

SEMANTICS OF MODAL AUXILIARY VERB USES BY PRESCHOOL CHILDREN*

Roy D. Pea
Bank Street College of Education
and Clark University

&

Ronald Mawby
Clark University

* Paper presented at The Second International Congress for the Study of Child Language, August 9th to 14th, 1981, Vancouver, British Columbia.

SEMANTICS OF MODAL AUXILIARY VERB USES BY PRESCHOOL CHILDREN

Roy D. Pea
Bank Street College of Education
and Clark University

&

Ronald Mawby
Clark University

Modal auxiliaries are a dominant verb phrase form in the language of preschoolers (Fletcher, 1979; Wells, 1979), and a major means for expressing the modal aspects of thought so central to human mentality (e.g. Johnson-Laird, 1978; Lyons, 1977; Miller, 1977; Pieraut-Le Bonniec, 1980), yet the study of the semantics of modal and quasi-modal auxiliaries has been generally neglected. This is not altogether surprising, since modals in adult language are notoriously complex (e.g. Lyons, 1977; Palmer, 1979), expressing a variety of modalities and interacting in surprising ways with negation (e.g. Miller & Kwilosz-Lyons, 1980; Wertheimer, 1972). Nonetheless, we believe it is important to provide a preliminary characterization of an early period in the ontogenesis of modal semantics, which we will then discuss from the genetic-dramatistic perspective on lexical development (Pea & Kaplan, 1981). We will confine our attention here to modal and quasi-modal auxiliary verbs (see Table 1), primarily because, unlike

(Insert Table 1 here)

modal adverbs such as "perhaps", modal adjectives such as "necessary" or "possible", and modal inflections such as "-able", they occupy the most central position among modal linguistic forms in the current grammatical structure of English (Lyons, 1977, p. 802).

Our goals for this initial inquiry into early modal semantics were: (1) to characterize which modals and quasi-modals preschool children use, in a range of settings representative for the talk of preschoolers; (2) to develop a system of semantic categories for the analysis of uses of such expressions, informed by work in modal logic by linguists and philosophers; (3) concurrent with the second goal, to characterize the general bodies of knowledge, or modalities, which appear to be invoked in preschoolers' uses of such expressions, and the extent to which affirmative versus negative values of such modalities are utilized in their talk; and (4) to characterize, insofar as possible given the brevity of this paper, the interconnections of the semantics of modal auxiliary development with their pragmatic and syntactic aspects, and the complexities of children's lives. To these ends, we chose to study a corpus of children's utterances taking place in a wide range of activities and over an extended period of interactions with agents of different status. The talk of preschoolers in a nursery, between peers and with their teacher, satisfied these requirements. Had our purpose

been to "assess" what any individual child does with modals, our research strategies would have been quite different.

Six children, three boys and three girls, from white professional families attended a nursery at Rockefeller University¹ for two hours a day, four days a week, over a period of seven months, and were regularly videotaped in a variety of contexts, such as free play, snack time, arts and crafts, and cleaning-up. The children ranged in age from 28 to 34 months when the nursery recordings began. Utterances and aspects of the environmental context were transcribed and entered onto computer tapes for subsequent analysis. Seven videotaped sessions across the seven months of recording with a total length of nine hours were selected for analysis. The total number of child utterances during these nine hours of nursery activity were 4027.

Four principle modalities have been distinguished by linguists and philosophers in their discussions of modal logics and their relationships to natural language expressions of modal concepts. These modalities appear to be necessary for the characterization of modal auxiliary semantics for adult English. Schematic definitions of the four modalities, or bodies of knowledge which may be invoked in the use of natural language modal expressions, are presented in Table 2. The

(Insert Table 2 here)

PRAGMATIC modality is comprised of two distinguishable but related modalities, the DYNAMIC and the DEONTIC. The DYNAMIC modality is concerned with the logic of actions, and such questions as whether or not an agent has the ability to accomplish an act, or whether it is necessary that the agent do X in order to accomplish an act. The DEONTIC modality is concerned with such questions as whether or not an agent has permission or is obligated to do some act. The deontic modality is related to the dynamic in ways such as the following: if one is unable to do X, one cannot be obligated to do X. The EPISTEMIC modality is concerned with the logic of knowledge or belief claims, such as whether or not some event is necessary or possible, given inferences from factual knowledge. The ALETHIC modality was the first studied extensively by philosophers, and is concerned with whether propositions expressed in utterances are or are not logically necessary or possible (hence unconcerned with 'fact').

