

RESEARCH PAPER

The Grammaticalization of Modal Verbs in Brazilian Portuguese: A Synchronic Approach

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This paper analyzes the grammaticalization of modal verbs in Brazilian Portuguese from a synchronic perspective. It takes as its point of departure the hypothesis that grammaticalization is a process in which linguistic elements widen their scope. Since this process is gradual and involves one step at a time, the synchronic correlate of this hypothesis is that if a modal verb has multiple meanings, these meanings should be of contiguous scope types on the grammaticalization scale in their synchronic distribution. The corpus data on which the paper is based show that this prediction is fully confirmed.

Keywords: Portuguese; modal verbs; grammaticalization; Functional Discourse Grammar; layering

1. Introduction

The aim of this paper is to investigate to what extent the grammaticalization process that involves modal verbs in Brazilian Portuguese may be explained in terms of the layered approach to grammatical categories in Functional Discourse Grammar (FDG, Hengeveld & Mackenzie 2008). In this approach grammatical elements are defined in terms of their semantic scope, and grammaticalization is seen as a process in which linguistic elements widen their scope (Hengeveld 2011). In the case of modal verbs this would mean that modal elements with lower scope develop into modal elements with wider scope. This diachronic prediction has synchronic consequences: if a modal verb has multiple modal meanings, these meanings should be of contiguous scope types in their synchronic distribution. In order to test these predictions, the distribution of modal verbs in Brazilian Portuguese across various modal meanings is studied.

The organization of this paper is as follows. Section 2 provides some basic background information on FDG and its treatment of modality. Section 3 elaborates the predictions that follow from the FDG approach. Section 4 presents the modal verbs included in the study and demonstrates their auxiliary nature. Section 5 then tests the predictions using examples taken from the internet. In section 6 we discuss the results, and in section 7 we present our conclusions.

2. Modality in FDG

2.1. Scope¹

Modality, and TMAE (Tense, Mood, Aspect, Evidentiality) categories in general, are defined here using the concept of scope as applied in FDG. The classification we use is based on Hengeveld & Mackenzie (2008), itself based on Hengeveld (2004), and includes the modifications proposed in Hengeveld (2011) and Hengeveld & Hattner (2015). **Table 1** summarizes this classification.

Scope relations are defined in **Table 1** in terms of four different semantic layers. Working inside out, the *situational concept* (f) is the set of properties of a possible state-of-affairs; a *state-of-affairs* (e) is the situated real or hypothesized situation the speaker has in mind; the *episode* (ep) is a thematically coherent

¹ This section is largely based on Hengeveld (2011).

	propositional content	episode	state-of-affairs	situational concept
Aspect			event quantification	phasal aspect (im)perfectivity
Tense		absolute tense	relative tense	
Evidentiality	inference	deduction	event perception	
Mood	subjective epistemic modality	objective epistemic modality	event-oriented modality	participant-oriented modality

Table 1: TMAE categories in Functional Discourse Grammar.

combination of states-of-affairs that are characterized by unity or continuity of time, location, and participants; the *proposition* (p) is the mental construct entertained about a state-of-affairs.

Tense, mood, aspect, and evidentiality are not unified categories in their application to these layers of semantic organization, but fall into different subcategories according to their scope. Aspect is subdivided into two categories, separating quantitative aspectual distinctions (such as habitual and distributive), which quantify over states-of-affairs as a whole, from qualitative aspectual distinctions (such as imperfective and resultative), which affect the internal temporal organization of a state-of-affairs. Tense is subdivided into absolute tense distinctions (such as past and future), which locate (a series of) states-of-affairs in time with respect to the moment of speaking, and relative tense distinctions (such as anterior and posterior), which locate a single state-of-affairs in time relative to another one. Evidentiality splits up in inference distinctions (such as supposition), which indicate how the propositional content follows from the speaker's existing knowledge, deduction distinctions (such as deduction on the basis of visual evidence), which indicate how an episode is deduced from observable facts, and event perception distinctions (such as witnessed and non-witnessed), which concern the direct perception of a state-of-affairs by the speaker. The widest range of subcategories is found in the area of Mood, where we find subjective epistemic modal distinctions (such as dubitative modality), which indicate the speaker's commitment with respect to the true value of a propositional content; objective epistemic modal distinctions (such as alethic possibility), which indicate the outcome of the objective evaluation of the reality value of an episode; event-oriented modal distinctions (such as moral obligation), which characterize a state-of-affairs in terms of its desirability or feasibility; and participant-oriented modality distinctions (such as ability), which express a relation between a participant in a state-of-affairs and the realization of that state-of-affairs. The modal distinctions mentioned here are further elaborated in the next section, using examples from Brazilian Portuguese, a language in which modality is predominantly expressed by modal verbs (*poder* 'may/can', *dever* 'should/must/be likely to', *ter de/ter que* 'have to', and *saber* 'know how to') and by modal adverbs (*realmente* 'really', *talvez* 'maybe', *provavelmente* 'probably', etc.).

