An Inquisitive Semantics Analysis for the Chinese Polar Question Particle *Ma*

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Abstract

Inquisitive Semantics provides two operators that serve to modify the inquisitive content of a given proposition. The goal of this paper is to show that the two operators together provide an account for the semantics of the Chinese polar question particle *ma*, arguing that the *ma*-particle is the lexical realization of the combination of non-inquisitive and inquisitive operators. It will also be shown that the proposed analysis yields a novel account for the (in-)compatibility of the *ma*-particle and different types of Chinese questions.

1 Introduction

The syntax and semantics of question formation in *wh*-in-situ languages are often related to sentence-final particles. For example, the Clausal Typing Hypothesis [2] states that while questions are typed by movement of *wh*-phrases in *wh*-movement languages, in a *wh*-in-situ language, questions are clause-typed by question particles. It is also argued that the *ma*-particle in Chinese serves to clause-type polar questions, for instance:

(1) a. John líkaī-le ma?
John leave-ASP MA
'Did John leave?'

b. John kàn-guò shéme rén ma?
John see-ASP what person MA
'Did John see someone?'

The goal of this paper is to show that Inquisitive Semantics [7] offers the right set of operators that accounts for the process of clause-typing by the *ma*-particle. Inquisitive Semantics provides two closure operators that serve to modify the inquisitive content of a given proposition $\mathcal{P}$. The inquisitive operator *?* forms an inquisitive proposition by adding a pseudo-complement as a novel possibility for $\mathcal{P}$. The non-inquisitive closure *!* "flattens" a proposition by uniting all possibilities already contained in $\mathcal{P}$ into a single possibility.

(2) a. $? =_{def} \lambda\mathcal{P}_{\langle\langle s,t\rangle,t\rangle}.\lambda p_{\langle s,t\rangle}.[\mathcal{P}(p) \vee {}^*\mathcal{P}(p)]$

b. $! =_{def} \lambda\mathcal{P}_{\langle\langle s,t\rangle,t\rangle}.\lambda p_{\langle s,t\rangle}.\forall w.[w \in p \rightarrow \exists q.[q \in \mathcal{P} \wedge q(w)]]$

In what follows, I will argue that the *ma*-particle denotes the lexical realization of the combination of *?* and *!*. In other words, when *ma* is attached to a proposition, the proposition is flattened by *!*, followed by a novel possibility being added through disjoining by *?*. The analysis predicts that any question formed with *ma* is always a polar question, because by adding the *ma*-particle, the non-inquisitive operator *!* flattens the possibilities, and the outcome is always a singleton set. Once the inquisitive operator *?* brings in the pseudo-complement, the final result will always denote a proposition that contains only two possibilities – a polar question.

*Thanks to Maria Aloni, Chris Barker, Lucas Champollion, Ivano Ciardelli, and Anna Szabolcsi for advice and relevant discussion.

Furthermore, it will be shown that the analysis not only explains the possible patterns, but also yields a novel account of the incompatibility of the *ma*-particle and different types of questions. For instance, as noted by [10], the *ma*-particle is incompatible with A-not-A questions (hereafter, ANAQ). The novel observation made in this paper is that *ma* also cannot co-occur with *wh*-adjunct questions (ADJQ) and quantity questions (QNTQ). I will argue that this is because the pseudo-complement formed by *?* is the empty set, because (i) all the possible worlds have been exhausted by the two mutually exclusive possibilities in ANAQ, and (ii) the ADJQ and QNTQ do not have negative answers. Thus, the outcome of applying *?* cannot be interpreted as a question of any sort because it is NON-INQUISITIVE and INSIGNIFICANT, based on the Inquisitive Principle [1]. I will specify the semantics for the *ma*-particle in section 2, and turn to discuss the patterns of incompatibility in section 3. Section 4 concludes this paper.

2 Polar Q-particle and Inquisitive Semantics

Section 2.1 provides an argument from the response to the *ma*-questions to support the claim that *ma* is a polar question particle. Section 2.2 lays out the theoretical background for the semantics of *ma*, and shows how the proposed semantics for *ma* "types" polar questions.

