference.

Strong negative prior belief: A has a neighbour who always behaves unkindly to her. A and B have met at A's apartment. A told B that they are meeting the neighbour shortly before A and B are heading out for dinner. A's neighbour acts very friendly when they meet. A to B:

(i)   #Mijn buurman is   aardig, toch?
      My   neighbour are.3sg kind   TOCH
      'My neighbour is kind, right?'

Weak negative prior belief: A does not like the taste of lemon. She is now in a restaurant with B and A chooses the only available dessert − a lemon cheesecake − for them. They share a piece and both take a bite. A happens to like it and B does not yet express her judgement. A to B:

(ii)   Het is   lekker, toch?
       It   are.3sg tasty   TOCH
       'It is tasty, right?'

3.3.2   The felicitous use of personal taste toch and hè questions

This project's felicity conditions of personal taste *toch* and personal taste *hè* questions are the same, apart from one requirement which only applies to the *toch* questions. This requirement is explained after the felicity conditions are presented. Subsequently, their (other) felicity conditions are discussed, by using a table which presents examples that illustrate their felicity.

Felicity Conditions (Personal Taste Toch Question). *A toch question q with declarative anchor $\alpha = P(x)$, that expresses a personal taste, is felicitous if all following conditions are fulfilled:*

1. the speaker must be certain that α is true, independent of the judgement provided by the addressee

2. the speaker must consider it possible that the addressee agrees about the truth of α, independent of the judgement of the speaker

3. the speaker must initiate the experience of x or share her expectation that x will have property P

Felicity Conditions (Personal Taste Hè Question). *A hè question q with declarative anchor $\alpha = P(x)$, that expresses a personal taste, is felicitous if all following conditions are fulfilled:*

1. the speaker must be certain that α is true, independent of judgement provided by the addressee

2. the speaker must consider it possible that the addressee agrees about the truth of α, independent of the judgement of the speaker

The difference between the *toch* and *hè* felicity conditions is that the *hè* conditions lack the third *toch* condition. This third condition captures the requirement that needs to be met for a *toch* question to be felicitous, but which is not necessary for the felicity of a *hè* question: the initiation/expectation requirement. When asking a *toch* question with $P(x)$ as its anchor, the speaker needs to be the initiator of the experience of x or the speaker must share her expectation which expresses that x has property P. The situations below illustrate this phenomenon.

> **No initiation nor expectation:** A and B are watching a sunset because they happened to be at the beach at the hour the sun started setting. A likes it and B does not express her judgement. A to B:

(iii)   #Het is   mooi,   toch?
      It   are.3sg beautiful TOCH
      'It is beautiful, right?'

(iv)   Het is   mooi,   hè?
      It   are.3sg beautiful HÈ
      'It is beautiful, right?'

In this situation both A and B did not initiate the event of viewing the sunset and both did not share their expectation about it. It is therefore unnatural for the speaker to ask the *toch* question in this situation (iii). Despite the lack of initiation and expectation the *hè* question is felicitous (iv).

> **Initiation:** A proposes to watch the sunset tonight. After walking to the sunset location they sit down and watch it. A likes the sunset and B does not expresses her judgement. A to B:

(v)   Het is   mooi,   toch?
It   are.3sg beautiful TOCH
'It is beautiful, right?'

(vi)   Het is   mooi,   hè?
It   are.3sg beautiful HÈ
'It is beautiful, right?'

Expectation: A and B are going to watch the sunset. While walking towards the viewing spot A utters "I'm so excited, I think it will be beautiful". After the walk A and B are sitting down and view the sunset. A likes it and B does not expresses her judgement. A to B:

(vii)   Het is   mooi,   toch?
It   are.3sg beautiful TOCH
'It is beautiful, right?'

(viii)   Het is   mooi,   hè?
It   are.3sg beautiful HÈ
'It is beautiful, right?'

In both scenarios ((v) and (vii)), it is natural for the speaker to ask the *toch* question, because in the former case A is the initiator of the sunset viewing and in the latter case A shares her expectation of the sunset, which is in correspondence with the declarative anchor.[29] The *hè* question is felicitous regardless of whether the requirement is satisfied (see scenarios (vi) and (viii)).

Although the felicity conditions of *toch* and *hè* questions differ because the initiation/expectation requirement is only relevant for *toch* questions, the first and second *toch* conditions are identical to the first and second *hè* conditions.[30] The (in)felicity of both personal taste question types is further explained by referring to the examples in table 28 below. This table illustrates whether the personal taste *toch* question (column 4) and the personal taste *hè* question (column 6) are felicitous given specific combinations of prior belief (column 1), speaker judgement (column 2), and addressee judgement (column 3). In table 28 it is assumed that the initiation/expectation requirement is satisfied. Columns 5 and 7 therefore represent only examples in which this requirement is met. The table then shows that apart from this requirement both *toch* and *hè* questions are used correctly and incorrectly under the same circumstances (columns 4 and 6).

---

[29]Also, because a felicitous combination of prior belief, speaker judgement, and addressee judgement applies which will be explicated below.

[30]The notion of independence is present in all these conditions, which means that in the situation both participants must judge x independent from one another, for the personal taste biased question to be felicitous. This is in correspondence to the analysis by Kiss (2022, p. 215) on independence when personal taste declarative anchors are involved.

Prior Belief	Speaker Judgement	Addressee Judgement	Toch	Ex	Hè	Ex
Positive	No Experience	No Experience		(1)		(2)
		Negative Judgement	no	(3)	no	(4)
		Positive Judgement		(5)		(6)
		Unknown Judgement	yes	(7)	yes	(8)
	Negative Judgement	No Experience		(9)		(10)
		Negative Judgement	no	(11)	no	(12)
		Unknown Judgement		(13)		(14)
		Positive Judgement		(15)		(16)
	Positive Judgement	No Experience		(17)		(18)
		Negative Judgement	no	(19)	no	(20)
		Positive Judgement		(21)		(22)
		Unknown Judgement	yes	(23)	yes	(24)
Negative	No Experience	No Experience		(25)		(26)
		Negative Judgement	no	(27)	no	(28)
		Unknown Judgement		(29)		(30)
		Positive Judgement		(31)		(32)
	Negative Judgement	No Experience		(33)		(34)
		Negative Judgement	no	(35)	no	(36)
		Unknown Judgement		(37)		(38)
		Positive Judgement		(39)		(40)
	Positive Judgement	No Experience		(41)		(42)
		Negative judgement	no	(43)	no	(44)
		Positive judgement		(45)		(46)
Weak Negative	Positive Judgement	Unknown Judgement	yes	(47)	yes	(48)
Strong Negative			no	(49)	no	(50)
Neutral	No Experience	No Experience		(51)		(52)
		Negative Judgement	no	(53)	no	(54)
		Unknown Judgement		(55)		(56)
		Positive Judgement		(57)		(58)
	Negative Judgement	No Experience		(59)		(60)
		Negative Judgement	no	(61)	no	(62)
		Unknown Judgement		(63)		(64)
		Positive Judgement		(65)		(66)
	Positive Judgement	No Experience		(67)		(68)
		Negative Judgement	no	(69)	no	(70)
		Positive Judgement		(71)		(72)
		Unknown Judgement	yes	(73)	yes	(74)

Table 28. Felicity of personal taste *toch* and *hè* questions derived from specific combinations of prior belief, speaker and addressee judgements given that the initiation/expectation requirement is satisfied

The conveyed bias towards the truth of α when using a personal taste biased question is captured by the first part of the first felicity condition: the speaker must be certain that α is true. Since α expresses the speaker's *personal* taste about x, the speaker must have experienced and judged x herself. Her opinion cannot be based upon the judgement of other conversation participants, which is captured by the second part of the first condition: the certainty must be independent of the judgement of the addressee. To be certain about the truth of α the speaker must at least have a positive prior belief in or a positive judgement of α. So, in case the speaker has a non-positive prior belief and in the situation she did not positively judge x to have P, this first condition is not satisfied: both the *toch* and the *hè* question are infelicitous. Examples (63) and (64) illustrate such situation: neutral prior belief is combined with negative speaker judgement (and with an unknown judgement of

the addressee).[31],[32]

PriorBelief = neu, **SpJudgement** = neg, **AddrJudgement** = unknown

Context: A never tasted or made a Lebanese dish before, she now prepared one for B and herself. While B took a bite and did not yet share her judgement, A tasted the dish and does not like it. A to B:

(63) #Het is   lekker, toch?
    It   are.3sg tasty   TOCH
    'It is tasty, right?'

(64) #Het is   lekker, hè?
    It   are.3sg tasty   HÈ
    'It is tasty, right?'

The speaker's certainty in the truth of α when she has a positive prior belief is damaged when she judges x to have $\neg P$ (negative judgement) within the situation. In this case the first condition is violated and the *toch* and *hè* questions are thus infelicitous. Examples (9) and (10) illustrate such situation: positive prior belief is combined with negative speaker judgement (and with an unknown judgement of addressee).[33]

PriorBelief = pos, **SpJudgement** = neg, **AddrJudgement** = unknown

Context: A is taking B to a theater play that A saw before and liked. During this second time A was shocked by some elements and realised she did not like the play anyway. When they exit the theater B did not yet share her verdict. A asks B:

(13) #Het was   mooi,   toch?
    It   are.3sg.pst beautiful TOCH
    'It was beautiful, right?'

(14) #Het was   mooi,   hè?
    It   are.3sg.pst beautiful HÈ
    'It was beautiful, right?'

The second felicity condition captures the intuition that the speaker uses a personal taste biased question to find out whether the addressee agrees with the speaker's positive opinion about x: the speaker must consider it possible that the addressee agrees about the truth of α, independent of the speaker. The independence captures the addressee's *personal*

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[31]The example numbers correspond to those in table 28 (and in appendix E) and therefore they may not be successive in this section's text.

[32]Other examples in which non-positive prior belief is combined with non-positive speaker judgement are to be found in appendix E: (25), (26), (27), (28), (29), (30), (31), (32), (33), (34), (35), (36), (37), (38), (39), (40), (51), (52), (53), (54), (55), (56), (57), (58), (59), (60), (61), (62), (65), (66).

[33]Examples (9), (10), (11), (12), (15), (16) in appendix E illustrate the infelicity of both questions when other combinations of positive prior belief and negative speaker judgement apply.

judgement about x. When the speaker believes that $P(x)$, she knows the addressee does not agree with her about x if the addressee did not yet experience x or when the addressee expresses the negative judgement $\neg P(x)$. In the first case because without experiencing x, one cannot form an personal opinion about it. In the second case because it is the addressee's opinion rather than factual evidence, the speaker can only accept that this judgement is true to the addressee. Despite the specific state of the speaker's prior belief and judgement, both the *toch* and the *hè* question are infelicitous in both scenarios. This is accurately captured by the felicity conditions: the second condition is violated, because the speaker does not consider it possible that the addressee agrees with her. Consider examples (1)-(4) which illustrate the infelicity of the *toch* and *hè* questions both when the addressee did not yet experience x and when she expresses her negative judgement (combined with positive prior belief and the speaker not yet experiencing x).[34,35]

PriorBelief = pos, **SpJudgement** = no ex, **AddrJudgement** = no ex

Context: A saw a movie she very much enjoyed. She invites her friend B to come watch that movie. A knows B never saw the movie before. They are ready to start the movie. A to B:

(1) #De film is mooi, toch?
     The movie are.3sg beautiful TOCH
     'The movie is beautiful, right?'

(2) #De film is mooi, hè?
     The movie are.3sg tasty HÈ
     'The movie is tasty, right?'

PriorBelief = pos, **SpJudgement** = no ex, **AddrJudgement** = neg

Context: Based on a recipe A liked before, she is preparing dinner for B and herself. A did not take a bite yet, B did and expresses her dislike. A to B:

(3) #Het is lekker, toch?
     It are.3sg tasty TOCH
     'It is tasty, right?'