One point of interest for the developmental study of modals is that the interdefinability of possibility and necessity cross-cuts all four modalities. For example, as shown in Table 3, p is necessary if and

(Insert Table 3 here)

only if it is not possible that p is not the case. This interdefinability of modals by means of negation has the consequence that systematic logical relationships, such as contradiction and contrariness, are expressible with modal auxiliaries, and may be exploited

in conversational inferences. Also note that negation may, across all modalities, modify modals in two different ways, either de dicto (-□, -◇), which includes the modal operator, as in "it is not permissible for you to leave", or de re (□-, ◇-), in which the negation modifies only the clause and not the modal, as in "it is possible for you to not go outside".

RESULTS

A general summary of results provides some indication of the predominant features of preschoolers' uses of modals and quasi-modals in nursery settings. Of the 4027 child utterances, 395 of them (10%) used at least one modal or quasi-modal auxiliary verb², for a total of 418 of such terms. Two or more such terms were used in only 21 of the 395 utterances (5%). Further, of all of the modals used, 89% (373) were categorizable, 8% were incompleting utterances or inaudible, and 3% were ambiguous between modalities. Our semantic analyses made extensive use of the discourse context, including prior topics and subsequent responses to and elaborations of the specific modal utterance being analysed, as well as details of the environmental context. Two experienced coders working independently concurred on 91% of the total set of assignments to modal semantic categories.

Table 4 summarizes these findings by modality and by modal values.

(Insert Table 4 here)

Four principle groups of modals may be distinguished. The epistemic modality value of possibility was extremely common in the children's utterances³, a finding due in large part to the predominance of volitional statements such as "I'll give you a little tiny fork" (170 of the 217 epistemic modality cases (78%), or 46% of all occurrences of modals. The second group are the modals of the dynamic modality, or 24% of the total. The third group are the modals of the deontic modality, or 18% of the total, with the fourth group, the remaining epistemics, accounting for 13% of the total. Examples of each of these categories are presented in Table 5.

(Insert Table 5 here)

Next, one may ask which modal values are predominant in the children's uses of modals, irrespective of the particular modality concerned. It is very striking that the modals which convey the affirmative modal values of necessity and possibility together represent 91% of all the modals the children used. Negatives occurred only once in every twelve uses of modals by the preschoolers. Several notable gaps occurred in negative modal values. For the DEONTIC modality, children did not express either the permission to not do, or non-obligation, as in "I don't have to do that". For the DYNAMIC

modality, the practical possibility of not doing some act was also not expressed. In fact, almost all of the negative modals either expressed constraints on action or an unwillingness to act AT THE TIME OF SPEAKING. In other words, there was little spatiotemporal distance between the negative modal symbolic act and the event to which it referred.

Similarly prominent is the absence of modal uses for the alethic modality. Such young children did not discuss the logical possibility or necessity of propositions expressed in utterances, just as we might expect given the great difficulty with such conceptions for much older children revealed in Osherson & Markman's (1974/1975) work.

Many of the most fascinating findings concern the frequencies and modal values for the individual modals used (see Table 6), which we may

 (Insert Table 6 here)

but briefly refer to here. The children's choices of modals were selective, and many affirmative terms were used without negative counterparts. MAY, MUST, OUGHT (TO), and SHALL were never used; MIGHT, SHOULD, and WOULD were rarely used. Only a few terms, such as CAN, CAN'T, COULD, and HAVE TO were used to convey the three remaining modalities; others such as GONNA were restricted to a single modality.

From the holistic framework for lexical development of Genetic-Dramatism outlined earlier in this session (Pea & Kaplan, 1981), we may view the modal terms used as INSTRUMENTALITIES which embody the ACTION an AGENT engages in for a PURPOSE, taking place with respect to a SCENE, which may be either a concrete environmental context, or at some symbolic remove from the current physical setting (e.g., next year; Easter; in a fairy tale). We have observed several prototypic features of the uses of modals in this corpus, which may be compared to lexical developmental goals:

(1) the scenes of modality are almost always current environmental or discourse contexts, rather than symbolic scenes at some temporal or spatial distance from modal speech acts; even announcements of intentions to act are with reference to plans just about to be enacted. The "distancing" (Werner & Kaplan, 1963) of modal speech acts from their referential events is thus a critical development rarely manifested in the preschoolers' modal talk.