2.1 *Yes/no*-particle as a diagnostic for polar question

In Chinese, *ma* is characterized as the polar question particle because a clause must be interpreted as a polar question when it is attached by the *ma*-particle,[1] as shown in example (1a) where *ma* is attached to an atomic declarative and the sentence has become a polar question. In example (1b), even when it contains a *wh*-phrase, the meaning for the clause is still a polar question because of the appearance of the *ma*-particle.

A solid diagnostic for the interpretation of polar question comes from the *yes/no*-particle used in the response. As pointed out by [5], the *yes/no*-particle in English is sensitive to question type. Particularly important for this paper is that the *yes/no*-particle can only be contained in a response to polar question, but not to *wh*-question.

(3) a. Q: What did you eat yesterday? A: (*Yes) I ate the hamburger.

b. Q: Did you eat something yesterday? A: Yes, I ate the hamburger.

[1]It is worth to point out here that sometimes Chinese questions need not be formed with the *ma*-particle [10]. For instance, the question in (i) is formed with a rising intonation in the end of the sentence.

(i) I know that there will be a conference tomorrow in the Department of Philosophy, and John was making a note about the program and schedule. I ask:
nǐ míngtiān huì qù zhéxué-suǒ de huìyì?
you tomorrow will go philosophy-department DE conference
'You will go to the conference in the Department of Philosophy tomorrow?'

However, it should be noted that this kind of question actually corresponds to the rising declarative questions discussed in [8]. One typical property of Gunlogsonian declarative questions is that it has to be accompanied with a biased context. Thus, the question is not felicitous in context where the speaker does not have biased attitude, as shown in example (ii). In this paper, I will assume Gunlogson's analysis for declarative questions.

(ii) Context: I know that there will be a conference tomorrow in the Department of Philosophy, but I have no idea whether John will be there or not. At the lobby, I see John and ask:
#nǐ míngtiān huì qù zhéxué-suǒ de huìyì?
you tomorrow will go philosophy-department DE conference
'You will go to the conference in the Department of Philosophy tomorrow?'

Similarly, the answer to the question in Chinese example (1b) can contain the *yes*/*no*-particle, *duì*/*bùduì* 'correct/incorrect,' as illustrated in the question-answer pair in (4). In contrast, without the *ma*-particle in that question as in (5), the response cannot contain the *yes*/*no*-particle.

(4) a. John kàn-guò shéme rén ma?
John see-ASP what person MA
'Did John see someone?'

b. duì, tā kàn-guò Bill.
correct he see-ASP Bill
'Yes, he saw Bill.'

(5) a. John kàn-guò shéme rén?
John see-ASP what person
'Who did John see?'

b. (*duì,) tā kàn-guò Bill.
correct he see-ASP Bill
'He saw Bill.'

In short, the minimal pair in example (4-5) demonstrate the effect of *ma* as the polar question particle. In the next subsection I will outline the theoretical background and show the explanation.

2.2 Semantics of the *ma*-particle

Section 2.2.1 outlines the assumptions and definitions of Inquisitive Semantics. Section 2.2.2 shows the application of the proposed semantics to the *ma*-particle.

2.2.1 Inquisitive Semantics

In Inquisitive Semantics, the semantic value of a sentence is conceived as one or several ways to update the common ground. In this way, a sentence expresses a proposition (of type $\langle st, t\rangle$) that denotes the set of one or multiple maximal possibilities $p_{\langle s,t\rangle}$. The informative content of a sentence is defined through info function. Specifically, a proposition that eliminates some possible world(s) from the common ground is informative, and a proposition that does not eliminate any world is non-informative. Throughout this paper I will assume a fixed set of worlds ω.

Definition 1. A *possibility* is the set $p \subseteq \omega$ of possible worlds.

Definition 2. A *proposition* is the set $\mathcal{P} \subseteq \wp(\omega)$ of possibilities.

Definition 3. The *informative content* of a proposition $\mathsf{info}(\mathcal{P}) = \bigcup \mathcal{P}$.

Definition 4. A proposition is *informative* iff $\mathsf{info}(\mathcal{P}) \subset \omega$.

Definition 5. A proposition is *non-informative* iff $\mathsf{info}(\mathcal{P}) = \omega$.

Crucial here is the notion of inquisitive content. When a proposition raises an issue to settle, it contains more than one maximal possibility. Specifically, a proposition that contains more than one maximal possibility is inquisitive, and a proposition that contains only one maximal possibility is non-inquisitive.