(4) #Het is lekker, hè?
     It are.3sg tasty HÈ
     'It is tasty, right?'

When the speaker has a strong negative prior belief in α, the *toch* and *hè* questions are infelicitous, regardless of speaker's judgement state within the situation. A strong negative

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[34]In appendix E other examples in which the addressee did not experience x are presented: (9), (10), (17), (18), (25), (26), (33), (34), (41), (42), (51), (52), (59), (60), (67), (68).

[35]Other examples that illustrate such scenario can be found in appendix E: (11), (12), (19), (20), (27), (28), (35), (36), (43), (44), (53), (54), (61), (62), (69), (70).

prior belief in α means that the speaker already experienced and negatively judged x before and when she experiences the same x again and judges x to have P in that situation then this positive judgement is not enough to overrule the negative prior belief. This is because the matter being judged (x) is the exact same matter she has the negative prior belief about. The speaker is then not certain about the truth of $P(x)$, the first condition is thus violated and the *toch* and *hè* questions are infelicitous. Examples (49) and (50) illustrate a situation in which the speaker has a strong negative prior belief.

PriorBelief = strong neg, **SpJudgement** = pos, **AddrJudgement** = unknown

Context: A has a neighbour who always behaves unkindly to her. A and B have met at A's apartment. A told B that they are meeting the neighbour shortly before A and B are heading out for dinner. A's neighbour acts very friendly when they meet. A to B:

(49) #Mijn buurman is aardig, toch?
    My neighbour are.3sg kind TOCH
    'My neighbour is kind, right?'

(50) #Mijn buurman is aardig, hè?
    My neighbour are.3sg kind HÈ
    'My neighbour is kind, right?'

The *toch* and *hè* questions are also infelicitous in case the speaker has a positive prior belief in or a positive judgement about α, and the addressee expresses her positive judgement about α. The speaker can no longer sincerely ask the biased questions, since she no longer seeks for information as the answer to the question is known to the speaker. Both questions are in such a situation rather hidden statements than actual questions, which request information. In examples (21) and (22) the situation is captured in which positive prior belief is combined with positive speaker positive addressee judgement.[36]

PriorBelief = pos, **SpJudgement** = pos, **AddrJudgement** = pos

Context: A is taking B to a painting in a museum she already saw and which she thinks is beautiful. They arrive at the painting, A still thinks it is beautiful and B expresses that she thinks it is gorgeous. A to B:

(21) #Het schilderij is mooi, toch?
    The painting are.3sg beautiful TOCH
    'The painting is beautiful, right?'

(22) #Het schilderij is mooi, toch?
    The painting are.3sg beautiful TOCH

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[36]Examples (5), (6), (45), (46), (71), and (72) are illustrations of other situations in which positive addressee judgement is combined with the speaker being certain about α.

'The painting is beautiful, right?'

The *toch* and the *hè* question are felicitous when they are a sincere information request and both conditions (and the third *toch* condition) are satisfied. The first condition is satisfied either in case the speaker has a positive prior belief in $P(x)$ and she does not judge x negatively within the situation, or when she has a positive judgement $-$ by assigning P to x $-$ and did not have a strong negative prior belief. In the first case the speaker is certain about the truth of $P(x)$ before the situation and if she does not judge x negatively during the situation, there is nothing that alters this certainty (see examples (7) and (8) below). In the second case the positive judgement within the situation provides the speaker's certainty in the truth of $P(x)$. In case the speaker has a positive prior belief the positive judgement is a confirmation of that belief. When the speaker has a neutral prior belief the positive judgement updates this belief. Even if the speaker has a weak negative prior belief this belief is overruled by the positive judgement. A weak negative prior belief means that the speaker has experienced y before and judged y to have property $\neg P$. y falls within the same category as x but it not the exact same matter. Because x differs from the matter being judged before the negative prior belief is overruled by the positive judgement (see examples (47) and (48) below).

The second condition is satisfied when the addressee experiences x and either expresses her positive judgement or does not yet express her judgement. However, in case the addressee expresses her positive judgement (and the speaker is certain about α) the speaker's aim to elicit information is no longer present and then the minimal requirement of a biased question is violated. This results in both biased question types being infelicitous. In case the addressee's judgement is unknown, the speaker considers it possible that the addressee might agree with the speaker's positive judgement of x and since the addressee experiences and judges x without depending on the speaker's opinion, the independence in the second condition is also accounted for. Examples (7) and (8) illustrate the felicity of both questions when the speaker is $-$ because of her positive prior belief $-$ certain about α and the addressee's judgement is unknown.[37] Both biased questions are felicitous when a weak negative prior belief is combined with positive speaker and unknown addressee judgement, such a situation is illustrated by examples (47) and (48).

PriorBelief = pos, **SpJudgement** = no ex, **AddrJudgement** = unknown

Context: A has a friend and A loved the smell of her friend's perfume. She takes another friend B to the perfumery to show her the perfume she likes. She sprays it on a piece of paper and hands it to B. B smells at it without expressing her judgement about the smell. A to B:

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[37]In appendix E examples (23), (24), (73), and (74) present another situation in which the speaker is certain about α and the addressee's judgement is unknown.

(7) Het ruikt   lekker, toch?
     It   smell.3sg nice   TOCH
     'It smells nice, right?'

(8) Het ruikt   lekker, hè?
     It   smell.3sg nice   HÈ
     'It smells nice, right?'

PriorBelief = weak neg, **SpJudgement** = pos, **Addr.Judgement** = unknown

Context: A does not like the taste of lemon. She is now in a restaurant with B and A chooses the only available dessert − a lemon cheesecake − for them. They share a piece and both take a bite. A happens to like it and B does not yet express her judgement. A to B:

(47) Het is   lekker, toch?
     It   are.3sg tasty   TOCH
     'It is tasty, right?'

(48) Het is   lekker, hè?
     It   are.3sg tasty   HÈ
     'It is tasty, right?'

3.4   Discussion

This discussion section provides a synopsis of the differences between the felicitous use of *toch* questions and of *hè* questions in the first subsection. In the second subsection their uses are compared to reverse polarity tag questions in English.

3.4.1   Comparison of toch and hè questions

Although both *toch* and *hè* questions convey a speaker's bias towards the truth of their declarative anchor, they are felicitous in different circumstances. A first difference is that the conditions under which a *hè* question is felicitous are the same regardless of the specific anchor type (see the *hè* conditions at 3.2.4 and 3.3.2), whereas the *toch* questions' felicity conditions differ depending on whether the anchor expresses the speaker's personal taste or a matter of fact (see the *toch* conditions at 3.2.3 and 3.3.2).

Furthermore, in section 3.3.2 it has been discussed that for a *toch* question which is based on a personal taste declarative anchor to be felicitous, the initiation/expectation requirement must be met.[38] However, for a personal taste *hè* question to be felicitous this requirement does not need to be satisfied. Apart from this difference, the uses of the personal taste *toch* and *hè* question are felicitous under equal circumstances.

When *toch* and *hè* questions are based on an anchor that expresses a matter of fact, there are several differences between their uses. First, the *hè* question is potentially

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[38]This requirement states that for a *toch* question with personal taste anchor $P(x)$ the speaker must initiate the experience of x or she must share her expectation that x will have property P.

felicitous when the speaker has a neutral or negative prior belief,[39] whereas for the felicity of the *toch* question, the prior belief needs to be positive. Secondly, *hè* questions are infelicitous when negative evidence is provided, whereas a *toch* question is felicitous when the speaker has positive prior belief and *negative* evidence that is not both external and direct is provided.

3.4.2   Comparison of both question types with English tag questions

A reverse polarity tag question (hereafter: English tag question) is a biased question type in English that consists of a declarative anchor and a tag in which the polarity "is the opposite of the polarity of the declarative anchor" (Farkas and Roelofsen 2017, p. 239).[40] Similar to *toch* and *hè* questions, a bias towards the truth of the anchor is conveyed when a English tag question is used.

Even though English tag questions have not been analysed using this project's semantic distinctions,[41] it could still be argued that their felicity does not fully correspond to the felicity of the other questions. The difference in felicitous use between the distinctive question types is demonstrated by presenting situations in which one question is felicitous and the other is not.

The rain and student meeting situations below illustrate that the felicitous use of English tag and *hè* questions differs. The *hè* question is felicitous in the first example (i) and infelicitous in the second (iv), whereas the reverse is the case for the English tag question (respectively (iii) and (vi)). Farkas and Roelofsen (2017, p. 273) illustrate the infelicity of the English tag question in the rain situation and Gaasbeek (2021, p. 12) presents the English tag question to be felicitous in the student meeting situation. The *hè* question is felicitous in the rain situation because neutral prior belief is combined with positive deduced external evidence, and then the *hè* question's felicity conditions are satisfied. It is infelicitous in the student meeting situation because the speaker knows that the addressee does not agree about the truth of the declarative anchor. The second *hè* condition is thus violated.[42] English tag and *hè* questions are therefore not felicitous under the same conditions.

English tag questions seem to behave like *toch* questions, because of the correspondence in their (in)felicity in both the rain and student meeting situation. However, the sunset situation exposes a difference between those questions types. Farkas and Roelofsen

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[39]That is, when those types of prior belief are combined with positive external evidence.

[40]See (3) below which is an example of such question.

[41]In this project specific evidence forms and declarative anchor types are distinguished and used to determine the felicitous use of *toch* and *hè* questions. These distinctions have not (yet) been applied to tag questions in English.

[42]Second felicity condition: the speaker must consider it possible that the addressee agrees about the truth of α, independent of the speaker.

(2017, p. 240) show that the English tag question is felicitous in this situation and it is explained in section 3.3.2 that the use of the *toch* question is infelicitous in the sunset situation. Where it is necessary for a *toch* question to satisfy the initiation/expectation requirement, this is not necessary for a English tag question. *Toch* and English tag questions are thus not felicitous under the same circumstances.

Rain situation: A sits in a windowless office and is ignorant about the weather situation. Then her colleague B walks in wearing a wet rain coat. A to B:

(i)   Het regent, hè?
      It   rain.3sg HÈ
      'It is raining, right?'

(ii) #Het regent, toch?
       It   rain.3sg TOCH
       'It is raining, right?'

(iii) #It is raining, isn't it?

Student meeting situation: At a student meeting, A is the student representative and knows who will be present today. B is a student who is present at the meeting and believes that more students are coming. A: We are all here now, shall we begin the meeting? B to A:

(iv) #Er   komen   meer studenten, hè?
       There come.3pl more students   HÈ
       'There are more students coming, right?'

(v)   Er   komen   meer studenten, toch?
      There come.3pl more students   TOCH
      'There are more students coming, right?'

(vi) There are more students coming, aren't there?

Sunset situation: A and B are watching a sunset because they happened to be at the beach at the hour the sun started setting. A to B:

(vii) Het is   mooi, hè?
       It   are.3sg beautiful HÈ
       'It is beautiful, isn't it?'

(viii) #Het is   mooi, toch?
        It   are.3sg beautiful TOCH
        'It is beautiful, isn't it?'

(ix)   It is beautiful, isn't it?