(2) the actions of modal purpose are most frequently self-oriented and volitional or wishful in nature (e.g. permission requests, action requests, internal reports) rather than world or other-oriented (e.g. attributions) and predictive or explanatory. The will-do is thus much more basic to the children's talk than the will-happen.

(3) different agent-statuses may be taken on by the preschoolers in pretend play scenes, but generally are a reflection of family roles. The modalities in such scenes were predominantly DEONTIC and "authority"-based, e.g. "You will be the grownup" as the child assigns a make-believe status role to another child.

(4) the purposes of modality are remarkably diverse, from soliciting help in order to accomplish subgoals of higher-order goals, to obtaining permission, to taking power in toy-possession negotiations, to soliciting attention by proudly asserting new achievements or physical abilities. The same purpose (e.g. conveying the modal concept of epistemic possibility) was often achieved by different instrumentalities (e.g., "can", "could"), but some lexical terms serve a greater diversity of purposes in adult English than in the children's talk, such as "will" for promises, and "need to" for stating obligations.

In conclusion, we probably do not need to state that we have but scratched the surface of child modality. But at least we have manned the shovels. We must confess that one goal for our paper was left unstated - our wish that you might also be enticed to the study of modal semantic development. The great riches of human intelligence, creativity, and sociality are perhaps nowhere more apparent than in modal language. Locked within the expression and understanding of modals throughout childhood and adulthood lie, we believe, many mysteries: of moral development, of the development of planning, of the understanding of power and status, of scientific and aesthetic understanding, of the construction of a theory of mind. What remains is the necessity of their study.

FOOTNOTES

¹ Laboratory staff, facilities, data collection, transcription, and proof-editing were supported by a grant from the Grant Foundation to Professor George A. Miller. Some of the analyses in this paper were supported by NIMH Traineeship #15125 to the first author while at Rockefeller University.

² For purposes of exposition, we will refer to these collectively as "modals" throughout the remainder of this paper. In addition, but not a focus of analysis here, the children used "want to/wanna" 241 times and "don't want to/don't wanna" 18 times. The complexities of "want" (e.g. Wilensky, 1977) warrant a separate study, now in progress. "I want X" is often, though not always, used to accomplish the same ends as "Can I have X?"

³ Ninety-three percent of 115 uses of "gonna", and 87% of 55 uses of "will" (as well as 100% of the 259 uses of affirmative and negative forms of "want to") expressed volition, and of these, most sentence subjects were first person (80%, 81%, and 95%, respectively, for the different terms). Relatively few predictive uses of such terms occurred for non-volitional events or even volitional events of other persons than the child.

REFERENCES

- Fletcher, P. The development of the verb phrase. In P. Fletcher & M. Garman (Eds.), Language Acquisition: Studies in First Language Development. Cambridge: Cambridge University Press, 1979.
- Hintikka, J. Knowledge and Belief. Ithaca, N.Y.: Cornell University Press, 1962.
- Johnson-Laird, P.N. The meaning of modality. Cognitive Science, 1978, 2, 17-26.
- Lewis, C.I. & Langford, C.H. Symbolic Logic. New York: Dover, 1932.
- Lyons, J. Semantics. (2 vols.) Cambridge: Cambridge University Press, 1977.
- McCawley, J.D. Everything that Linguists have Always Wanted to Know about Logic* : *but were ashamed to ask. Chicago: University of Chicago Press, 1981.
- Miller, G.A. How people think about modal verbs. Colloquium paper presented at University of Minnesota, April 4, 1977.
- Miller, G.A. & Kwilosz-Lyons, D.M. Interactions of modality and negation in English. In A. Yoshi, B. Nash-Webber & I. Sag (Eds.), Elements of Discourse Understanding. Cambridge: Cambridge University Press, 1981.
- Osherson, D. & Markman, E. Language and the ability to evaluate contradictions and tautologies. Cognition, 1974-75, 3, 213-226.
- Palmer, F.R. Modality and the English Modals. London: Longman, 1979.
- Pea, R.D. & Kaplan, B. Lexical development from the perspective of genetic-dramatism. Paper presented at The Second International Congress for the Study of Child Language, August 9th to 14th, 1981, Vancouver, British Columbia, Canada.
- Pieraut-Le Bonniec, G. The Development of Modal Reasoning: Genesis of Necessity and Possibility Notions. New York: Academic Press, 1980.
- Rescher, N. The Logic of Commands. London: Routledge & Kegan Paul, 1966.
- Wells, C.G. Learning and using the auxiliary verb in English. In V. Lee (Ed.), Cognitive Development: Language and Thinking from Birth to Adolescence. London: Croom Helm, 1979.
- Werner, H. & Kaplan, B. Symbol Formation. New York: John Wiley, 1963.
- Wertheimer, R. The Significance of Sense: Meaning, Modality, and Morality. Ithaca, N.Y.: Cornell University Press, 1972.