Definition 6. A proposition is *inquisitive* iff $\mathsf{info}(\mathcal{P}) \notin \mathcal{P}$.

Definition 7. A proposition is *non-inquisitive* iff $\mathsf{info}(\mathcal{P}) \in \mathcal{P}$.

Accordingly, the Inquisitive Principle that characterizes four different types of propositions is defined based on informativity and inquisitivity, as shown in Table 1. Two types of propositions are particularly important in the context of this paper: question and insignificance. A proposition is characterized as a question iff it is inquisitive and non-informative, and a proposition is insignificant iff it is non-inquisitive and non-informative.

Table 1: Inquisitive Principle

	Informative	Non-informative
Inquisitive	Hybrid	Question
Non-inquisitive	Assertion	Insignificant

(6) A proposition is a question iff $\textsf{info}(\mathcal{P}) = \omega$ and $\textsf{info}(\mathcal{P}) \notin \mathcal{P}$.

(7) A proposition is insignificant iff $\textsf{info}(\mathcal{P}) = \omega$ and $\textsf{info}(\mathcal{P}) \in \mathcal{P}$.

Finally, I adopt three operators defined by [12]. The inquisitive operator *?* in (8) forms an inquisitive proposition by disjoining the proposition and its pseudo-complement as a novel possibility. Since negation is not treated as the complement set of the original denotation [12, p.22], a novel definition is required for the * (negation) operator, as in (9). The non-inquisitive closure *!* serves to flatten a proposition by uniting all possibilities already contained in $\mathcal{P}$ into a single possibility. The proposed semantics for the *ma*-particle is that *ma* denotes the lexical complex of the combination of the two closure operators in (8) and (10) that serve to modify the inquisitive content.

(8) Inquisitive operator: $? =_{def} \lambda\mathcal{P}_{\langle\langle s,t\rangle,t\rangle}.\lambda p_{\langle s,t\rangle}.[\mathcal{P}(p) \vee {}^{*}\mathcal{P}(p)]$

(9) Pseudo-complement: $* =_{def} \lambda\mathcal{P}_{\langle\langle s,t\rangle,t\rangle}.\lambda p_{\langle s,t\rangle}.\forall w.[w \in p \rightarrow \neg\exists q.[q \in \mathcal{P} \wedge q(w)]]$

(10) Non-inquisitive operator: $! =_{def} \lambda\mathcal{P}_{\langle\langle s,t\rangle,t\rangle}.\lambda p_{\langle s,t\rangle}.\forall w.[w \in p \rightarrow \exists q.[q \in \mathcal{P} \wedge q(w)]]$

(11) Polar question particle: $[\![ma]\!] = ?!$

2.2.2 Application

The application of *ma* as the realization of the *?!* complex to atomic declaratives is straightforward. Since an atomic declarative denotes a singleton set that contains only one possibility, the application of *!* is vacuous in the sense that it does not change the inquisitive content. It is the novel possibility that is added by *?* that turns the proposition into a polar question by making it inquisitive and non-informative.

(12) a. $[\![\text{John likai-le}]\!] = [\![!(\text{John likai-le})]\!] = \{\{w \mid \textsf{leave}_w(j)\}\}$

b. $[\![?(!(\text{John likai-le}))]\!] = \{\{w \mid \textsf{leave}_w(j)\}\} \cup \{\{w \mid \neg\textsf{leave}_w(j)\}\}$
$= \{\{w \mid \textsf{leave}_w(j)\}, \{w \mid \neg\textsf{leave}_w(j)\}\}$ POLAR Q

To explain how the *ma*-particle types the clause that contains a *wh*-phrase as in (1b), I assume, following [4], that Chinese in-situ *wh*-phrase denotes the set of entity that is composed through pointwise functional application [11]. The outcome of the semantic composition is the set of multiple possibilities that corresponds to the classic semantic value of *wh*-question. By adding the *ma*-particle, *!* flattens the possibilities and the result is a non-inquisitive singleton set. Once the inquisitive operator *?* brings in the pseudo-complement, the outcome denotes a proposition that contains only two possibilities, i.e., the meaning for polar questions. As we have seen earlier, the *yes/no*-particle is sensitive to the meaning of question type. Since the semantic value of the *wh*-question has been changed, the answer to the question can naturally contain the *yes/no*-particle as a part of the response. This is illustrated in (13), assuming the universe consists of John, Bill, Cathy, and Mary.