2.2. Modality

2.2.1. Participant-oriented modality

Participant-oriented modality in general describes a relation between a participant in a state-of-affairs and the potential realization of that state-of-affairs. There are two subtypes:

- *participant-oriented facultative modality* describes the ability of a participant to engage in the state-of-affairs type designated by the predicate and its arguments. In Brazilian Portuguese a distinction is made between intrinsic ability (*poder* 'be able to, can'), like in (1) and acquired ability (*saber* 'know how to'), like in (2):

- (1) Adriano não **pode** mais jogar futebol por falta de condicionamento técnico e físico.²
'Adriano **cannot** play soccer anymore due to lack of technical and physical condition.'
- (2) Axl Rose **sabe** como fazer um bom show.³
'Axl Rose **knows how** to create a nice show.'

² http://portal.correio.com.br/opiniaio/noticias.php?coluna_id=69, consulted 8-8-2014.

³ <http://www.axlrosefaclube.com/2013/03/newcastle-axl-rose-sabe-como-fazer-um-bom-show/>, consulted 8-8-2014.

– *participant-oriented deontic modality* describes a participant's being under the obligation or having permission to engage in the SoA type designated by the predicate, as illustrated in (3) and (4):

(3) Eu **tenho que** trabalhar o dia todo.⁴

'I **have to** work the whole day.'

(4) Putin diz que Snowden **pode** ficar na Rússia se interromper revelações.⁵

'Putin says that Snowden **may** stay in Russia if he stops the disclosures.'

2.2.2. Event-oriented modality

Event-oriented modalities characterize a state-of-affairs in terms of its feasibility or desirability. There are two subtypes again:

– *event oriented facultative modality* characterizes a state-of-affairs in terms of the physical or circumstantial enabling conditions on its occurrence. This type is exemplified in (5) and (6):

(5) A mensagem não **pôde** ser enviada.⁶

'The message **could** not be sent.'

(6) Apesar de não ser 100% eficaz, a imunização **pode** salvar milhares de pessoas, principalmente em países subdesenvolvidos.⁷

'Although not 100% effective, immunization **can** save thousands of people, mainly in developing countries.'

In this type of modality the possibility of occurrence of an event does not depend on the intrinsic capacities of the participant, but it arises from the circumstances in which the event occurs.

– *event oriented deontic modality* characterizes a states-of-affairs in terms of what is generally desirable or undesirable, as shown in (7) and (8):

(7) Após a remoção da cápsula, **deve-se** limpar vigorosamente o gargalo, principalmente se a cápsula removida for de chumbo que, como já foi dito, é um material tóxico ao organismo.⁸

'After removing the cap, one **must** vigorously clean the bottleneck, specially if the removed cap is made of lead which, as was already said, is a toxic substance.'

(8) **Deve** se contar ou não ao paciente sobre provável diagnóstico de Alzheimer?⁹

'Should one or **shouldn't** one tell a patient about a probable diagnosis of Alzheimer?'

The obligations expressed by means of event-oriented deontic modality do not rest upon a particular participant, but represent general rules of conduct. This sense of general applicability can most clearly be identified in impersonal expressions as illustrated in (7) and (8).

2.2.3. Episode-oriented modality

Hengeveld (2011) distinguishes a modality type at the level of the episode that in Hengeveld & Mackenzie (2008) was considered a subtype of event-oriented modality. According to Hengeveld (2011) *objective epistemic modality* characterizes episodes in terms of the (im)possibility of their occurrence in view of what is known about the world.

Taking into account that absolute tense is an operator of the layer of the episode, while relative tense is an operator at the state-of-affairs, this position can be defended by considering the interaction between tense and modality. Consider example (9):

⁴ <http://g1.globo.com/pr/parana/noticia/2012/07/fiz-tudo-para-livrar-ele-das-drogas-diz-pai-que-matou-filho-para-defender-mae.html>, consulted 8-8-2014.

⁵ <http://internacional.estadao.com.br/noticias/geral,putin-diz-que-snowden-pode-ficar-na-russia-se-interromper-revelacoes,1048987>, consulted 8-8-2014.

⁶ <http://support.microsoft.com/kb/239135/pt-br>, consulted 8-8-2014.