Wright, G.H. von An Essay in Deontic Logic and the General Theory of Action. (Acta Philosophica Fennica, 21). Amsterdam: North-Holland, 1968.

Wright, G.H. von An Essay in Modal Logic. Amsterdam: North-Holland, 1951.

Wright, G.H. von Norm and Action. London: Routledge & Kegan Paul, 1963.

Table 3. Modalities and Modal Values^a

<u>Symbolic Representation</u>	<u>DYNAMIC</u>	<u>DEONTIC</u>	<u>EPISTEMIC</u>	<u>ALETHIC</u>
$\Box p$	necessary to do	obligated to do	necessary	necessary
$\Diamond p$	possible to do	permitted to do	possible	possible
$\Box -p$	necessary to not do	obligated to not do	necessary not	necessary not
$-\Diamond p$	impossible to do	not permitted to do	impossible	impossible
$-\Box p$	not necessary to do	not obligated to do	not necessary	not necessary
$\Diamond -p$	possible to not do	permitted to not do	possible not	possible not

MODAL INTERDEFINABILITY: Either necessity or possibility may be treated as primitive, and the other term defined in terms of the primitive and negation. So, for necessity:

$$\Box p = -\Diamond -p \quad (p \text{ is necessary if and only if it is not possible that } p \text{ is not the case)}$$

and for possibility:

$$\Diamond p = -\Box -p \quad (p \text{ is possible if and only if it is not necessary that } p \text{ is not the case)}$$

¹The semantic categories which are common to all of the modalities in their logical form conform to a variant of the Aristotelian logical square which incorporates de re and de dicto negations, i.e., those of both narrow and wide scope (Pieraut-Le Bonniec, 1980). Traditionally, de re categories of the modalities have been neglected, but negations of different scope do have different logical status. Many natural language statements which involve scope of negation and modal value are ambiguous between two interpretations, even within a specific modality, such as "I can't go to the movie", which may mean either OBLIGATED TO NOT GO or NOT PERMITTED TO GO (de re necessity and de dicto possibility, respectively). The semantic category modal values may be symbolically represented in the same way, regardless of the modality. We have used the standard Lewis & Langford (1932) notation. KEY: " \Box " = necessary; " \Diamond " = possible; "-" = negation; "p" = any proposition.

Table 4. The Frequencies of Modal Values Expressed in Preschoolers' Uses of Modals and Quasi-Modals

	<u>DYNAMIC</u>	<u>DEONTIC</u>	<u>EPISTEMIC</u>	<u>ALETHIC</u>	<u>TOTALS</u>
necessary	64	17	4	0	85
possible	10	42	201	0	253
necessary not	1			0	1
-----		(8) ^a	(5)	-----	(13) --
impossible	11			0	11
not necessary	3	0		0	3
-----			(6)	-----	(6) --
possible not	0	0		0	0
TOTALS PER MODALITY	89	67	217 ^b	0	373 ^b
PERCENT PER MODALITY OF TOTAL CODABLE ^c TERMS	24%	18%	58%	0%	100%

^a Numbers within parentheses for negative modal or quasi-modal uses refer to cases which are ambiguous between two different modal values within a modality.

^b One miscellaneous case is included in these column totals, ambiguous between de re and de dicto possibility (\Diamond -p and $-\Diamond$ p).

^c Twelve cases occurred which were ambiguous across modalities, and 33 cases were either incompleting utterances or inaudible.