(13) a. $[\![\text{John kàn-guò shéme rén}]\!] = \{\{w \mid \mathsf{see}_w(j,b)\}, \{w \mid \mathsf{see}_w(j,c)\}, \{w \mid \mathsf{see}_w(j,m)\}\}$

b. $[\![!(\text{John kàn-guò shéme rén})]\!] = \{\{w \mid \mathsf{see}_w(j,b) \vee \mathsf{see}_w(j,c) \vee \mathsf{see}_w(j,m)\}\}$

c. $[\![?(!(\text{John kàn-guò shéme rén}))]\!]$
$= \{\{w \mid \mathsf{see}_w(j,b) \vee \mathsf{see}_w(j,c) \vee \mathsf{see}_w(j,m)\}\} \cup \{\{w \mid \neg\exists x.\mathsf{see}_w(j,x)\}\}$
$= \{\{w \mid \mathsf{see}_w(j,b) \vee \mathsf{see}_w(j,c) \vee \mathsf{see}_w(j,m)\}, \{w \mid \neg\exists x.\mathsf{see}_w(j,x)\}\}$ POLAR Q

In Summary, the application of *!* operator produces a non-inquisitive singleton set. The *?* operator turns this set into an inquisitive proposition by disjoining the pseudo-complement formed by *. As a result, the outcome is always a proposition that contains two possibilities – a polar question. This corresponds to the analysis for *ma* as a clause-typer for polar questions in [2].

3 Insignificance

The analysis proposed in this paper yields the following prediction in (14)

(14) Throughout the composition, if the pseudo-complement formed by * is the empty set, the *ma*-question will be unacceptable because the output of disjoining is insignificant and non-inquisitive; i.e., $!(\mathcal{P})\cup\varnothing = !(\mathcal{P})$.

If the prediction is borne out, we will be able to find some Chinese examples that are incompatible with the *ma*-particle. In this section I discuss the observation made by [10] for ANAQ, and provide some novel observation for ADJQ and QNTQ as empirical evidences that support the Inquisitive Semantics analysis, as the *ma*-particle really cannot co-occur with any of these questions.

3.1 A-not-A question and the *ma*-particle

As noted by [10], the *ma*-particle cannot co-occur with ANAQ. At first sight, this seems to be an argument against *ma* as a polar question particle, because ANAQ is a subtype of polar questions.

(15) ANAQ and *ma*:
John xǐ(huān)-bù-xǐhuān Bill *ma?
John li(ke)-NEG-like Bill MA

One might suggest that ANAQ is a special kind of polar questions that cannot be typed by the *ma*-particle. For example, one observation made in the literature for ANAQ is that its response cannot contain the *yes/no*-particle, and as we have seen above, whether the response can contain the *yes/no*-particle is a crucial factor to characterize polar questions.

(16) Q: John xǐ(huān)-bù-xǐhuān Bill?
John li(ke)-NEG-like Bill
'Does John like Bill or not?'

A: (*duì,) tā xǐhuān Bill.
correct he like Bill
'He likes Bill'

However, this observation is not accurate. For example, when ANAQ is formed with a copular verb *shì*, it immediately becomes plausible for the response to contain the *yes/no*-particle. Thus, an account is still called for the incompatibility of ANAQ and *ma*.

(17) Q: John shì-bú-shì xǐhuān Bill?
John copular-NEG-copular like Bill
'Does John like Bill or not?'

A: duì, tā xǐhuān Bill.
correct he like Bill
'Yes, he likes Bill'

(18) John shì-bú-shì xǐhuān Bill *ma?
John copular-NEG-copular like Bill MA

I argue that the example in (15) is not a counterexample against *ma* as a polar question particle. On the contrary, the incompatibility between *ma* and ANAQ is actually a strong argument in favor of the Inquisitive Semantics analysis for *ma* as a polar question particle. Following [13], I assume that the semantic value of an ANAQ is the set of two mutually exclusive possibilities.

(19) $[\![\text{John xǐ-bù-xǐhuān Bill}]\!] = \{\{w \mid \mathsf{like}_w(j,b)\}, \{w \mid \neg\mathsf{like}_w(j,b)\}\}$

By adding the *ma*-particle to the ANAQ, three operations are performed. First, the non-inquisitive operator *!* flattens the proposition. Unlike the cases discussed earlier, at this point the proposition is insignificant because the possibility is exhaustive, i.e., $\mathcal{P} = \omega$.