3.5 Two types of biased questions in Dutch: Conclusion

This project investigated the felicitous use of two types of biased questions in Dutch: *toch* and *hè* questions. To accurately determine felicity conditions for both biased question types, this project proposed a distinction in declarative anchor type (matter-of-fact and personal taste) and a further specification of contextual evidence (source, quality and recipients to whom the evidence is new). This project resulted in the formulation of the questions' felicity conditions:

Felicity Conditions (Matter-of-Fact Toch Question). *A toch question q with declarative anchor $\alpha = P(x)$, that expresses a matter of fact, is felicitous if all following conditions are fulfilled:*

1. the speaker must have a positive prior belief in α
2. the speaker must consider it possible that the addressee might agree (potentially after some thought) about the truth of α
3. the speaker is not certain both participants agree about the truth status of α

Felicity Conditions (Personal Taste Toch Question). *A toch question q with declarative anchor $\alpha = P(x)$, that expresses a personal taste, is felicitous if all following conditions are fulfilled:*

1. the speaker must be certain that α is true, independent of the judgement provided by the addressee
2. the speaker must consider it possible that the addressee agrees about the truth of α, independent of the judgement of the speaker
3. the speaker must initiate the experience of x or share her expectation that x will have property P

Felicity Conditions (Matter-of-Fact and Personal Taste Hè Question). *A hè question q with declarative anchor $\alpha = P(x)$, that expresses a matter of fact or personal taste, is felicitous if all following conditions are fulfilled:*

1. the speaker must be certain that α is true, independent of the information or judgement provided by the addressee
2. the speaker must consider it possible that the addressee agrees about the truth of α, independent of the judgement or information provided by the speaker

3.5.1 Contribution and future research

Besides a better understanding in the use of two types of biased questions in Dutch, the main contribution of this project to biased question research in general is that it highlights the relevance of several finer-grained semantic distinctions when analysing biased polar questions. Not only the distinction of different prior belief and contextual evidence states

are relevant (neutral, positive, and negative), but so are the distinction between two types of declarative anchors and the specification of contextual evidence. Since it is illustrated in this project that these further distinctions were necessary to accurately capture the felicitous uses of *toch* and *hè* questions, these distinctions are potentially relevant for parallel analyses of biased questions in other languages.

In the current project, the felicity conditions are solely based on the assessment of three native speakers. A suggestion for further research is to take these felicity conditions as hypotheses and validate them through experimental tests. In such a potential experiment, situation descriptions − in which different combinations of prior belief and contextual evidence apply − could be presented to a diverse group of participants.[43] The participants could be instructed to take the role of the speaker in these situations. The participants may then be asked to formulate a question that best fits (or naturally fits in) the situation, or a list of possible questions may be presented out of which the participants should choose the most natural possibility.

In the current project only the contextual evidence of matter-of-fact biased questions was further specified (i.e. source, quality and recipients), and in future research it may also be worthwhile to do so for contextual evidence in personal taste biased questions. A specific form of personal taste contextual evidence is positive addressee judgement of α. It is argued in this project that this form combined with the speaker being certain about the truth of α results in an infelicitous use of personal taste biased questions, because the speaker can no longer sincerely ask such a biased question. Distinguishing between 'direct' and 'deduced' quality of the addressee's judgement may provide further insight. In case of a direct positive addressee judgement − while the speaker is certain of α − asking a personal taste biased question indeed seems insincere. In case of *deduced* positive addressee judgement, however, there is a possibility that the speaker might still be uncertain about what the addressee means. A biased question may then be sincere, and thus felicitous.[44]

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[43]Ideally, all participants are native Dutch speakers from different regions within the Netherlands.

[44]In a situation in which the sunset is being watched, a direct positive addressee judgement could be the addressee uttering 'the sunset is beautiful'. A deduced positive addressee judgement in such a situation could be the addressee expressing 'wow'.

4. Conclusion

This project examined the use of polar questions and aimed at gaining insight into: the use of (non-)manual markers in polar question in Sign Language of the Netherlands (NGT), and the use of two biased polar questions in Dutch.

Polar questions in NGT were discussed in chapter 2 and resulted in the formulation of the following preliminary generalisations. The first three generalisations are concerned with the presence of (non-)manuals in polar questions in NGT in general, whereas the last five generalisations consider the presence of (non-)manuals in five specific polar question forms.

Preliminary generalisation 1 *Polar questions in NGT are not necessarily expressed through marked − or specifically raised − eyebrows.*

Preliminary generalisation 2 *The use of lowered eyebrows and squeezed eye shape coincide, and wide eye shape only occurs when raised eyebrows are present.*

Preliminary generalisation 3 *The marker of nodding only occurs when the marker of chin in is present, and forward body position only occurs when the marker of chin out is present.*

Preliminary generalisation 4 *The syntactic structure which combines a radical and a 'toch' tag requires that no polarity is expressed at the radical, and that at the tag the markers of nodding and* PALMS-UP *are present.*

Preliminary generalisation 5 *The syntactic structure which combines a radical and an 'of niet' tag requires that the radical expresses no negative polarity, and that at the tag the markers of shaking,* PALMS-UP, *and no eyebrow marking are present.*

Preliminary generalisation 6 *The syntactic structure which combines a radical and a hesitation tag requires that no polarity is expressed at the radical, and that at the tag the markers of lip corners down, body position forward, chin out, shaking or neutral head movement, and* PALMS-UP *are present.*

Preliminary generalisation 7 *The syntactic structure which combines a radical and a disbelief tag requires that at the tag the markers of shaking, chin in, and wide* PALMS-UP *are present.*

Preliminary generalisation 8 *The syntactic structure which combines a radical and a confirmation tag requires that at the tag the markers of nodding, shoulders up, wide* PALMS-UP*, and no eyebrow marking are present.*

Chapter 3 presented the analysis of the use of two types of biased question in Dutch: *toch* questions and *hè* questions. Based on this analysis the following felicity conditions were extracted.

Felicity Conditions (Matter-of-Fact Toch Question). *A toch question q with declarative anchor $\alpha = P(x)$, that expresses a matter of fact, is felicitous if all following conditions are fulfilled:*

1. the speaker must have a positive prior belief in α
2. the speaker must consider it possible that the addressee might agree (potentially after some thought) about the truth of α
3. the speaker is not certain both participants agree about the truth status of α

Felicity Conditions (Personal Taste Toch Question). *A toch question q with declarative anchor $\alpha = P(x)$, that expresses a personal taste, is felicitous if all following conditions are fulfilled:*

1. the speaker must be certain that α is true, independent of the judgement provided by the addressee
2. the speaker must consider it possible that the addressee agrees about the truth of α, independent of the judgement of the speaker
3. the speaker must initiate the experience of x or share her expectation that x will have property P

Felicity Conditions (Matter-of-Fact and Personal Taste Hè Question). *A hè question q with declarative anchor $\alpha = P(x)$, that expresses a matter of fact or personal taste, is felicitous if all following conditions are fulfilled:*

1. the speaker must be certain that α is true, independent of the information or judgement provided by the addressee
2. the speaker must consider it possible that the addressee agrees about the truth of α, independent of the judgement or information provided by the speaker

The introduction of this project (chapter 1) described two parallel research paths: one representing research in sign languages and in particular NGT, and the other covering research in spoken languages and specifically Dutch. Although both parts of the current project had different starting points because research in sign languages is young compared to research in spoken languages, the contribution of both parts to their research paths is

similar. Both contribute to a better understanding of the use of polar questions, respectively in NGT and Dutch and this leads to further movement along their paths. The NGT part of this project resulted in preliminary generalisations about the use of (non-)manuals in polar questions in NGT, and the Dutch part concluded with the conditions under which *toch* and *hè* questions are felicitous. Further testing − as proposed in respectively sections 2.7 and 3.5 − is required to reach more definite conclusions.

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A. Metadata of the participants in the Corpus NGT

Participant	Region	Age at time of recording	Gender	Number of questions signed
S001	Amsterdam	69	m	6
S002	Amsterdam	81	f	14
S003	Amsterdam	62	f	18
S004	Amsterdam	77	f	18
S005	Mixed	22	f	31
S006	Mixed	19	f	11
S007	Other	35	f	17
S008	Other	29	f	32
S009	Amsterdam	30	f	1
S010	Amsterdam	35	f	4
S011	Amsterdam	37	m	5
S012	Amsterdam	39	m	10
S013	Groningen	33	f	6
S014	Groningen	41	f	8
S015	Groningen	41	m	7
S016	Groningen	66	m	12
S017	Groningen	68	m	12
S018	Groningen	82	f	14
S019	Groningen	33	m	12
S020	Groningen	34	f	1
S021	Groningen	24	f	10
S022	Groningen	18	m	9
S023	Groningen	41	f	3
S024	Groningen	44	m	4
S025	Groningen	30	m	24
S026	Groningen	28	m	13
S027	Groningen	22	f	10
S028	Groningen	20	f	5
S029	Groningen	17	m	1
S030	Groningen	18	m	2
S031	Groningen	59	f	3
S034	Groningen	41	f	3
S035	Groningen	26	m	9
S036	Groningen	26	f	4
S037	Groningen	61	m	5
S038	Groningen	62	m	2
S039	Groningen	42	f	6
S040	Groningen	42	f	8
S042	Groningen	67	m	1
S043	St. Michielsgestel	74	m	4
S044	St. Michielsgestel	72	f	4
S045	Voorburg	84	m	1
S047	Amsterdam	59	f	2
S061	Voorburg	71	f	1
S062	Voorburg	61	f	1
S065	St. Michielsgestel	35	f	3
S067	Other	39	f	10
S068	Other	37	f	12
S069	Mixed	40	m	6
S070	Mixed	28	m	8
S071	Amsterdam	45	m	1
S072	Amsterdam	66	f	2
S075	Amsterdam	41	m	8
S076	Amsterdam	23	m	4
S077	Mixed	28	m	6
S078	Mixed	24	f	7
S079	Voorburg	33	m	1
S081	Mixed	34	m	4
S086	Amsterdam	43	m	1
S087	Voorburg	48	f	1

Table 29. Metadata of the participants who signed the questions which are analysed within this project

B.   (Non-)manual marker annotation guideline

The non-manual behaviour of the participants in the corpus videos is examined in order to determine whether some non-manual markers are used when (specific forms of) polar questions in NGT are asked. The following markers are focused on: eyebrows, eye shape, shoulders, body position, lip corners, head, nose, and eye gaze. Another feature that is also investigated is whether the manual sign PALMS-UP is used. Each non-manual marker can take different shapes. Eyebrows, for example, can be identified as being raised, low, or neutral. The table below presents the different states the (non-)manual markers can be characterized as.

	marker	categories						
1	eyebrows	neutral	raised	low				
2	eye shape	neutral	wide	squeezed				
3	shoulder	neutral	up					
4	body position	neutral	leaning forward	leaning backwards	tilted	sideways		
5	lip corners	neutral	up	down				
6	head	neutral	chin in	chin out	shaking	nodding	shake	nod
7	nose	neutral	wrinkled					
8	eye gaze	other participant	experimenter	space				
9	PALMS-UP	yes	no					

Table 30. (Non-)manual markers and their characterizing categories

This appendix provides the guideline that stipulates which criteria should be fulfilled for a marker to be characterized as being in one of its states. After most of the marker descriptions below, some pictures illustrate the different marker's states.[1]

If it is unclear in which state the marker is, then this marker is annotated as 'uncertain', one could add in the comment section why it is not clear. **In order to determine the participant's natural/neutral state of the different markers it might be helpful to watch some seconds before and after the fragment that needs annotation**. It could be the case that in a fragment the participant combines different *non-neutral* states of a marker, then *this combination* is annotated. For example, in the course of the fragment the participant's eyes are both wide and squeezed, this is annotated as 'wide, squeezed'. In case a neutral and a non-neutral state of the marker are combined, only the non-neutral state is annotated: e.g., the situation in which participant's body position first moves in a tilted state and then back to a neutral position, is annotated as 'tilted'.