Table 5. Examples of modal and quasi-modal child utterances expressing the modal values of affirmative(+) and negative(-) possibility and necessity for the dynamic, deontic, and epistemic modalities^a

<u>DYNAMIC MODALITY</u> ^b		
<u>Possibility</u>		<u>Necessity</u>
(+)	I <u>can</u> wash. I can flush the toilet too.	I <u>nee...</u> , I <u>need</u> a cup. (while holding milk carton)
(-)	I <u>can't</u> reach. I'm not big enough to reach. (light switch)	I <u>don'</u> <u>need</u> it. (rejecting offer of tissue)

<u>DEONTIC MODALITY</u>		
<u>Possibility</u> (<u>Permission</u>)		<u>Necessity</u> (<u>Obligation</u>)
(+)	Now <u>could</u> I have it?	<u>Have to</u> go wash your hands! (pretend mother at dinner)
(-)	You <u>can't</u> come to my house ^c .	

<u>EPISTEMIC MODALITY</u>		
<u>Possibility</u>		<u>Necessity</u>
(+)	Sue, if you didn't want that other pretzel, I <u>would</u> eat it.	And now I turn off the light. This way, uhm, then then if this is in then, that thing in, in that will <u>have to</u> go to bed. (re: turning off plant box light; teacher has told them it makes the plants "sleep")
(-)	It <u>can't</u> fit, it won't fit on top of it.	

^a Space constraints do not allow the inclusion of all discourse and environmental context utilized in the semantic categorization of these utterances. The modal which is the focus of the example is underscored.

^b The various modalities are defined in Table 2.

^c Note for the deontic and epistemic modalities that the negative examples are ambiguous between necessary not (\square -p) and not possible ($-\diamond$ p) interpretations. Other cases are ambiguous between not necessary ($-\square$ p) and possible not (\diamond -p) interpretations, but are not included here for ease of exposition.

Table 6. Frequency distribution of modal and quasi-modal auxiliary verb uses by modal semantic category and modal value

<u>Lexical term(s)</u>	<u>Total#</u>	Semantic modality		<u>% of total #^b</u>
		<u>(modal value)^a</u>	<u>Frequency</u>	
(1) CAN	(48)	deontic permission	29	60
		epistemic possibility	6	13
		dynamic possibility	5	10
		incomplete/inaudible	5	10
		cross-modally ambiguous	3	6
(2) CAN'T	(30)	dynamic possibility	10	33
		deontic (obligated not/ not permitted)	7	23
		incomplete/inaudible	7	23
		epistemic (necessary not/ not possible)	4	13
		dynamic (necessary not)	1	3
		epistemic (not possible/ possible not)	1	3
(3) COULD	(30)	deontic permission	12	40
		epistemic possibility	9	30
		dynamic possibility	5	17
		cross-modally ambiguous	2	7
		dynamic (not possible)	1	3
		incomplete/inaudible	1	3
(4) GONNA	(124)	epistemic possibility	123	99
		incomplete/inaudible	1	1
(5) NOT GONNA	(2)	epistemic (not necessary/ possible not)	1	50
		incomplete/inaudible	1	50
(6) GOT TO	(4)	deontic obligation	2	50
		dynamic necessity	1	25
		cross-modally ambiguous	1	25
(7) HAD BETTER	(1)	dynamic necessity	1	100
(8) HAVE TO	(54)	dynamic necessity	24	44
		deontic necessity	14	26
		incomplete/inaudible	8	15
		cross-modally ambiguous	6	11
		epistemic necessity	2	4

^a Within-modality ambiguities with negation are noted by the listing of both negative modal values.

^b Total percentages per lexical term may not equal 100% due to rounding.

Table 6 (continued)

<u>Lexical term(s)</u>	<u>Total#</u>	<u>Semantic modality (modal value)</u>	<u>Frequency</u>	<u>% of total #</u>
(9) NOT HAVE TO/	(2)	deontic (obligated not/not permitted)	1	50
		incomplete/inaudible	1	50
(10) MIGHT	(1)	epistemic possibility	1	100
(11) NEED (TO)	(42)	dynamic necessity	38	90
		incomplete/inaudible	4	10
(12) DON'T NEED	(3)	dynamic (not necessary)	3	100
(13) SHOULD	(2)	epistemic necessity	1	50
		deontic permission	1	50
(14) SUPPOSED TO	(1)	epistemic necessity	1	100
(15) NOT SUPPOSED	(1)	incomplete	1	100
(16) WILL	(59)	epistemic possibility	54	92
		incomplete/inaudible	4	7
		deontic obligation	1	2
(17) WON'T	(6)	epistemic(not necessary/ possible not)	5	83
		epistemic(necessary not/ not possible)	1	17
(18) WOULD	(8)	epistemic possibility	8	100

Table 2. Four Modalities for Modal and Quasi-Modal Auxiliaries

(Note: the coding categories for the semantics of modal and quasi-modal auxiliary verbs are derived from a survey of the substantial philosophical and linguistic literature on the various modalities; sources to which we owe substantial debts are cited in the descriptions of the various categories. Table 5 provides examples of children's utterances expressing these modalities.)