(20) $[\![!(\text{John xǐ-bù-xǐhuān Bill})]\!] = \{\{w \mid \mathsf{like}_w(j,b) \vee \neg\mathsf{like}_w(j,b)\}\} = \omega$

INSIGNIFICANT

The pseudo-complement formed by the * operator now is the empty set. As a consequence, the application of *?* is vacuous because the inquisitive content is not changed, and the analysis correctly predicts ANAQ to be incompatible with the *ma*-particle, since the outcome of disjoining the proposition and the empty set is still insignificant.

(21) $$\begin{aligned}[\![?(!(\text{John xǐ-bù-xǐhuān Bill}))]\!] &= \{\{w \mid \mathsf{like}_w(j,b) \vee \neg\mathsf{like}_w(j,b)\}\} \cup \varnothing \\ &= \{\{w \mid \mathsf{like}_w(j,b) \vee \neg\mathsf{like}_w(j,b)\}\}\end{aligned}$$

INSIGNIFICANT

In short, the analysis yields a novel account for the incompatibility of the *ma*-particle and ANAQ. This solves the conundrum raised by [10] that the polar question particle *ma* is incompatible with a polar question (ANAQ).

3.2 The absence of semantic negative answers

The novel observation in this paper is that the *ma*-particle also cannot co-occur with ADJQ and QNTQ, for instance:

(22) a. ADJQ
John weìshéme zaì kū?
John why PROG cry
'Why is John crying?'

b. ADJQ + *ma*
*John weìshéme zaì kū ma?
John why PROG cry MA

(23) a. QNTQ:
John maǐ-le jǐ-běn shū?
John buy-ASP how.many-CL book
'How many books did John buy?'

b. QNTQ + *ma*:
*John maǐ-le jǐ-běn shū ma?
John buy-ASP how.many-CL book MA

I argue that this is because of the existential presupposition involved in ADJQ and QNTQ. Specifically, in (22a), the ADJQ presupposes the existence of a reason for why John is crying. In (23a), the QNTQ presupposes that a certain number of books have been purchased by John. The evidence comes from the negative response to the questions. While a negative response to ADJQ is usually felicitous, the reason itself cannot be negated alone. In other words, *John is not crying for any reason* is not considered a felicitous answer.

(24) Q: Why is John crying?

a. John meí zaì kū.
John NEG PROG cry
'John is not crying.'

b. #John meí yīnweì rènhé yuányīn zaì kū.
John NEG because any reason PROG cry
'John is not crying for any reason.'

Similarly, a negative response is usually allowed for QNTQ. However, again the number expression cannot be negated alone. The response to the QNTQ can be either *John bought some number of books*, or *John didn't buy any book*, but *líng-běn shū* '0 book' is not considered a felicitous answer.

(25) Q: How many books did John buy?

a. John meí maǐ shū.
John NEG buy book
'John did not buy any book.'

b. #John maǐ-le líng-běn shū.
John buy-ASP 0-CL book
'John bought 0 book.'

Thus, I assume that ADJQ and QNTQ do not have any negative answer, so the responses in (24b) and (25b) are infelicitous. The negative responses in (24a) and (25a) are to be conceived as a presupposition denial against the existential presupposition in ADJQ and QNTQ. The incompatibility of the *ma*-particle and the two types of *wh*-questions is now explained because the pseudo-complement formed by the inquisitive operator *?* will become the empty set since no semantic negative answer is involved in the semantic value of ADJQ and QNTQ. As we have seen in the case of ANAQ, these questions are predicted to be unacceptable when the *ma*-particle is attached, because of insignificance.