⁷ <http://www.einstein.br/blog/paginas/post.aspx?post=808>, consulted 8-8-2014.

⁸ http://www.academiadovinho.com.br/_deg_servico.php, consulted 8-8-2014.

⁹ http://www2.uol.com.br/vyaestelar/paciente_alzheimer.htm consulted 8-8-2014.

- (9) Quanto ao jogador Juan Pablo Pino, com certeza **deverá** brilhar na próxima temporada.¹⁰
 'With respect to the player Juan Pablo Pino, he **is** certainly **likely to** be a star during the next season.'

Note that the entire stretch *brilhar na próxima temporada* 'to be a star during the next season' in (9), including the absolute temporal modifier *na próxima temporada* 'during the next season', falls under the scope of the objective epistemic modal verb *dever* 'be likely to'. The temporal modifier *na próxima temporada* 'during the next season' thus does not situate the likelihood expressed by *dever* in time, but rather locates the period in which the player will be a star in the next season after the statement is being made in the future. The likelihood of this event to happen already exists at the moment of speaking.

The episode in (9) consists of just one event, but another state-of-affairs may be added to such an episode. Consider example (10), in which the two states-of-affairs show unity of absolute time, place, and participants, as is typical of episodes:

- (10) Para os cargos que tiveram poucos aprovados não sei o que eles vão fazer, mas provavelmente eles **devem** realizar outro concurso antes da páscoa e contratar novos professores depois das férias de inverno no próximo ano.
 'For those positions for which very few people were approved, I don't know what they'll do, but probably they **are likely to** prepare another test before Easter and hire new teachers after the winter holiday next year.'

Note that each of the states-of-affairs within the episode in (10) has its own relative tense modifier (*antes de páscoa* 'before Easter' and *depois das férias de inverno* 'after the winter holiday'), but both of them are under the scope of the episodic absolute temporal modifier *no próximo ano* 'next year'.

2.2.4. Proposition-oriented modality

Proposition-oriented modality expresses the speaker's commitment with respect to the truth value of a propositional content. The relevant subtype here is *subjective epistemic modality*, which is concerned with the degree and type of the Speaker's commitment with respect to the propositional content: it may be presented as true, doubtful or hypothetical. This modality type is expressed in Brazilian Portuguese through the modal adverbs, as illustrated in (11) and (12):

- (11) A habilidade de se expressar é, **provavelmente**, a mais importante de todas as que uma pessoa pode possuir.¹¹
 'The ability to express oneself is **probably** the most important of all abilities a person may have.'
 (12) Fernanda Rodrigues **possivelmente** será madrinha do bebê de Sandy.¹²
 'Fernanda Rodrigues will **possibly** be Sandy's godmother.'

Note that this type of modality takes objective epistemic modality within its scope, as illustrated in examples (9) and (10), in which the modal *dever* is within the scope of the modal adverbials *com certeza* 'certainly' and *provavelmente* 'probably'.

2.2.5. Summary

Table 2 summarizes the various modal meanings distinguished in this section.

propositional content	episode	state-of-affairs	situational concept
– subjective epistemic	– objective epistemic	– event-oriented deontic – event-oriented facultative	– participant-oriented deontic – participant-oriented facultative

Table 2: Modality in FDG.

¹⁰ <http://forum.fmanager.com.br/topic/29007-fm-2007-o-misterio-de-monalisa/page-28>.

¹¹ <http://www.institutogessoni.com.br/cursos-e-workshops/oratoria-e-expressao-verbal>, consulted 8-8-2014.

¹² <http://jornaldehoje.com.br/fernanda-rodrigues-sera-madrinha-bebe-de-sandy/>, consulted 8-8-2014.

3. Grammaticalization in the modality domain

Hengeveld (1989: 142) hypothesizes that diachronic developments in the field of TMA expressions will go from lower to higher scope, and not the other way around. Translated into the current FDG model (Hengeveld 2011, *forthc.*), the pathway relevant for modality may be described as follows:

$$(13) p \leftarrow ep \leftarrow e \leftarrow f$$

When applying this general pathway to the categories in **Table 2** the more specific prediction is as specified in **Table 3**.