B.1   Eyebrows

Following de Vos' characterization (Vos, Kooij, and Crasborn 2009, p. 318) of the possible eyebrow shapes, the distinguished forms are inner brow raised, outer brow raised, and eyebrows low. The inner brow is the part of the eyebrow that begins around the nose and ends at the middle of the eyebrow. The outer brow starts at the other end of the eyebrow

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[1]These pictures are screenshots of some video fragments in the NGT corpus (Crasborn, Zwitserlood, and Ros 2008; Crasborn and Zwitserlood 2008).

and also ends around the middle of the eyebrow. The eyebrows are annotated as 'raised' if both the inner and the outer brow are raised. When the eyebrows are low they are annotated as 'low'. It could be the case that the eyebrows are low but the inner or outer brow is raised, since the lowness of the eyebrow is more dominant this combination is annotated as 'low'.[2] In case the eyebrows are in a relaxed position the eyebrows are annotated with 'neutral'. Also, when the eyebrows move down or up only for a short moment within the given fragment, it is annotated: respectively, as 'low' or 'raised'.

The eyebrows could seem *neutral* in situations in which the eyebrows are in a *non-neutral* state before the fragment starts[3] and they do not change during the fragment. However, compared to the actual neutral state they are non-neutral and although they do not change within the course of the fragment, they are a change compared to this actual neutral state and should therefore be annotated as the particular non-neutral state they are in.[4] It is therefore advised to watch some seconds before the fragment, to determine whether the eyebrows' state is neutral or not.

In case it is hard to determine in which state the eyebrows are in, the eyebrows are annotated as 'uncertain'.

raised eyebrows

(slightly) raised eyebrows

low eyebrows

neutral eyebrows

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[2]In Vos, Kooij, and Crasborn (2009) this is marked as AU 1+2+4 or AU 1+4.
[3]For example because the question in the fragment is following another question.
[4]This is because they could be a particular question marker.

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B.2 Eye shape

The eyes could be in a neutral, squeezed, and wide shape. The eyes are in a squeezed state if the under eyelids are pressed up, the eye shape is then annotated as 'squeezed'. When the eyes are in such squeezed shape, the upper eyelids could additionally be pressed down. The eyes' shape is annotated with 'wide' when both eyelids are pressed away from each other (i.e., upper eyelid up and under eyelid down). If the eyes are in a natural shape, then the eye shape is annotated as 'neutral'. Please note that the eyes' shape could seem squeezed when the eyebrows are low or wide when the eyebrows are raised, while *actually* the eyes are in a neutral state. In these cases, the eye shape should be annotated as 'neutral'. If the eye shape is hard to determine due to these eyebrow positions, one could add a note about the eyebrows in the comment section. In general, if it is not clear in which state the eyes are, it is annotated with 'uncertain'.

neutral eye shape (low eyebrows)
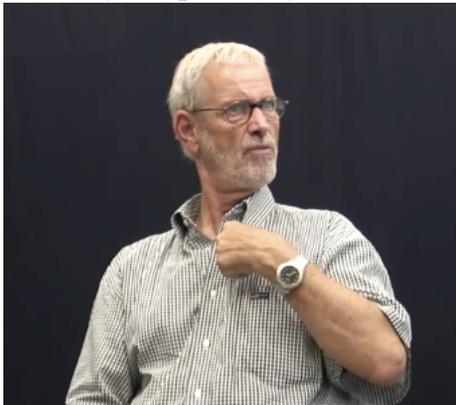
squeezed eye shape (low eyebrows)

wide eye shape (raised eyebrows)

wide eye shape (uncertain eyebrows)

squeezed eye shape (raised eyebrows)   neutral eye shape (neutral eyebrows)

B.3 Shoulders

The participant could raise the shoulders (one or both) or hold them in a neutral position. When the shoulders are relaxed it is annotated with 'neutral' and when one or both shoulders are raised with 'up'. *It could be the case that the body is slightly leaning to the side without tightening the shoulders, in doing so one shoulder is higher than the other without really lifting any of the shoulders*. The shoulders are then annotated with 'neutral', and the tilted position is possibly annotated in the body position tier (see section B.4). If it is unclear whether the shoulders are in a neutral or an up state it is annotated with 'uncertain'.

shoulders up   shoulders neutral

shoulders neutral   shoulders neutral

B.4 Body position

The body can be in several positions: neutral, leaning forward, leaning backwards, sideways and tilted. If the top of the body is moving forward, then the body position is annotated with 'leaning forward'. If the top of the body is moving backwards, then it is annotated as 'leaning backwards'. Both these movements could involve moving shoulders as well. In case such shoulder movements are due to the movement of the body they are not annotated as such in the shoulder tier: this movement is only described in the body position tier.

The body position is annotated as 'tilted' if the top of the body is facing forward and the body *moves* in a tilted shape (leaning sideways *movement*). If the body is in a (slightly) tilted position, but there is *no movement* towards that position involved the body position is annotated as 'neutral' instead. If the upper body (with or without head movement) is turned sideways then the body position is annotated with 'sideways', this could − for example − happen when the participant communicates with the experimenter.

It could be the case that the body is moving in several directions, the combination of movements is then annotated (e.g., forward to side movement is annotated as 'leaning forward, sideways'). The body is in a neutral position if it is relaxed and not heavily moving, this is annotated with 'neutral'. If it is unclear in which body position the participant is, then this is annotated as 'uncertain'.

neutral body position

neutral body position

leaning forward body position

leaning forward body position

leaning backwards body position   sideways body position

B.5   Lip corners

The lip corners could be curled up, pushed down, or in a relaxed state. This is respectively annotated as 'up', 'down', or 'neutral'. Some participants already have their lip corners curled up/down when in a relaxed state, annotators should therefore view some seconds before and/or after the fragment in order to first get a better view of the participant's neutral lip corners' state. Besides signing, the participants also use mouth gestures and mouthing, which result in movements of their mouths including their lip corners, it could therefore be hard to determine in which state the lip corners are. To minimize the influence of this factor, **only the state of the lip corners at the end of the fragment is annotated**. Also, the lip corners are only annotated as non-neutral if they *move* into some non-neutral state at the end of the fragment. Thus, if there is no lip corner movement involved at the end of the fragment, the lip corners are annotated as 'neutral'. If the lip corners' state is unclear it is annotated as 'uncertain'.
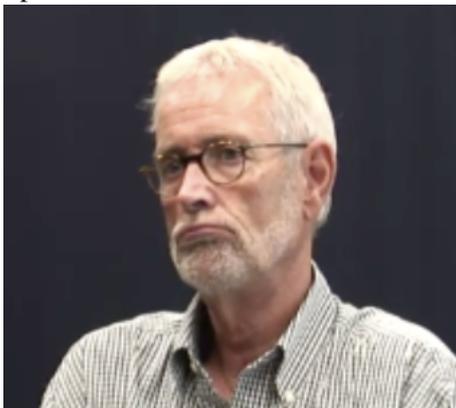
lip corners down   lip corners neutral[5]

B.6   Head

The head could be in several states: neutral, chin out, chin in, shaking, shake, nodding, and nod. If the **chin** is pulled backwards or pushed down, it is annotated as 'chin in'. In case the chin is pushed forward or up it is annotated as 'chin out'. A combination is also possible if for example the participant moves the chin forward and down it is annotated as: 'chin out, chin in'.

The head is annotated as 'shaking' when the head is moving from side to side more than once.

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[5]despite the lip corners being slightly down, it is the participant's neutral state, therefore the lipcorners are annotated with 'neutral'.

If it just moves *once* it is annotated as 'shake'. If the head moves several times vertically, it is annotated with 'nodding'. If the head makes *one* nod, which means that the chin moves from an up position to a down position (and possibly back), then the head is annotated as 'nod'. Both 'nod' and 'shake' can occur more than once within the fragment. The difference between for example two nods (which is annotated as 'nod') and nodding is that nodding is a continuous vertical movement whereas in case of two nods there is one up-to-down movement followed by a pause in which no nodding takes place followed by another up-to-down movement. The same distinction applies to shake and shaking, but in this case a horizontal movement is involved.

In case the head/chin is in a relaxed and non-moving position, the head is annotated as 'neutral'. If it is uncertain which state the head is in, this column is annotated with 'uncertain'.

chin in

chin in

chin out
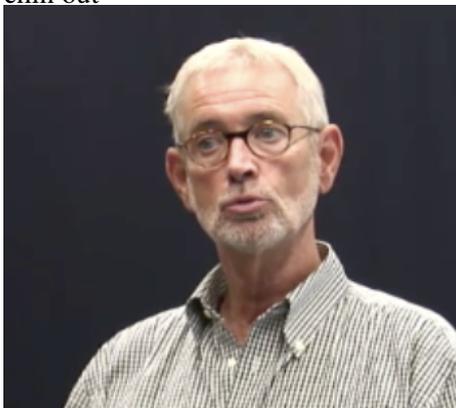
chin out

chin out

chin out

B.7 Nose

The participant's nose could be in a neutral or in a wrinkled state. In the wrinkled state the nose is pulled up such that wrinkles arise at its top (just below the eyes) and the tip of the nostrils are pulled up as well. If the nose is in this wrinkled state it is annotated with 'wrinkled'. The nose is not only annotated as 'wrinkled' if the nose is wrinkled during the entire fragment, but also when it is only wrinkled for a short moment. If the nose is in a relaxed state it is annotated as 'neutral'. If it is uncertain whether the nose is in one of these states it is annotated as 'uncertain'.

nose wrinkled   nose wrinkled

B.8 Eye gaze

The participant could look in three different directions. The most common direction is towards the other participant which is annotated as 'other participant'. If the participant is looking in the direction of the experimenter, the participant is in some way turned sideways and it is annotated as 'experimenter'. The eye gaze is also annotated as 'experimenter' if the participant looks at multiple experimenters during the fragment. If the participant does not look towards the other participant or the experimenter then the participant is looking into space, this last direction is annotated as 'space'. Also, within the scope of asking the question the participant could look in multiple directions, in this case the combination is annotated: e.g., looking at both the other participant and the experimenter is annotated as 'other participant, experimenter'. If it is uncertain in which direction the participant is looking this tier should be annotated with 'uncertain'.

space   space

B.9   PALMS-UP

If the participant signs PALMS-UP then this manual marker is annotated with 'yes' and in the case that no PALMS-UP is signed the annotation is 'no'. PALMS-UP could be signed with one or with both hands. The borderline case in which a PALMS-UP sign seems to be made when the hand returns from a manual sign to a neutral position (e.g., to the lap) could be annotated with 'uncertain', as in such case the sign is so subtle that it is uncertain whether it should really be interpreted as PALMS-UP.