Four principle modalities are distinguished: DEONTIC, DYNAMIC, EPISTEMIC, and ALETHIC, the first two subsumed under the PRAGMATIC generic modality, since they each concern the conditions of action.

DEONTIC

This modality is concerned with the possibility (permission) or necessity (obligation) of acts performed by agents, which derives from some source or cause (e.g. another agent allows permission, or obligates one; or one obligates another by command; see Lyons, 1977; von Wright, 1951, 1968; Rescher, 1966).

e.g. It is necessary that I pay my income tax by April 15th.

DYNAMIC

This modality is concerned with the logic of actions basic to deontic logic, such as whether an agent has the ability to accomplish an act (von Wright, 1963), or whether it is necessary to do X/have X to accomplish an act.

e.g. It is necessary that I use the screwdriver to open the safe.

EPISTEMIC

This modality is concerned with the logical structure of statements which assert or imply that a (set) of proposition(s) is known or believed (Hintikka, 1962; Lyons, 1977, p. 793; McCawley, 1981). The factuality of the proposition(s) for knowers/believers is at issue here.

e.g. It is necessary that Ronald Reagan is President of the United States.

ALETHIC

This modality is concerned with the truth of propositions. The distinction between necessary and possible (contingent) truth is one made in the alethic modality (Lyons, 1977; Pieraut-Le Bonniec, 1980; von Wright, 1951).

e.g. It is necessary that you are either reading or not reading this sentence.

Table 1. Modal and quasi-modal auxiliary verbs^a

<u>MODALS</u>	<u>QUASI-MODALS</u>
*can	going to/ *gonna
*cannot/*can't/can not	*not going to/ *not gonna
*could	*got to/ *gotta
could not/couldn't	don't got to/don't gotta
may	*had better
may not	had better not
must	*have to
must not	*have to not/*not have to
*need	ought to
need not/*not need	ought to not/ought not to
*might	*supposed to
might not	supposed to not/not supposed to
shall	
shall not/shan't	
*should	
should not	
*will	
will not/*won't	
*would	
would not/wouldn't	

(^a Words or phrases marked by an asterisk occurred at least once in the corpus non-imitatively)

Table 2. Four Modalities for Modal and Quasi-Modal Auxiliaries

(Note: the coding categories for the semantics of modal and quasi-modal auxiliary verbs are derived from a survey of the substantial philosophical and linguistic literature on the various modalities; sources to which we owe substantial debts are cited in the descriptions of the various categories. Table 5 provides examples of children's utterances expressing these modalities.)

Four principle modalities are distinguished: DEONTIC, DYNAMIC, EPISTEMIC, and ALETHIC, the first two subsumed under the PRAGMATIC generic modality, since they each concern the conditions of action.

DEONTIC

This modality is concerned with the possibility (permission) or necessity (obligation) of acts performed by agents, which derives from some source or cause (e.g. another agent allows permission, or obligates one; or one obligates another by command; see Lyons, 1977; von Wright, 1951, 1968; Rescher, 1966).

e.g. It is necessary that I pay my income tax by April 15th.

DYNAMIC

This modality is concerned with the logic of actions basic to deontic logic, such as whether an agent has the ability to accomplish an act (von Wright, 1963), or whether it is necessary to do X/have X to accomplish an act.

e.g. It is necessary that I use the screwdriver to open the safe.

EPISTEMIC

This modality is concerned with the logical structure of statements which assert or imply that a (set) of proposition(s) is known or believed (Hintikka, 1962; Lyons, 1977, p. 793; McCawley, 1981). The factuality of the proposition(s) for knowers/believers is at issue here.

e.g. It is necessary that Ronald Reagan is President of the United States.

ALETHIC

This modality is concerned with the truth of propositions. The distinction between necessary and possible (contingent) truth is one made in the alethic modality (Lyons, 1977; Pieraut-Le Bonniec, 1980; von Wright, 1951).

e.g. It is necessary that you are either reading or not reading this sentence.