Modal expressions generally start out at the lowest layer (f) and then gradually widen their scope to next higher layers, never skipping an intermediate layer. Thus, it is expected that a modal verb that expresses a participant oriented modality may not come to express an objective epistemic modality without first passing through the event-oriented phase. Similarly, it may not come to express subjective epistemic modality without passing through the objective phase. The synchronic correlate of this prediction, that will be investigated here, is that the various meanings of a modal verb should occupy contiguous parts of the pathway in (13). In other words, the following distributions are examples of ones that are and are not (*) expected:

$$(14) \begin{array}{cccc} p & \leftarrow & ep & \leftarrow & e & \leftarrow & f \\ & & & & + & & \\ & & & & & + & + \\ & & & + & + & + \\ + & + & + & + \\ + & + & + \\ + & + \\ * & + & & + \\ * & + & & + \\ * & & + & + \\ \text{etc.} \end{array}$$

These predictions are largely compatible with, but are more precise than predictions that have been made in earlier studies on the grammaticalization of modal verbs, formulated within other kinds of theoretical framework. Traugott and Dasher (2002: 147), for instance, arrive at the following generalizations:

Not all languages have modals in the strict sense of grammaticalized (auxiliated or otherwise morphosyntactically specialized) verbs. Of those that do, not all have deontic-epistemic polysemies. But for those that do, we have confirmed earlier findings that:

- (i) deontic > epistemic, not vice versa,
- (ii) narrow > wide scope, not vice versa,
- (iii) root possibility/necessity > epistemic, not vice versa,
- (iv) subjectification increases within each domain.

Note that these individual predictions are all compatible with the generalized prediction embodied in (13).

Some further earlier findings referred to in the quote above are presented in Bybee, Perkins and Pagliuca (1994). Taking into account metaphorical extension as a mechanism for change, these authors postulate the following pathway to epistemic possibility:

$$(15) \text{ability} \rightarrow \text{root possibility/permission} \rightarrow \text{epistemic possibility}$$

Propositional content		episode		state-of-affairs		situational concept
- subjective epistemic	←	- objective epistemic	←	- event-oriented deontic - event-oriented facultative	←	- participant-oriented deontic - participant-oriented facultative

Table 3: Diachronic developments in the field of modality.

In this pathway, the more concrete meanings of ability are extended to the more abstract domain of epistemic possibility in which the change into root possibility is a pre-condition to the development of epistemic possibility. Again, this prediction is compatible with the generalized prediction in (13).

4. Modal verbs in Brazilian Portuguese

Brazilian Portuguese has a number of modal auxiliary verbs that are of interest to our research question. These are *dever* 'must, be likely to', *poder* 'can', *saber* 'know how to', *ter que/ter de* 'have to'. In order to demonstrate the auxiliary status of these verbs we apply a criterion for the periphrastic status of a construction discussed in Olbertz (1998: 38–44). This criterion concerns the idea that the modal value of the auxiliary verb only obtains when the modal verb occurs together with the lexical verb it modifies, not when it occurs in isolation. There are two ways in which this criterion is operationalized: (i) through pronominalization of the infinitival complement of a verb, and (ii), through omission of the infinitival complement of a verb. Both tests are aimed at establishing whether a verb can be dissociated from its complement without meaning effects. The effect of pronominalization of the complement of a lexical verb (Olbertz 1998: 39) is shown in (16):

- (16) A O que você **quer**?
'What do you **want**?'
B **Quero** ir à praia.
'I **want** to go to the beach.'

In this case the verb *querer* 'want' can be dissociated in (16A) from the infinitival complement it takes in (16B). The modal auxiliaries listed above do not allow this dissociation, as shown in examples (17)–(20):

- (17) A *O que ele **deve**?
"What **must** he?"
B Ele **deve** fazer as tarefas.
'He **must** make his homework.'
(18) A *O que ele **pode**?
"What **may** he?"
B Ele **pode** ficar em casa.
'He **may** stay at home.'
(19) A *O que ele **sabe**?
"What does he **know how** to?"
B Ele **sabe** nadar.
He **knows how** to swim.'
(20) A *O que ele **tem (que/de)**?
"What does he **have to**?"
B Ele **tem que** sair cedo.
'He **has to** leave early.'

Note that the ungrammaticality of the A-examples in (17)–(20) only concerns the modal use of the verbs under study. All of these verbs also have a lexical use outside the periphrastic constructions (*dever* 'to owe', *poder* 'to be capable of dealing with', *saber* 'know something', *ter* 'have, possess'), as illustrated in the following examples:

- (21) Os clubes **devem** muito dinheiro para a Receita Federal.¹³
'The clubs **owe** a lot of money to the Federal Revenue Service.'
(22) Se não **pode** com a concorrência, junte-se a elas.¹⁴
'If you are not able to **deal** with the competition, join them.'
(23) Maioria [dos alunos] não **sabe** matemática ao final do ensino médio.¹⁵
Most students do not **know** mathematics at the end of high school.

¹³ http://blogremio.blogspot.com.br/2014/02/o-poder-publico-mais-fanatico-do-brasil_16.html.