C. Syntactic structures in the Corpus NGT

This appendix presents five tables which capture the annotated polar questions in the Corpus NGT which correspond to the five syntactic structures which are analysed in section 2.5 of this project. Below each table it is specified which syntactic structure is captured in that table.

					radical			
index	*file*	*eyebrows*	*eye gaze*	*body position*	*head movement*	*head*	*eye shape*	*nose*
3	CNGT0430	neutral	addressee	forward, backward	nodding	chin out, chin in	neutral	neutral
12	CNGT0814	lowered	addressee	forward	neutral	chin out, chin in	squeezed	neutral
16	CNGT0431	raised	addressee	neutral	neutral	chin in	wide	neutral
64	CNGT1885	raised	addressee	neutral	neutral	neutral	neutral	neutral
143	CNGT0295	raised	space,addressee	forward	neutral	chin in,chin out	wide	neutral
146	CNGT0295	lowered	addressee	neutral	nod	chin out	neutral	neutral
148	CNGT2045	raised	addressee	sideways	shake	chin in	wide	neutral
180	CNGT0055	neutral	addressee	forward,tilted	nod	chin in	squeezed	neutral
245	CNGT0328	raised	space	forward	nod	chin in	neutral	neutral
248	CNGT0329	raised	addressee	neutral	neutral	chin out,chin in	wide	neutral
262	CNGT1551	lowered	space,addressee	forward	nod	chin in	squeezed	neutral
364	CNGT1685	raised	addressee	forward	nod,nod	chin in	neutral	neutral
391	CNGT0215	raised	addressee	forward,tilted	nod	chin out	wide	neutral
393	CNGT0215	lowered,raised	space,addressee	forward	neutral	neutral	neutral	neutral
422	CNGT0012	neutral	addressee	forward	nod	neutral	neutral	neutral

index	PALMS-UP	*lip corners*	*shoulders*	*Dutch translation*	*English translation*
3	no	neutral	up	Kun je dat tegenover jezelf wel maken	Can you do that to yourself
12	no	neutral	neutral	Zeg maar gehandicapt	Say disabled
16	no	down	neutral	Steun je hem	Do you support him
64	no	neutral	neutral	Als ik klaar ben, zal ik de map dan wegleggen	When I finish should I stow the map away
143	no	down	neutral	CI en gehoorapparaten zijn volgens mij hetzelfde	I think, CI and hearing aids are the same
146	no	up	up	Ik voel dat in de toekomst er minder aandacht voor doven is	I feel there will be less attention to the deaf in the future
148	no	up	up	Heb je het nodig om dat te kunnen bekijken	Do you need it to be able to see it
180	no	neutral	up	Voel je dat ook zo	Do you feel that way
245	no	down	up	Dat zijn twee aparte groepen	Those are two distinct groups
248	yes	neutral	neutral	Is een mongool ook gehandicap	Is a mongoloid also disabled
262	no	up	up	Ben ik het daar mee eens	Do I agree with that
364	no	neutral	neutral	Ze hebben toch een naamgebaar	They do have a name sign
391	no	neutral	up	Ben je dan gehandicapt	Are you disabled then
393	yes	neutral	up	Is hij dan nog steeds gehandicapt	Would he still be handicapped
422	no	up	neutral	Mag dat en ben je het ermee eens?	Is that allowed and do you agree

					tag			
index	*file*	*eyebrows*	*eye gaze*	*body position*	*head movement*	*head*	*eye shape*	*nose*
4	CNGT0430	neutral	addressee	other	shaking	neutral	neutral	neutral
13	CNGT0814	neutral	addressee	backward	shaking	chin out, chin in	neutral	neutral
17	CNGT0431	raised	addressee	tilted	shake	chin out	wide	wrinkled
65	CNGT1885	neutral	addressee	neutral	shake	neutral	neutral	neutral
144	CNGT0295	raised	addressee	neutral	shaking	chin out	wide	neutral
147	CNGT0295	neutral	addressee	forward,tilted	shaking	chin out	squeezed,wide	neutral
149	CNGT2045	neutral	addressee	neutral	shaking	neutral	wide	neutral
181	CNGT0055	neutral	addressee	tilted	shaking	neutral	squeezed	neutral
246	CNGT0328	raised	addressee	neutral	shaking	chin out	neutral	neutral
249	CNGT0329	raised	addressee	neutral	shaking	chin out	wide	neutral
263	CNGT1551	neutral	addressee,space	tilted	shaking	chin in	squeezed	wrinkled
365	CNGT1685	raised	addressee	neutral	shaking	chin in	neutral	neutral
392	CNGT0215	neutral	addressee	tilted	shake	neutral	neutral	neutral
394	CNGT0215	neutral	addressee	neutral	shake	chin out	neutral	neutral
423	CNGT0012	neutral	addressee	neutral	shake	chin out,chin in	neutral	neutral

index	PALMS-UP	*lip corners*	*shoulders*	*Dutch translation*	*English translation*
4	yes	neutral	other	of niet?	or not?
13	yes	down	neutral	of niet?	or not?
17	yes	neutral	neutral	of niet?	or not?
65	no	neutral	neutral	of niet?	or not?
144	yes	neutral	neutral	of niet?	or not?
147	no	up	neutral	of niet?	or not?
149	yes	up	neutral	of niet?	or not?
181	yes	up	neutral	of niet?	or not?
246	yes	down	neutral	of niet dan?	aren't they?
249	yes	neutral	neutral	of niet?	or not?
263	no	up	up	of niet mee eens?	or you don't agree?
365	yes	up	neutral	of niet?	or not?
392	no	neutral	up	of niet?	or not?
394	yes	neutral	neutral	of niet?	or not?
423	yes	up	neutral	of niet?	or not?

Table 31. This table represents both the radical data points and the tag data points of the syntactic structure, which represents a choice between two alternative: **a radical and its negative alternative**. This negative alternative is the question's tag and is captured by the form '**of niet**' (translation: 'or not'). In this project, the radical and the tag of this structure have been annotated as separate data points.

index	file	eyebrows	eye gaze	body position	head movement	head	eyeshape	nose	PALMS-UP
15	CNGT0431	neutral	addressee,space,addressee	neutral	nod	chin out	wide	neutral	yes
97	CNGT0527	lowered	addressee,space,addressee	forward	nod,nod	chin out	squeezed	neutral	no
129	CNGT0095	lowered,raised	space,addressee	backward,forward	nod	neutral	neutral	neutral	yes
209	CNGT0130	raised	addressee,space,addressee	forward	nod	chin out	neutral	neutral	yes
286	CNGT0058	neutral	addressee	neutral	nod	chin in	squeezed	neutral	yes
326	CNGT0098	other	addressee	forward	nod	chin in	other	neutral	yes

index	lip corners	shoulders	Dutch translation	English translation
15	down	up	Het is toch vanzelfsprekend om te steunen?	Isn't it natural to support?
97	neutral	neutral	Is dat de bedoeling van de vraag?	Is that the purpose of the question?
129	up	neutral	Het contact met mij is moeilijk, terwijl dat met doven vrij is, zo is het toch?	Contact with me is difficult, while with the deaf it is so free, isn't it?
209	down	neutral	Op school doet een kind toch een gehoorapparaat in?	At school a child is wearing a hearing aid, right?
286	neutral	up	Doven kunnen goed liplezen toch?	Deaf people are good in reading lips, right?
326	down	up	Het is nu toch een goede tijd?	Now is the good moment, right?

Table 32. This table represents the data points of the syntactic structure in which a question's radical is combined with a '**toch**' (translation: 'right') tag.

index	file	eyebrows	eye gaze	body position	head movement	head	eyeshape	nose	PALMS-UP
5	CNGT0430	neutral	space, addressee	tilted	nod, nod, nod,shaking	chin out	neutral	neutral	yes
23	CNGT0427	raised	space,addressee	forward	neutral	chin in,chin out	neutral	neutral	yes
52	CNGT1926	raised	addressee	forward	neutral	chin in,chin out	neutral	neutral	yes
92	CNGT0255	raised	space,addressee	tilted,forward	nodding	chin in,chin out	wide	neutral	yes
111	CNGT0862	raised	addressee	tilted	nodding	chin in	wide	neutral	yes
118	CNGT0136	neutral	addressee	backward,tilted	other	chin in	neutral	neutral	no
308	CNGT0529	raised	addressee	backward	neutral	chin in,chin out,chin in	neutral	neutral	yes
332	CNGT0259	neutral	addressee	forward	shaking	chin out,chin in,chin out	neutral	neutral	yes
355	CNGT1684	neutral	space	forward	nod	chin in,chin out	other	neutral	yes
413	CNGT0416	lowered	addressee,space	forward	shaking	chin out	squeezed	neutral	yes
442	CNGT0429	raised	addressee	forward,tilted	nod,shaking	chin out	wide	neutral	yes
443	CNGT0429	neutral	addressee	forward	shaking	chin in,chin out	neutral	neutral	yes

index	lip corners	shoulders	Dutch translation	English translation
5	down	neutral	Kan je het maken tegenover jezelf, tegenover het kind, tegenover je man?	Can you do that to yourself, to your child, to your husband?
23	down	neutral	Rolstoelers, blinden enzovoort, hebben die een eigen cultuur?	People in wheelstairs or being blind etc., do they have a culture of their own?
52	down	up	Zouden we dan Chinees moeten gebaren?	Should we sign in Chinese then?
92	down	neutral	Ouders willen het elke dag inzetten, kan dat?	Parents want to use it every day, it that possible?
111	down	up	Dat is een steeds groter worden de groep, toch?	That is an ever-growing group, right?
118	down	up	Beter dan vroeger?	Better than before?
308	down	up	De CI eraf halen van het hoofd en wegleggen?	Remove the CI from the head and put it away?
332	up	neutral	Bedoel je 'opschepper' ofzo?	Do you mean 'bragger' or something?
355	up	up	Wil ik dat er hier ook een standaard komt?	Do I want one standard here too?
413	down	neutral	Frederik of zo?	Frederik or something?
442	neutral	up	Wordt er dan ook uitgelegd waarom dat de woordvolgorde is?	Is there also an explanation why the word order is like that?
443	down	up	Is dat niet hetzelfde als logopedie?	Isn't that the same as speech therapy?

Table 33. This table represents the data points of the syntactic structure in which a question's radical is combined with a **hesitation** tag.

index	file	eyebrows	eye gaze	body position	head movement	head	eyeshape	nose	PALMS-UP
46	CNGT0436	lowered	addressee	forward	nodding,shake	chin in,chin out	squeezed	wrinkled	yes
196	CNGT0131	lowered,raised	addressee	neutral	nod,shaking	chin out,chin in	wide	neutral	yes
348	CNGT0099	lowered	addressee,space,addressee	backward,forward,backward	shaking	chin in	squeezed	neutral	yes

index	lip corners	shoulders	Dutch translation	English translation
46	down	neutral	Neurenberg?	Neurenberg?
196	neutral	up	Omdat je stem anders klinkt, als een papagaai?	Because your voice sounds different, like a parrot?
348	neutral	neutral	Vind je het gek als hij me behandelt alsof ik nog een klein kind ben?	Do you think it is crazy if you treat me like a child?

Table 34. This table represents the data points of the syntactic structure in which a question's radical is combined with a tag of **disbelief**.

index	file	eyebrows	eye gaze	body position	head movement	head	eyeshape	nose	PALMS-UP
107	CNGT0137	neutral	addressee	forward	nodding	chin in	squeezed	neutral	yes
253	CNGT0061	neutral	addressee	other	shaking,nod	chin in	neutral	neutral	yes
267	CNGT0128	neutral	addressee	forward	nod	chin out	neutral	neutral	yes
325	CNGT0098	neutral	addressee	forward	nodding,shaking	chin in,chin out	neutral	neutral	yes
347	CNGT1620	neutral	space,addressee	neutral	shaking,nod,nod	chin in,chin out	neutral	neutral	yes
351	CNGT0015	other	addressee	neutral	nod,nod	chin in	squeezed	wrinkled	yes
368	CNGT0216	raised	addressee	forward	shaking,nod	neutral	wide	neutral	yes
444	CNGT0429	neutral	addressee	forward	nod	chin in,chin out	neutral	neutral	yes

index	lip corners	shoulders	Dutch translation	English translation
107	down	up	Ja toch?	Yes right?
253	neutral	up	Het maakt toch niet uit?	It doesn't matter, right?
267	up	neutral	We hebben communicatieproblemen, en zo meer, toch?	We have communication problems, and so on, right?
325	down	up	Als het maar gelukkig is, toch?	As long as it is happy, right?
347	neutral	neutral	En zo is er van alles, ja toch?	And so there are all sort of things, right?
351	neutral	up	Dat zijn mooie, kleine gebaren, maandag - zondag, ja toch?	Those are beautiful small signs, Monday - Sunday, right?
368	up	up	Dat is niet moeilijk, toch?	That is not difficult, right?
444	neutral	neutral	Door te schrijven?	By writing?

Table 35. This table represents the data points of the syntactic structure in which a question's radical is combined with a **confirmation** tag.