This analysis yields the following theoretical implication for the debate of existential presupposition in questions. The central issue of the debate is whether questions have existential presuppositions, and generally there are two mainstream theories for the debate. [6] argues that the negative responses are actually semantic answers to questions. Thus, *wh*-questions do not have any existential presupposition. In contrast, it is argued that the negative responses are denials against existential presupposition in questions [9, 3]. Given our discussion, the *ma*-particle becomes an effective diagnostic for existential presupposition in questions, because whether a *wh*-question has a semantic negative answer is crucial for the (in-)compatibility of the *ma*-particle. Our answer to the question of the existential presupposition debate is that some questions like (1b) do have a negative answer. In this way, they are compatible with the *ma*-particle and do not have any existential presupposition in nature. This is in line with the proposal made in [6]. However, some question types like ADJQ and QNTQ are different. The negative responses in (24a) and (25a) are not semantic answers involved in the questions. Instead, they are presupposition denials. Thus, since the pseudo-complement formed by * is the empty set, the proposition is deemed to be insignificant.

In short, the Inquisitive Semantics analysis yields a novel account for the incompatibility puzzle raised by [10]. Crucial here is that the pseudo-complement set formed by * operator is the empty set. It is also shown that the compatibility of the *ma*-particle and other different types of *wh*-questions depends on whether the question has a negative answer. A conclusion drawn from the discussion is that existential presupposition is not an inherent and general properties for all kinds of questions, but rather it depends on the meaning of question types.

4 Conclusion

In this paper I present a novel analysis for the Chinese polar question particle *ma*. It is argued that Inquisitive Semantics provides the right set of operators that can well account for the semantics of the *ma*-particle. The two operators *?* and *!* together produce the set of two possibilities by flattening the proposition, followed by adding the pseudo-complement as a novel possibility. As a result, the outcome is always the set that contains only two possibilities – a polar question.

It is further shown that the analysis can also explain the impossible patterns. The incompatibility between the *ma*-particle and other types of questions results from (i) the possibilities are exhaustive (ANAQ), or (ii) the absence of negative answers (ADJQ and QNTQ). The theoretical implication of the analysis is questions do not generically have existential presupposition, but rather whether existential presupposition is involved in a question depends on the meaning of the question type.

In this way, the analysis corresponds to the Clausal Typing Hypothesis in [2], and further offers a novel semantics for the process of clause-typing. In addition, the analysis also complements the hypothesis by predicting the incompatibility of the *ma*-particle and different types of questions.

References

[1] Scott AnderBois. Focus and uninformativity in Yucatec Maya questions. *Natural Language Semantics*, 20:349–390, 2012.

[2] Lisa Lai-Shen Cheng. *On the Typology of Wh-Questions*. PhD thesis, Massachusetts Institute of Technology, 1991.

[3] Ileana Comorovski. *Interrogative phrases and the Syntax-semantics Interface*. Kluwer Academic Publisher, 1996.

[4] Hongyuan Dong. *Issues in the Semantics of Mandarin Questions*. PhD thesis, Cornell University, 2009.

[5] Donka Farkas and Floris Roelofsen. Polarity particle responses as a window onto the interpretation of questions and assertions. *Language*, 91(2):329–414, 2015.

[6] J. Groenendijk and M. Stokhof. *Studies on the Semantics of Questions and the Pragmatics of Answers*. PhD thesis, University of Amsterdam, Amsterdam, 1984.

[7] Jeroen Groenendijk and Floris Roelofsen. Inquisitive semantics and pragmatics. In Zubeldia-L. Larrzabal, J., editor, *Proceedings of the 7th international Tbilisi symposium on language, logic, and computation*, pages 41–72, Leioa, 2009. University of the Basque Country Publication Service.

[8] Christine Gunlogson. Declarative questions. In Brendan Jackson, editor, *Proceedings of SALT XII*, pages 124–143, Cornell University, Ithaca, NY, 2002. CLC Publications.

[9] Lawrence Horn. *On the semantics of properties of logical operators in English*. PhD thesis, UCLA, Los Angeles, CA, 1972.

[10] Boya Li. *Chinese final particles and the Syntax of the periphery*. PhD thesis, Leiden University, 2006.

[11] Junko Shimoyama. Indeterminate phrase quantification in Japanese. *Natural Language Semantics*, 139–173(14):2, 2006.

[12] Nadine Theiler. A multitude of answers: embedded questions in Typed Inquisitive Semantics. Master's thesis, University of Amsterdam, Amsterdam, 2014.

[13] Mengxi Yuan and Yurie Hara. Questioning and Asserting at the same time: the L tone in A-not-A questions. In Maria Aloni; Michael Franke; Floris Roelofsen, editor, *Proceedings of 19th Amsterdam Colloquium*, pages 265–272, University of Amsterdam, 2013.