¹⁴ <http://www.novonegocio.com.br/oportunidades-negocios/como-um-corretor-de-imoveis-pode-atrair-clientes/>, consulted 8-8-2014.

¹⁵ <http://g1.globo.com/educacao/noticia/2012/03/maioria-nao-sabe-matematica-ao-final-do-ensino-medio-segundo-saesp.html>

- (24) O cara é um magnata, **tem** vários carros na garagem.¹⁶
The guy is a tycoon, he **has** several cars in the garage.

Another way in which a verb can be dissociated from its complement (Olbertz 1998: 42) is through omission of the complement in contexts in which this complement is contextually given. This is shown for a lexical verb in (25).

- (25) Eu posso ir mas não quero.
'I can go but I don't want to.'

In certain contexts the Brazilian Portuguese modal verbs also allow omissibility of the infinitival complement. This is shown in examples (26)–(29):

- (26) Eu quero ir mas não **posso**.
'I want to go but I **can't**.'
(27) Eu não quero ir mas **devo**.
'I don't want to go but I have to.'
(28) Eu quero nadar mas não **sei**.
'I want to swim but I am not able to.'
(29) Eu não quero ir mas **tenho que/de**.
'I don't want to go but I have to.'

Note that omission of the infinitival complement is only possible with animate subjects in non-epistemic uses. The following adapted version of example (6) shows the ungrammaticality of omission with an inanimate subject:

- (30) *A imunização tem como objetivo salvar milhares de pessoas mas não **pode**.
'Immunization has as its objective to save thousands of people but it **can't**.'

Example (31), an adapted version of example (10), shows that the epistemic reading is excluded in the case of omission.

- (31) Eles não querem realizar outro concurso no próximo ano mas **devem**.
'They don't want to organizer another test next year but they **have to** (\neq **are likely to**).'

Taken together, these facts show that the Brazilian Portuguese modal verbs are not fully grammaticalized in all their uses. Most interestingly, the highest degree of grammaticalization is exhibited in the epistemic uses, which correspond to the highest degrees of grammaticalization on the hypothesized pathway given in (13).¹⁷

Note finally that in Brazilian Portuguese the positive answer to a yes/no question generally takes the form of the finite verb that was used in the question. This leads to situations such as the one illustrated in (32) and (33):

- (32) A Você **tem que** ir?
'Do you **have to** go?'
B **Tenho**.
'I have to.'
(33) A Você **pode** comprar o pão?
'**Can** you buy bread?'
B **Posso**.
'I can.'

¹⁶ <http://www.meusport.com/forum/showthread.php?t=205331>

¹⁷ We are grateful to Hella Olbertz for pointing out the issues dealt with in the preceding paragraphs to us.

In question-answer pairs like (32) and (33) the answer is the result of a mere copying procedure and not a semantically relevant use of the verb in the question, such that situations like these have to be excluded too when testing the auxiliary behaviour of modal verbs.

After thus establishing the (partial) auxiliary status of the four modal verbs *dever*, *poder*, *saber* and *ter que/ter de* we now turn to the distribution of these verbs across the different modality types.

5. The distribution of modal verbs across layers

5.1. Introduction

In this section we test the predictions elaborated in section 3 using examples from the internet.

5.2. Uses of *dever*¹⁸

The lowest layer at which the modal *dever* occurs in Portuguese is that of the situational concept (f). In this use it has a deontic meaning and describes a participant's being under the obligation to engage in the SoA type designated by the predicate. This use is illustrated in the following examples:

- (34) Eu acho que você **deve** falar agora!¹⁹
'I think that you **have to** speak now!'
- (35) Treinador de Weidman ironiza Anderson Silva e diz que ele **deve** aprender a perder.²⁰
'The coach of Weidman talks ironically about Anderson Silva and says he **has to** learn how to lose.'

Dever is also used to characterize a state-of-Affairs (e) as desirable or permitted, as in the following examples:

- (36) Não se **deve** fumar uma hora antes e nem uma hora depois do exercício físico²¹
'One **shouldn't** smoke one hour before nor one hour after physical exercise.'
- (37) Não se **deve** dar castigos corporais às crianças.²²
'One **shouldn't** punish children physically.'