D.   Examples of matter-of-fact questions

This appendix provides the biased questions and situations that correspond to the examples listed in both 'Ex' columns in table 27. Below each situation description it is stated whether the particular *toch* and *hè* question is felicitous or not. Both biased questions are only felicitous to ask when the speaker's intention is to elicit information, which means that cases of irony or hidden statements in the form of a question are not felicitous. Examples (9), (10), (11), (12), (25), and (26) are variants of a student meeting situation introduced by Sudo (2013, p. 287). Examples (13), (14), (55), (56), (57), (58), (59), and (60) are variants of a rain situation introduced by Farkas and Roelofsen (2017, p. 273). In the same paper a math situation is described (Farkas and Roelofsen 2017, p. 269), which is paraphrased in the current paper to examples (27) and (28). Finally, the cinema situation (examples (61) and (62)) is paraphrased from Kiss (2022, p. 212).

PriorBelief = pos, **ContEvidence** = pos, **EvSource** = ext, **EvQual** = di, **EvRec** = both

Context: B is A's friend and is getting married. Some time before the wedding B told A she would love to have a lot of roses at the wedding. Before the ceremony A and B are visiting the venue which is covered with roses. A to B:

(1)   #Er   zijn   veel rozen op de trouwlocatie, toch?
          There are.3pl many roses at the venue   TOCH
          'There are a lot of roses at the venue, right?'

(2)   #Er   zijn   veel rozen op de trouwlocatie, hè?
          There are.3pl many roses at the venue   HÈ
          'There are a lot of roses at the venue, right?'

PriorBelief = pos, **ContEvidence** = pos, **EvSource** = ext, **EvQual** = di, **EvRec** = addr

Context: Salesman A prepares a box that contains four camera's which customer B wants to buy. Before the payment A shows the box to B, to check the order. A to B:

(3)   Dit   zijn   de vier camera's, toch?
          These are.3pl the four camera's TOCH
          'These are the four camera's, right?'

(4)   Dit   zijn   de vier camera's, hè?
          These are.3pl the four camera's HÈ
          'These are the four camera's, right?'

PriorBelief = pos, **ContEvidence** = pos, **EvSource** = ext, **EvQual** = de, **EvRec** = both

Context: A thinks B smokes, which B never confirmed. Now, both A and B are looking at a box of cigarettes in B's bag. A to B:

(5)   ?Jij rookt,   toch?
          You smoke.2sg TOCH
          'You smoke, right?'

(6)   Jij   rookt,   hè?
        You smoke.2sg HÈ
        'You smoke, right?'

PriorBelief = pos, **ContEvidence** = pos, **EvSource** = ex, **EvQual** = de, **EvRec** = addr

Context: A and B are roommates. A knows that B usually eats a banana a day. A looks at their fruit bowl and notices a banana is missing. She shows the bowl to B and asks:

(7)   Jij   hebt   een banaan gegeten, toch?
        You have.2sg a   banana eaten   TOCH
        'You ate a banana, right?'

(8)   Jij   hebt   een banaan gegeten, hè?
        You have.2sg a   banana eaten   HÈ
        'You ate a banana, right?'

PriorBelief = pos, **ContEvidence** = pos, **EvSource** = addr, **EvQual** = di, **EvRec** = sp

Context: B organizes a student meeting. Among other students, B and A are present. A believes that more students are coming. B utters "let's wait for a little longer, not everyone is here yet." A to B:

(9)   #Er   komen   meer studenten, toch?
        There come.3pl more students   TOCH
        'There are more students coming, right?'

(10)   #Er   komen   meer studenten, hè?
        There come.3pl more students   HÈ
        'There are more students coming, right?'

PriorBelief = pos, **ContEvidence** = pos, **EvSource** = addr, **EvQual** = de, **EvRec** = sp

Context: B organizes a student meeting. Among other students, B and A are present. A believes that more students are coming. B utters "let's wait for a little longer." A to B:

(11)   ?Er   komen   meer studenten, toch?
        There come.3pl more students   TOCH
        'There are more students coming, right?'

(12)   Er   komen   meer studenten, hè?
        There come.3pl more students   HÈ
        'There are more students coming, right?'

PriorBelief = pos, **ContEvidence** = neg, **EvSource** = ext, **EvQual** = di, **EvRec** = both

Context: A has been cycling to work in heavy rain. At work she sits in a windowless office, after some time she walks with colleague B to the canteen to get some coffee. They pass a window and the sky is completely blue. A to B:

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(13)   #Het regent,   toch?
         It   rain.3sg TOCH
         'It is raining, right?'

(14)   #Het regent,   hè?
         It   rain.3sg HÈ
         'It is raining, right?'

PriorBelief = pos, **ContEvidence** = neg, **EvSource** = ext, **EvQual** = de, **EvRec** = both

Context: A has been looking at this week's sale products at the convenience store. Once she is doing her groceries at this store, she only picks products she believes to be discounted. At the checkout cashier B is scanning her products, the total amount displayed on the screen is way higher than expected. Before paying A asks B:

(15)   Deze producten zijn   in de aanbieding, toch?
         These products   are.3pl in the sale   TOCH
         'These products are on sale, right?'

(16)   #Deze producten zijn   in de aanbieding, hè?
         These products   are.3pl in the sale   HÈ
         'These products are on sale, right?'

PriorBelief = pos, **ContEvidence** = neg, **EvSource** = addr, **EvQual** = di, **EvRec** = sp

Context: A and B are invited to a mutual friend's birthday party. A believes the party starts at 13:00. A and B are talking about the party and then B utters: "The birthday party starts at 12:00 tomorrow." A to B:

(17)   Het begint   om 13:00, toch?
         It   start.3sg at   13:00 TOCH
         'It is starting at 13:00, right?'

(18)   #Het begint   om 13:00, hè?
         It   start.3sg at   13:00 HÈ
         'It is starting at 13:00, right?'

PriorBelief = pos, **ContEvidence** = neg, **EvSource** = addr, **EvQual** = de, **EvRec** = sp

Context: A and B are invited to a mutual friend's birthday party. A believes the party starts at 13:00. A and B are talking about the party and then B utters: "I will pick you up at 14:00 tomorrow to go to the birthday party." A to B:

(19)   Het begint   om 13:00, toch?
         It   start.3sg at   13:00 TOCH
         'It is starting at 13:00, right?'

(20)   #Het begint   om 13:00, hè?
         It   start.3sg at   13:00 HÈ
         'It is starting at 13:00, right?'

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PriorBelief = pos, **ContEvidence** = none, **EvSource** = NA, **EvQual** = NA, **EvRec** = NA

Context: A is at an outdoor concert with B. A heard there are fireworks planned as well. The singer just started performing. A to B:

(21)   Er   komt   straks ook vuurwerk, toch?
             There come.3sg later   also fireworks TOCH
             'There will also be fireworks later, right?'

(22)   Er   komt   straks ook vuurwerk, hè?
             There come.3sg later   also fireworks HÈ
             'There will also be fireworks later, right?'

PriorBelief = neg, **ContEvidence** = pos, **EvSource** = ext, **EvQual** = di, **EvRec** = both

Context: On a Saturday A wants to walk through a park where she often walks on Saturdays. She therefore expects the park to be freely accessible. When she arrives at the park she sees security guard B standing in front of a closed gate. They both look at the fenced park. A to B:

(23)   #Het park is   niet open, toch?
            The park are.3sg not open TOCH
            'The park is not open, right?'

(24)   Het park is   niet open, hè?
            The park are.3sg not open HÈ
            'The park is not open, right?'

PriorBelief = neg, **ContEvidence** = pos, **EvSource** = ext, **EvQual** = de, **EvRec** = both

Context: B organizes a student meeting. Among others, A and B are both in the meeting room. A thinks everyone is present, but then she notices a list of participating students, at which B is looking as well. There are students on that list who are not yet present. A to B:

(25)   #Er   komen   meer studenten, toch?
            There come.3pl more students   TOCH
            'There are more students coming, right?'

(26)   Er   komen   meer studenten, hè?
            There come.3pl more students   HÈ
            'There are more students coming, right?'

PriorBelief = neg, **ContEvidence** = pos, **EvSource** = addr, **EvQual** = di, **EvRec** = sp

Context: Math teacher A presents a problem to pupil B: $\sqrt{9} + 3$. B utters that the answer to the problem must be 5, because the square root of 9 is 2 and 2 plus 3 is 5. A to B:

(27)   #De wortel van 9 is 2,   toch?
            The square root of 9 are.3sg 2   TOCH
            'The square root of 9 is 2, right?'

(28) #De wortel van 9 is 2,   hè?
       The square root of 9 are.3sg 2   HÈ
       'The square root of 9 is 2, right?'

PriorBelief = neg, **ContEvidence** = pos, **EvSource** = addr, **EvQual** = de, **EvRec** = sp

Context: A smokes and believes that B does not smoke. Then B asks whether A has a cigarette. A to B:

(29) #Jij rookt,   toch?
        You smoke.2sg TOCH
        'You smoke, right?'

(30) #Jij rookt,   hè?
        You smoke.2sg HÈ
        'You smoke, right?'

PriorBelief = neg, **ContEvidence** = neg, **EvSource** = ext, **EvQual** = di, **EvRec** = both

Context: A and B are waiting for the train to Amsterdam. A believes the train will depart at 12:55. Then a announcement is made which they both clearly hear: "time change: the train to Amsterdam will now leave at 13:00". A to B:

(31) #De trein vertrekt   om 12:50, toch?
        The train leave.3sg at   12:50 TOCH
        'The train is leaving at 12:50, right?'

(32) #De trein vertrekt   om 12:50, hè?
        The train leave.3sg at   12:50 HÈ
        'The train is leaving at 12:50, right?'

PriorBelief = neg, **ContEvidence** = neg, **EvSource** = ext, **EvQual** = di, **EvRec** = addr

Context: Salesman A is selling a box with three camera's in it. A therefore believes there are three camera's in the box. Before the payment, A shows the box which contains three camera's to B. A to B:

(33) #Er   zitten vier camera's in, toch?
        There sit.3pl four camera's in TOCH
        'There are four camera's in it, right?'

(34) #Er   zitten vier camera's in, hé?
        There sit.3pl four camera's in HÉ
        'There are four camera's in it, right?'

PriorBelief = neg, **ContEvidence** = neg, **EvSource** = external, **EvQual** = de, **EvRec** = both

Context: A and B are cycling to their flatmate in the middle of the night. Despite the hour A thinks the flatmate is still awake. Arriving at their home they see that the light is on in their home. A to B:

(35)   #Ze slaapt   al,   toch?
       She sleep.3sg already TOCH
       'She is already sleeping, right?'

(36)   #Ze slaapt   al,   hè?
       She sleep.3sg already HÈ
       'She is already sleeping, right?'

PriorBelief = neg, **ContEvidence** = neg, **EvSource** = external, **EvQual** = de, **EvRec** = addr

Context: A is B's math teacher, who knows B is a hard working pupil. They meet to discuss the exam B made, which A just graded (2/10). Before the meeting B was not aware of her result. A is showing B's exam which states her grade. A to B:

(37)   #Jij hebt   de stof   goed begrepen, toch?
       You have.2sg the material good understood TOCH
       'You have a good understanding of the material, right?'

(38)   #Jij hebt   de stof   goed begrepen, hè?
       You have.2sg the material good understood HÈ
       'You have a good understanding of the material, right?'

PriorBelief = neg, **ContEvidence** = neg, **EvSource** = addr, **EvQual** = di, **EvRec** = sp

Context: A is B's hairdresser. B has long hair and always wants A to cut the dead ends only. At the salon B utters: "only cut 0.5 cm please". A to B:

(39)   #Jij wilt   kort haar, toch?
       You want.2sg short hair TOCH
       'You want short hair, right?'

(40)   #Jij wilt   kort haar, hè?
       You want.2sg short hair HÈ
       'You want short hair, right?'

PriorBelief = neg, **ContEvidence** = neg, **EvSource** = addr, **EvQual** = de, **EvRec** = sp

Context: A is B's friend and A knows B is a vegetarian. At their lunch appointment B asks the waitress for the vegetarian options. A to B:

(41)   #Jij bent   geen vegetariër, toch?
       You are.2sg no   vegetarian TOCH
       'You are no vegetarian, right?'