The third attested use of *dever* is an epistemic one. Here an episode is qualified as probable. This is illustrated in (38) and (39):

- (38) Desemprego **deve** voltar a crescer no Brasil, alerta a Organização Internacional do Trabalho.²³
'Unemployment **is likely to** grow again in Brazil, warns the International Labour Organization.'
- (39) Segundo expectativa do ministro da Fazenda, Guido Mantega, a dívida **deverá** ser de 41% do PIB este ano.²⁴
According to the finance minister's expectation, Guido Mantega, the debt **is likely to** be 41% of GDP this year

Another use of *dever* is also attested, now at the propositional layer. In this case, it qualifies the propositional content as a result of an inference processed by the Speaker. Although this use is not strictly modal but rather evidential, we register it here to show all the layers at which the verb *dever* occurs:

¹⁸ The meanings of the different modal verbs analyzed here have been discussed in several studies on auxiliary verbs in Brazilian Portuguese. Among many others we would like to mention Pontes (1973), Lobato (1975, 1984), and Almeida (1988). More recent studies within different functional approaches are Neves (2000), Dall'Aglio Hattner (2008), and Comparini (2008).

¹⁹ <https://weheartit.com/entry/8685804>, consulted 8-8-2014.

²⁰ <http://extra.globo.com/esporte/mma/treinador-de-weidman-ironiza-anderson-silva-diz-que-ele-deve-aprender-perder-11294142.html>, consulted 8-8-2014.

²¹ <http://globoesporte.globo.com/eu-atleta/saude/noticia/2013/05/respiracao-correta-pode-aumentar-resistencia-durante-pratica-esportiva.html>, consulted 8-8-2014.

²² http://www2.uol.com.br/vyaestelar/educar_crianças.htm, consulted 8-8-2014.

²³ <http://www.oprincipiodasabedoria.com/?p=945>, consulted 8-8-2014.

²⁴ <http://zh.clicrbs.com.br/rs/noticias/economia/noticia/2010/12/governo-quer-diminuir-divida-publica-para-30-do-pib-ate-2014-3132799.html>

<i>dever</i>	p	ep	e	f
Deontic	-	-	+	+
Epistemic	-	+	-	-
Evidential	+	-	-	-

Table 4: Uses of *dever*.

- (40) Pelo que me consta, **deve** ter sido o último depoimento do ex-governador.²⁵
 'As far as I know, it **must** have been the last testimony of the former governor.'
- (41) Ele **deve** ter consumido alguma substância para ter perdido o juízo.²⁶
 'He **must** have taken something to have lost his mind.'

Summarizing, the verb *dever* may be used at all layers under investigation, as shown in **Table 4**.

5.3. Uses of *poder*

The lowest layer at which *poder* may be used is that of the situational concept. One of the meanings it expresses at this layer is intrinsic ability, a facultative modality, as illustrated in (42)–(43):

- (42) um camelo pode ficar vários dias sem beber água²⁷
 'A camel **is able to** spend several days without drinking water.'
- (43) Qualquer um **pode** aprender a aumentar tremendamente a sua capacidade mental.²⁸
 'Anyone can learn to increase his mental capacities tremendously.'

A second meaning *poder* expresses at this layer is a deontic one. In this case it expresses that a participant in a state-of-affairs has the permission to perform that state-of-affairs. This is illustrated in (44)–(45):

- (44) O psicoterapeuta não **pode** se envolver emocionalmente com o paciente.²⁹
 'The psychotherapist **cannot** get emotionally involved with the patient.'
- (45) Senhores Ministros, não **podemos** perder um só minuto.³⁰
 'Ministers, we **cannot** lose a single minute.'

The modal *poder* can also modify an event, in which case it may express two different meanings. The first meaning is a facultative one. In this reading it expresses the possibility of occurrence of an event in terms of general enabling conditions, as illustrated in (46)–(47):

- (46) A página não **pôde** ser exibida.³¹
 'The page **could** not be displayed.'
- (47) Desculpe, sua solicitação não **pôde** ser processada. Por favor, tente novamente.³²
 'Sorry, your request **could** not be processed. Please try again.'

The second meaning of *poder* at this layer is a deontic one. In this use it expresses the permissibility of an event in general terms. This is illustrated in (48)–(49):

- (48) **Pode-se** fumar neste restaurante.³³
 'One **may** smoke in this restaurant.'

²⁵ http://www.deolhoseouvidos.com.br/2011_arquivo_mensal/Index_02_fev.htm

²⁶ <http://www.al.ce.gov.br/index.php/clipping-o-estado/item/16719-ciro-diz-que-cap-wagner-%C3%A9-chefe-de-mil%C3%ADcia-na-pm>, consulted 8-8-2014.

²⁷ <http://diariodebiologia.com/2008/03/o-segredo-dos-camelos/>, consulted 8-8-2014.

²⁸ http://www.acasadoaprendiz.com.br/neurolinguistica_02_08.html, consulted 8-8-2014.

²⁹ <http://www.carolina.psc.br/index2.php?action=perguntas.php>, consulted 8-8-2014.

³⁰ <https://www.yumpu.com/pt/document/view/12997147/revista-gragoata-27-uff/161>, consulted 8-8-2014.

³¹ <http://www.reclameaqui.com.br/8373892/vagas/erro-ao-acessar-o-t-e-r-p-e/>, consulted 8-8-2014.

³² <http://www.duvidaseperguntas.com/1034/desculpe-solicitacao-processada-favor-novamente-facebook>, consulted 8-8-2014.

³³ <http://aquiperto.com/modulo.asp?n=346&sCon=12&sdis=15>, consulted 8-8-2014.

- (49) Aqui **pode-se** entrar com US\$ 500 em destilados.³⁴
'Here one **may** enter with liquor up to a value of US\$ 500.'

A third layer at which *poder* may operate is the episode. In this case the modal expresses objective epistemic modality, more specifically, it indicates the objective possibility that an episode occurs. The following examples illustrate this use:

- (50) Os policiais **podem** chegar a qualquer momento.³⁵
'The policemen may arrive any time now.'
- (51) Aeroporto de Ji-Paraná **poderá** ficar sem voos se não houver investimentos.³⁶
'The Ji-Parana airport **may** be closed down if there are no investments.'

Summarizing, *poder* can be used at three of the four layers under investigation, as shown in **Table 5**.

5.4 Uses of *ter de/ter que*³⁷

The lowest layer at which the modal *ter de/ter que* occurs in Portuguese is that of the situational concept, where it expresses a deontic meaning. At this layer, it describes a participant's being under the obligation to engage in the SoA type designated by the predicate, as shown in the following examples:

- (52) Você **tem que** pedir desculpas pessoalmente.³⁸
'You **have to** apologize personally.'
- (53) América Latina **tem de** apostar mais no mercado interno.³⁹
'Latin America **has to** rely more on the domestic market.'

Ter que/ter de is also used to characterize a state-of-affairs as obligatory, as illustrated in (54)–(55):

- (54) **Tem-se que** reconhecer o esforço.⁴⁰
'One **has to** recognize the effort.'
- (55) **Tem que** pensar duas vezes, **tem-se de** pensar sempre antes de falar e agir.⁴¹
'One **has to** think twice, one always **has to** think before talking or acting.'

At this layer these modals may also be used in a facultative sense, expressing the necessary conditions for an event to occur. This use is illustrated in (56)–(57):

- (56) Para se ser jogador de rugby **tem-se de** ter grande peso corporal e um físico musculado?⁴²
'Does one **have to** be heavy and muscular to be a rugby player?'
- (57) Vi que para ir até lá **tem que** ser de RER linha B.⁴³
'I saw that in order to arrive there one **has to** take RER line B.'

Summarizing, *ter de/ter que* can be used at two of the four layers under investigation, as indicated in **Table 6**.

5.5 Uses of *saber*

Expressing a facultative meaning, the only layer at which the modal *saber* occurs is that of the situational concept. At this layer, it describes the acquired ability of a participant to engage in the state-of-affairs type designated by the predicate and its arguments:

³⁴ <http://www1.folha.uol.com.br/fsp/1995/12/12/opinio/9.html>, consulted 8-8-2014.

³⁵ <http://virgula.uol.com.br/vestiba/usp-policiais-podem-invadir-a-qualquer-momento>, consulted 8-8-2014.

³⁶ <http://vimeo.com/68391897>, consulted 8-8-2014.

³⁷ These two uses are considered in this paper as alternative forms to express the same modal value. The differences between them are related to levels of formality, *ter que* being more colloquial than *ter de*.

³⁸ <https://br.answers.yahoo.com/question/index?qid=20100622091902AA4sRY0>, consulted 8-8-2014.

³⁹ <http://www.espacoconomia.com/america-latina-tem-de-apostar-mais-no-mercado-interno/>, consulted 8-8-2014.

⁴⁰ <http://www.seriebrasil.com.br/site/2010/05/tem-se-que-reconhecer-o-esforco/>, consulted 8-8-2014.

⁴¹ <http://pensador.uol.com.br/colecao/usuario486629/>, consulted 8-8-2014.

⁴² <https://br.answers.yahoo.com/activity?show=F54BBQOBUNA4RQJZO575QSFK4&t=g>, consulted 8-8-2014.

⁴³ <http://dicasdefrances.blogspot.nl/2011/02/gares-de-paris-rer-tranportes.html>, consulted 8-8-2014.