(42)   #Jij bent   geen vegetariër, hè?
       You are.2sg no   vegetarian HÈ
       'You are no vegetarian, right?'

PriorBelief = neg, **ContEvidence** = none, **EvSource** = NA, **EvQual** = NA, **EvRec** = NA

Context: B is visiting A today. It is Tuesday and A did some groceries at the market just before B arrived. A and B are chitchatting at A's home. A to B:

(43) #Op dinsdag is   er   geen markt, toch?
      On Tuesday are.3sg there no   market TOCH
      'There is no market on Tuesday, right?'

(44) #Op dinsdag is   er   geen markt, hè?
      On Tuesday are.3sg there no   market HÈ
      'There is no market on Tuesday, right?'

PriorBelief = neu, **ContEvidence** = pos, **EvSource** = ext, **EvQual** = di, **EvRec** = both

Context: A and B are walking in a city they never been to before. Across the street they see a store, to which they are heading. At the store, B tries to open the door while A is watching her, but it happens to be locked. A to B:

(45) #De winkel is   dicht, toch?
      The store   are.3sg closed TOCH
      'The store is closed, right?'

(46) De winkel is   dicht, hè?
      The store   are.3sg closed HÈ
      'The store is closed, right?'

PriorBelief = neu, **ContEvidence** = pos, **EvSource** = ext, **EvQual** = de, **EvRec** = both

Context: A and B are colleagues. Yesterday, B told A she was going on a date that evening. A has no idea about how the date ended. B arrives at the office the next day and wears the same clothes as yesterday. A to B:

(47) #Jij bent   blijven slapen, toch?
      You are.2g stay   sleep TOCH
      'You stayed the night, right?'

(48) Jij bent   blijven slapen, hè?
      You are.2g stay   sleep HÈ
      'You stayed the night, right?'

PriorBelief = neu, **ContEvidence** = pos, **EvSource** = addr, **EvQual** = di, **EvRec** = sp

Context: A does not know how B is feeling. B says "I'm so sad". A to B:

(49) #Jij bent   verdrietig, toch?
      You are.2sg sad   TOCH
      'You are sad, right?'

(50) #Jij bent   verdrietig, hè?
      You are.2sg sad   HÈ
      'You are sad,right?'

PriorBelief = neu, **ContEvidence** = pos, **EvSource** = addr, **EvQual** = de, **EvRec** = sp

Context: A walks in the park while a stranger B stops her and asks whether she has a cigarette. A to B:

(51) #Jij rookt,   toch?
       You smoke.2sg TOCH
       'You smoke, right?'

(52) #Jij rookt,   hè?
       You smoke.2sg HÈ
       'You smoke, right?'

PriorBelief = neu, **ContEvidence** = neg, **EvSource** = ext, **EvQual** = di, **EvRec** = both

Context: A and B are walking in a city they never been to before. A is not aware till what time and on which days the stores are open in this city. Across the street they see a store towards they are heading. They both see that the store's door is open and that there are customers inside. A to B:

(53) #De winkel is   dicht, toch?
       The store   are.3sg closed TOCH
       'The store is closed, right?'

(54) #De winkel is   dicht, hè?
       The store   are.3sg closed HÈ
       'The store is closed, right?'

PriorBelief = neu, **ContEvidence** = neg, **EvSource** = ext, **EvQual** = de, **EvRec** = both

Context: A is working at an office together with B. A is not aware of the weather situation. Then another colleague is entering the office wearing a wet rain coat. A to B:

(55) #Het is   zonnig, toch?
       It   are.3sg sunny   TOCH
       'It is sunny, right?'

(56) #Het is   zonnig, hè?
       It   are.3sg sunny   HÈ
       'It is sunny, right?'

PriorBelief = neu, **ContEvidence** = neg, **EvSource** = addr, **EvQual** = di, **EvRec** = sp

Context: A is at home and is not aware of the weather situation. Then her partner B enters the house and says "such a sunny day today". A to B:

(57) #Het regent,   toch?
       It   rain.3sg TOCH
       'It is raining, right?'

(58) #Het regent,   hè?
       It   rain.3sg HÈ
       'It is raining, right?'

PriorBelief = neu, **ContEvidence** = neg, **EvSource** = addr, **EvQual** = de, **EvRec** = sp

Context: A is at home and is not aware of the weather situation. She knows her partner B likes to walk in sunny weather. When B enters the house and she says "shall we go out for a walk". A to B:

(59)   #Het regent,   toch?
    It   rain.3sg TOCH
    'It is raining, right?'

(60)   #Het regent,   hè?
    It   rain.3sg HÈ
    'It is raining, right?'

PriorBelief = neu, **ContEvidence** = none, **EvSource** = NA, **EvQual** = NA, **EvRec** = NA

Context: A wants to go to the cinema at 19:00. She has no idea whether there is a movie playing at that time. At the cinema she walks towards clerk B. A to B:

(61)   #Er   draait   een film   om 19:00, toch?
    There play.3sg a   movie at   19:00 TOCH
    'There is a movie playing at 19:00, right?'

(62)   #Er   draait   een film   om 19:00, hè?
    There play.3sg a   movie at   19:00 HÈ
    'There is a movie playing at 19:00, right?'

E. Examples of personal taste questions

This appendix provides the biased questions and situation desciptions that correspond to the examples listed in both 'Ex' columns in table 28. Both *toch* and *hè* questions are only felicitous when the speaker's intention is to elicit information, which means that cases of irony or hidden statements in the form of a question are not felicitous.

PriorBelief = pos, **SpJudgement** = no ex, **AddrJudgement** = no ex

Context: A saw a movie she very much enjoyed. She invites her friend B to come watch that movie. A knows B never saw the movie before. They are ready to start the movie. A to B:

(1) #De film is   mooi,   toch?
     The movie are.3sg beautiful TOCH
     'The movie is beautiful, right?'

(2) #De film is   mooi,   hè?
     The movie are.3sg beautiful HÈ
     'The movie is beautiful, right?'

PriorBelief = pos, **SpJudgement** = no ex, **AddrJudgement** = neg

Context: Based on a recipe A liked before, she is preparing dinner for B and herself. A did not take a bite yet, B did and expresses her dislike. A to B:

(3) #Het is   lekker, toch?
     It   are.3sg tasty   TOCH
     'It is tasty, right?'

(4) #Het is   lekker, hè?
     It   are.3sg tasty   HÈ
     'It is tasty, right?'

PriorBelief = pos, **SpJudgement** = no ex, **AddrJudgement** = pos

Context: Based on a recipe A liked before, she is preparing dinner for B and herself. A did not take a bite yet, B did and expresses a positive judgement. A to B:

(5) #Het is   lekker, toch?
     It   are.3sg tasty   TOCH
     'It is tasty, right?'

(6) #Het is   lekker, hè?
     It   are.3sg tasty   HÈ
     'It is tasty, right?'

PriorBelief = pos, **SpJudgement** = no ex, **AddrJudgement** = unknown

Context: A has a friend and A loved the smell of her friend's perfume. She takes another friend B

to the perfumery to show her the perfume she likes. She sprays it on a piece of paper and hands it to B. B smells it without expressing her judgement about the smell. A to B:

(7)   Het ruikt   lekker, toch?
        It   smell.3sg nice   TOCH
        'It smells nice, right?'

(8)   Het ruikt   lekker, hè?
        It   smell.3sg nice   HÈ
        'It smells nice, right?'

PriorBelief = pos, **SpJudgement** = neg, **AddrJudgement** = no ex

Context: Based on a recipe A liked before, she is preparing dinner for B and herself. A takes a bite and does not like it, B did not yet take a bite. A to B:

(9)   #Het is   lekker, toch?
         It   are.3sg tasty   TOCH
         'It is tasty, right?'

(10)   #Het is   lekker, hè?
         It   are.3sg tasty   HÈ
         'It is tasty, right?'

PriorBelief = pos, **SpJudgement** = neg, **AddrJudgement** = neg

Context: A is taking B to a theater play that A saw before and liked. During this second time A was shocked by some elements and realised she did not like the play anyway. When they exit the theater B says she did not enjoy the play. A asks B:

(11)   #Het was   mooi,   toch?
         It   are.3sg.pst beautiful TOCH
         'It was beautiful, right?'

(12)   #Het was   mooi,   hè?
         It   are.3sg.pst beautiful HÈ
         'It was beautiful, right?'

PriorBelief = pos, **SpJudgement** = neg, **AddrJudgement** = unknown

Context: A is taking B to a theater play that A saw before and liked. During this second time A was shocked by some elements and realised she did not like the play anyway. When they exit the theater B did not yet share her verdict. A asks B:

(13)   #Het was   mooi,   toch?
         It   are.3sg.pst beautiful TOCH
         'It was beautiful, right?'

(14)   #Het was   mooi,   hè?
         It   are.3sg.pst beautiful HÈ
         'It was beautiful, right?'

PriorBelief = pos, **SpJudgement** = neg, **AddrJudgement** = pos

Context: A is taking B to a theater play that A saw before and liked. During this second time A was shocked by some elements and realised she did not like the play anyway. When they exit the theater B expresses she loved the play. A asks B:

(15) #Het was   mooi,   toch?
      It   are.3sg.pst beautiful TOCH
      'It was beautiful, right?'

(16) #Het was   mooi,   hè?
      It   are.3sg.pst beautiful HÈ
      'It was beautiful, right?'

PriorBelief = pos, **SpJudgement** = pos, **AddrJudgement** = no ex

Context: Based on a recipe A liked before, she is preparing dinner for B and herself. A takes a bite and likes it and B did not yet taste it. A to B:

(17) #Het is   lekker, toch?
      It   are.3sg tasty   TOCH
      'It is tasty, right?'

(18) #Het is   lekker, hè?
      It   are.3sg tasty   HÈ
      'It is tasty, right?'

PriorBelief = pos, **SpJudgement** = pos, **AddrJudgement** = neg

Context: A is taking B to a painting in a museum she already saw and which she thinks is beautiful. They arrive at the painting, A still thinks it is beautiful and B expresses she does not like the painting. A to B:

(19) #Het schilderij is   mooi,   toch?
      The painting   are.3sg beautiful TOCH
      'The painting is beautiful, right?'

(20) #Het schilderij is   mooi,   toch?
      The painting   are.3sg beautiful TOCH
      'The painting is beautiful, right?'

PriorBelief = pos, **SpJudgement** = pos, **AddrJudgement** = pos

Context: A is taking B to a painting in a museum she already saw and which she thinks is beautiful. They arrive at the painting, A still thinks it is beautiful and B expresses that she thinks it is gorgeous. A to B:

(21) #Het schilderij is   mooi,   toch?
      The painting   are.3sg beautiful TOCH
      'The painting is beautiful, right?'

(22) #Het schilderij is   mooi,   toch?
       The painting   are.3sg beautiful TOCH
       'The painting is beautiful, right?'

PriorBelief = pos, **SpJudgement** = pos, **AddrJudgement** = unknown

Context: A is taking B to a painting in a museum she already saw and which she thinks is beautiful. They arrive at the painting and A still thinks it is beautiful. B sees the painting but does not yet share her judgement. A to B:

(23) Het schilderij is   mooi,   toch?
       The painting   are.3sg beautiful TOCH
       'The painting is beautiful, right?'

(24) Het schilderij is   mooi,   toch?
       The painting   are.3sg beautiful TOCH
       'The painting is beautiful, right?'

PriorBelief = neg, **SpJudgement** = no ex, **AddrJudgement** = no ex

Context: A does not like the taste of lemon. She is now in a restaurant with B and A chooses the only available dessert − a lemon cheesecake − for them. They did not yet receive the dessert. A to B:

(25) #Het is   lekker, toch?
       It   are.3sg tasty   TOCH
       'It is tasty, right?'