<i>poder</i>	p	ep	e	f
Deontic			+	+
Facultative			+	+
Epistemic		+		

Table 5: Uses of *poder*.

<i>ter de/ter que</i>	p	ep	e	f
Deontic			+	+
Facultative			+	

Table 6: Uses of *ter de/ter que*.

<i>saber</i>	p	ep	e	f
Facultative				+

Table 7: Uses of *saber*.

- (58) 'Brasil **sabe** fazer grandes eventos', diz embaixador britânico.⁴⁴
 "Brasil **is capable of** organizing big events', says the British ambassador.'
 (59) Mitrovic já **sabe** falar português⁴⁵
 'Mitrovic **knows how to** speak Portuguese already.'

Summarizing, *saber* can be used at one of the four layers under investigation, as indicated in **Table 7**.

5.6. Summary of results

The distribution of modal verbs across layers is summarized in **Table 8**.

We will discuss this distribution in the light of our predictions in the next section.

6. Conclusion

We predicted in section 3 that, as a result of the hypothesized diachronic pathways of change, the various meanings of a modal verb should occupy contiguous parts of the pathway in (13), repeated here as (60):

$$(60) p \leftarrow ep \leftarrow e \leftarrow f$$

On the basis of the results summarized in **Table 8** we may now conclude that this prediction is correct. The four modal verbs investigated distribute across the various layers in the way indicated in **Figure 1**.

As **Figure 1** indicates, all four modal verbs occupy contiguous portions of the pathway in (60), with *dever* showing the widest range of applications and *saber* the smallest one, with *poder* and *ter* occupying intermediate positions. Furthermore, the four modals show a systematic difference in that they can be ranked one step at a time at the pathway in (60), as indicated by the bold line in **Figure 1**. The prediction is thus fully confirmed.

We may take one further step now and speculate about the diachronic developments that lay behind these synchronic data. As we argued in section 3, grammaticalization can be seen as a process of widening of scope along the pathway indicated in (60). Given the results of our synchronic analysis, and combining the data in **Table 8** and **Figure 1**, we may thus speculate that the modal verbs *dever*, *poder*, and *ter* have developed diachronically in the ways indicated in **Figures 2–4**. The development of *saber* is irrelevant here as it has only grammaticalized one step away from its lexical meaning.

⁴⁴ <http://esportes.estadao.com.br/noticias/geral,brasil-sabe-fazer-grandes-eventos-diz-embaixador-britanico,1099903>, consulted 8-8-2014.

⁴⁵ <http://www.destakes.com/redir/4135459c015e614a92849c0c7e3a16f1>, consulted 8-8-2014.

	p	ep	e	f
Deontic			<i>dever</i> <i>poder</i> <i>ter de/que</i>	<i>dever</i> <i>poder</i> <i>ter de/que</i>
Facultative			<i>poder</i> <i>ter de/que</i>	<i>poder</i> <i>saber</i>
Epistemic		<i>dever</i> <i>poder</i>		
Evidential	<i>dever</i>			

Table 8: The distribution of modal verbs.

Modal verb	p	ep	e	f
<i>Dever</i>	+	+	+	+
<i>Poder</i>		+	+	+
<i>Ter de/Ter que</i>			+	+
<i>Saber</i>				+

Figure 1: Distribution of modal verbs across layers.

	p	ep	e	f
Deontic			<i>dever</i> ← <i>dever</i>	
Facultative				
Epistemic		<i>dever</i>		
Evidential	<i>dever</i>			

Figure 2: Hypothesized development of *dever*.

Note that our predictions do not allow us to predict whether the epistemic use of *poder* developed from its deontic or its facultative use at the layer of the state-of-affairs (e), which is why we indicate both possibilities in **Figure 3**, in accordance with the pathway predicted by Bybee et al. given in (15). Future research using diachronic data will have to establish what the relevant connection was in the history of Portuguese.

Notwithstanding this open question, our results show that the theory of grammaticalization developed within the context of FDG makes the right predictions concerning the synchronic distribution of modal verbs across scopal layers. It thus provides a promising avenue for future research into the intricacies of the grammaticalization of temporal, modal, aspectual, and evidential categories.

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	p	ep	e	f
Deontic			<i>poder</i> ← <i>poder</i>	
Facultative			<i>poder</i> ← <i>poder</i>	
Epistemic		<i>poder</i>		
Evidential				

Figure 3: Hypothesized development of *poder*.

	p	ep	e	f
Deontic			<i>ter de/que</i> ← <i>ter de/que</i>	
Facultative			<i>ter de/que</i>	
Epistemic				
Evidential				

Figure 4: Hypothesized development of *ter de/que*.

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