(26) #Het is   lekker, hè?
       It   are.3sg tasty   HÈ
       'It is tasty, right?'

PriorBelief = neg, **SpJudgement** = no ex, **AddrJudgement** = neg

Context: A does not like the taste of lemon. She is now in a restaurant with B and A chooses the only available dessert − a lemon cheesecake − for them. A did not yet take a bite, B did and expresses she does not like it. A to B:

(27) #Het is   lekker, toch?
       It   are.3sg tasty   TOCH
       'It is tasty, right?'

(28) #Het is   lekker, hè?
       It   are.3sg tasty   HÈ
       'It is tasty, right?'

PriorBelief = neg, **SpJudgement** = no ex, **AddrJudgement** = unknown

Context: A does not like the taste of lemon. She is now in a restaurant with B and A chooses the only available dessert − a lemon cheesecake − for them. A did not yet take a bite, B did but does not yet express whether she likes it. A to B:

(29) #Het is   lekker, toch?
      It   are.3sg tasty   TOCH
      'It is tasty, right?'

(30) #Het is   lekker, hè?
      It   are.3sg tasty   HÈ
      'It is tasty, right?'

PriorBelief = neg, **SpJudgement** = no ex, **AddrJudgement** = pos

Context: A does not like the taste of lemon. She is now in a restaurant with B and A chooses the only available dessert − a lemon cheesecake − for them. A did not yet take a bite, B did and expresses she likes it. A to B:

(31) #Het is   lekker, toch?
      It   are.3sg tasty   TOCH
      'It is tasty, right?'

(32) #Het is   lekker, hè?
      It   are.3sg tasty   HÈ
      'It is tasty, right?'

PriorBelief = neg, **SpJudgement** = neg, **AddrJudgement** = no ex

Context: A prepares a dish for B and herself. She made this recipe before, back then she did not like the taste of it. A takes a bite and does not like it, B did not yet take a bit. A to B:

(33) #Het is   lekker, toch?
      It   are.3sg tasty   TOCH
      'It is tasty, right?'

(34) #Het is   lekker, hè?
      It   are.3sg tasty   HÈ
      'It is tasty, right?'

PriorBelief = neg, **SpJudgement** = neg, **AddrJudgement** = neg

Context: A prepares a dish for B and herself. She made this recipe before, back then she did not like the taste of it. A and B both taste the dish, A does not like it and also B expresses her dislike. A to B:

(35) #Het is   lekker, toch?
      It   are.3sg tasty   TOCH
      'It is tasty, right?'

(36) #Het is   lekker, hè?
      It   are.3sg tasty   HÈ
      'It is tasty, right?'

PriorBelief = neg, **SpJudgement** = neg, **AddrJudgement** = unknown

Context: A prepares a dish for B and herself. She made this recipe before, back then she did

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not like the taste of it. A and B both taste the dish, A does not like it and B does not share her judgement. A to B:

(37) #Het is lekker, toch?
It are.3sg tasty TOCH
'It is tasty, right?'

(38) #Het is lekker, hè?
It are.3sg tasty HÈ
'It is tasty, right?'

PriorBelief = neg, **SpJudgement** = neg, **AddrJudgement** = pos

Context: A prepares a dish for B and herself. She made this recipe before, back then she did not like the taste of it. A and B both taste the dish, A does not like it whereas B expresses she likes it:

(39) #Het is lekker, toch?
It are.3sg tasty TOCH
'It is tasty, right?'

(40) #Het is lekker, hè?
It are.3sg tasty HÈ
'It is tasty, right?'

PriorBelief = neg, **SpJudgement** = pos, **AddrJudgement** = no ex

Context: A has a friend and A disliked the smell of her friend's perfume. She takes another friend B to the perfumery to show her the perfume she disliked. She sprays it on a piece of paper and smells it. She happens to like it this time. B did not yet smell the piece of paper. A to B:

(41) #Het ruikt lekker, toch?
It smell.3sg nice TOCH
'It smells nice, right?'

(42) #Het ruikt lekker, hè?
It smell.3sg nice HÈ
'It smells nice, right?'

PriorBelief = neg, **SpJudgement** = pos, **AddrJudgement** = neg

Context: A has a friend and A disliked the smell of her friend's perfume. She takes another friend B to the perfumery to show her the perfume she disliked. She sprays it on a piece of paper and smells it. She happens to like it this time. B also smells the paper and expresses that she does not like the smell. A to B:

(43) #Het ruikt lekker, toch?
It smell.3sg nice TOCH
'It smells nice, right?'

(44) #Het ruikt lekker, hè?
It smell.3sg nice HÈ

'It smells nice, right?'

PriorBelief = neg, **SpJudgement** = pos, **AddrJudgement** = pos

Context: A has a friend and A disliked the smell of her friend's perfume. She takes another friend B to the perfumery to show her the perfume she disliked. She sprays it on a piece of paper and smells it. She happens to like it this time. B also smells the paper and expresses she likes the perfume. A to B:

(45)   #Het ruikt   lekker, toch?
       It   smell.3sg nice   TOCH
       'It smells nice, right?'

(46)   #Het ruikt   lekker, hè?
       It   smell.3sg nice   HÈ
       'It smells nice, right?'

PriorBelief = weak neg, **SpJudgement** = pos, **AddrJudgement** = unknown

Context: A does not like the taste of lemon. She is now in a restaurant with B and A chooses the only available dessert − a lemon cheesecake − for them. They share a piece and both take a bite. A happens to like it and B does not yet express her judgement. A to B:

(47)   Het is   lekker, toch?
       It   are.3sg tasty   TOCH
       'It is tasty, right?'

(48)   Het is   lekker, hè?
       It   are.3sg tasty   HÈ
       'It is tasty, right?'

PriorBelief = strong neg, **SpJudgement** = pos, **AddrJudgement** = unknown

Context: A and B are friends and met for a walk. A has a neighbour who always behaves unkindly to her. A and B see A's neighbour who act kindly this time. A to B:

(49)   #Mijn buurman is   aardig, toch?
       My   neighbour are.3sg kind   TOCH
       'My neighbour is kind, right?'

(50)   #Mijn buurman is   aardig, hè?
       My   neighbour are.3sg kind   HÈ
       'My neighbour is kind, right?'

PriorBelief = neu, **SpJudgement** = no ex, **AddrJudgement** = no ex

Context: A never tasted or made a Lebanese dish before, she now prepared one for B and herself. Both A and B did not yet take a bite. A to B:

(51)   #Het is   lekker, toch?
       It   are.3sg tasty   TOCH

'It is tasty, right?'

(52) #Het is   lekker, hè?
      It   are.3sg tasty   HÈ
      'It is tasty, right?'

PriorBelief = neu, **SpJudgement** = no ex, **AddrJudgement** = neg

Context: A never tasted or made a Lebanese dish before, she now prepared one for B and herself.
While A did not yet taste the dish, B did and expresses her dislike. A to B:

(53) #Het is   lekker, toch?
      It   are.3sg tasty   TOCH
      'It is tasty, right?'

(54) #Het is   lekker, hè?
      It   are.3sg tasty   HÈ
      'It is tasty, right?'

PriorBelief = neu, **SpJudgement** = no ex, **AddrJudgement** = unknown

Context: A never tasted or made a Lebanese dish before, she now prepared one for B and herself.
While A did not yet taste the dish, B did but does not yet express her judgement. A to B:

(55) #Het is   lekker, toch?
      It   are.3sg tasty   TOCH
      'It is tasty, right?'

(56) #Het is   lekker, hè?
      It   are.3sg tasty   HÈ
      'It is tasty, right?'

PriorBelief = neu, **SpJudgement** = no ex, **AddrJudgement** = pos

Context: A never tasted or made a Lebanese dish before, she now prepared one for B and herself.
While A did not yet taste the dish, B did and she expresses her positive judgement. A to B:

(57) #Het is   lekker, toch?
      It   are.3sg tasty   TOCH
      'It is tasty, right?'

(58) #Het is   lekker, hè?
      It   are.3sg tasty   HÈ
      'It is tasty, right?'

PriorBelief = neu, **SpJudgement** = neg, **AddrJudgement** = no ex

Context: A never tasted or made a Lebanese dish before, she now prepared one for B and herself.
While B did not yet taste the dish, A took a bite and does not like what she tastes. A to B:

(59) #Het is   lekker, toch?
      It   are.3sg tasty   TOCH

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'It is tasty, right?'

(60) #Het is   lekker, hè?
     It   are.3sg tasty   HÈ
     'It is tasty, right?'

PriorBelief = neu, **SpJudgement** = neg, **AddrJudgement** = neg

Context: A never tasted or made a Lebanese dish before, she now prepared one for B and herself. Both A and B take a bite, B expresses her dislike and A does not like it either. A to B:

(61) #Het is   lekker, toch?
     It   are.3sg tasty   TOCH
     'It is tasty, right?'

(62) #Het is   lekker, hè?
     It   are.3sg tasty   HÈ
     'It is tasty, right?'

PriorBelief = neu, **SpJudgement** = neg, **AddrJudgement** = unknown

Context: A never tasted or made a Lebanese dish before, she now prepared one for B and herself. Both A and B take a bite, A does not like it and B does not yet express her judgement. A to B:

(63) #Het is   lekker, toch?
     It   are.3sg tasty   TOCH
     'It is tasty, right?'

(64) #Het is   lekker, hè?
     It   are.3sg tasty   HÈ
     'It is tasty, right?'

PriorBelief = neu, **SpJudgement** = neg, **AddrJudgement** = pos

Context: A never tasted or made a Lebanese dish before, she now prepared one for B and herself. Both A and B take a bite, B expresses her positive judgement whereas A does not like the dish. A to B:

(65) #Het is   lekker, toch?
     It   are.3sg tasty   TOCH
     'It is tasty, right?'

(66) #Het is   lekker, hè?
     It   are.3sg tasty   HÈ
     'It is tasty, right?'

PriorBelief = neu, **SpJudgement** = pos, **AddrJudgement** = no ex

Context: A never tasted or made a Lebanese dish before, she now prepared one for B and herself. While B did not yet take a bite, A did and she likes it. A to B:

(67) #Het is   lekker, toch?
     It   are.3sg tasty   TOCH
     'It is tasty, right?'

(68) #Het is   lekker, hè?
     It   are.3sg tasty   HÈ
     'It is tasty, right?'

PriorBelief = neu, **SpJudgement** = pos, **AddrJudgement** = neg

Context: A never tasted or made a Lebanese dish before, she now prepared one for B and herself.
Both A and B took a bite. B expresses her dislike whereas A likes the dish. A to B:

(69) #Het is   lekker, toch?
     It   are.3sg tasty   TOCH
     'It is tasty, right?'

(70) #Het is   lekker, hè?
     It   are.3sg tasty   HÈ
     'It is tasty, right?'

PriorBelief = neu, **SpJudgement** = pos, **AddrJudgement** = pos

Context: A never tasted or made a Lebanese dish before, she now prepared one for B and herself.
Both A and B took a bite. B expresses her positive judgement and A likes the dish as well. A to B:

(71) #Het is   lekker, toch?
     It   are.3sg tasty   TOCH
     'It is tasty, right?'

(72) #Het is   lekker, hè?
     It   are.3sg tasty   HÈ
     'It is tasty, right?'

PriorBelief = neu, **SpJudgement** = pos, **AddrJudgement** = unknown

Context: A never tasted or made a Lebanese dish before, she now prepared one for B and herself.
Both A and B took a bite. A likes the dish and B did not yet express her judgement. A to B:

(73) Het is   lekker, toch?
     It are.3sg tasty   TOCH
     'It is tasty, right?'

(74) Het is   lekker, hè?
     It are.3sg tasty   HÈ
     'It is tasty, right?'