Table 6 (continued)

<u>Lexical term(s)</u>	<u>Total#</u>	<u>Semantic modality (modal value)</u>	<u>Frequency</u>	<u>% of total #</u>
(9) NOT HAVE TO/	(2)	deontic (obligated not/not permitted)	1	50
		incomplete/inaudible	1	50
(10) MIGHT	(1)	epistemic possibility	1	100
(11) NEED (TO)	(42)	dynamic necessity	38	90
		incomplete/inaudible	4	10
(12) DON'T NEED	(3)	dynamic (not necessary)	3	100
(13) SHOULD	(2)	epistemic necessity	1	50
		deontic permission	1	50
(14) SUPPOSED TO	(1)	epistemic necessity	1	100
(15) NOT SUPPOSED	(1)	incomplete	1	100
(16) WILL	(59)	epistemic possibility	54	92
		incomplete/inaudible	4	7
		deontic obligation	1	2
(17) WON'T	(6)	epistemic(not necessary/ possible not)	5	83
		epistemic(necessary not/ not possible)	1	17
(18) WOULD	(8)	epistemic possibility	8	100

Table 6. Frequency distribution of modal and quasi-modal auxiliary verb uses by modal semantic category and modal value

Lexical term(s)	Total#	Semantic modality	Frequency	% of total # ^b
		(modal value) ^a		
(1) CAN	(48)	deontic permission	29	60
		epistemic possibility	6	13
		dynamic possibility	5	10
		incomplete/inaudible	5	10
		cross-modally ambiguous	3	6
(2) CAN'T	(30)	dynamic possibility	10	33
		deontic (obligated not/ not permitted)	7	23
		incomplete/inaudible	7	23
		epistemic (necessary not/ not possible)	4	13
		dynamic (necessary not)	1	3
		epistemic (not possible/ possible not)	1	3
(3) COULD	(30)	deontic permission	12	40
		epistemic possibility	9	30
		dynamic possibility	5	17
		cross-modally ambiguous	2	7
		dynamic (not possible)	1	3
		incomplete/inaudible	1	3
(4) GONNA	(124)	epistemic possibility	123	99
		incomplete/inaudible	1	1
(5) NOT GONNA	(2)	epistemic (not necessary/ possible not)	1	50
		incomplete/inaudible	1	50
(6) GOT TO	(4)	deontic obligation	2	50
		dynamic necessity	1	25
		cross-modally ambiguous	1	25
(7) HAD BETTER	(1)	dynamic necessity	1	100
(8) HAVE TO	(54)	dynamic necessity	24	44
		deontic necessity	14	26
		incomplete/inaudible	8	15
		cross-modally ambiguous	6	11
		epistemic necessity	2	4

^a Within-modality ambiguities with negation are noted by the listing of both negative modal values.

^b Total percentages per lexical term may not equal 100% due to rounding.

Table 5. Examples of modal and quasi-modal child utterances expressing the modal values of affirmative(+) and negative(-) possibility and necessity for the dynamic, deontic, and epistemic modalities^a

<u>DYNAMIC MODALITY</u> ^b		
<u>Possibility</u>		<u>Necessity</u>
(+)	I <u>can</u> wash. I can flush the toilet too.	I nee..., I <u>need</u> a cup. (while holding milk carton)
(-)	I <u>can't</u> reach. I'm not big enough to reach. (light switch)	I <u>don't need</u> it. (rejecting offer of tissue)

<u>DEONTIC MODALITY</u>		
<u>Possibility</u> (<u>Permission</u>)		<u>Necessity</u> (<u>Obligation</u>)
(+)	Now <u>could</u> I have it?	<u>Have to</u> go wash your hands! (pretend mother at dinner)
(-)	You <u>can't</u> come to my house ^c .	

<u>EPISTEMIC MODALITY</u>		
<u>Possibility</u>		<u>Necessity</u>
(+)	Sue, if you didn't want that other pretzel, I <u>would</u> eat it.	And now I turn off the light. This way, uhm, then then if this is in then, that thing in, in that will <u>have to</u> go to bed. (re: turning off plant box light; teacher has told them it makes the plants "sleep")
(-)	It <u>can't</u> fit, it won't fit on top of it.	

^a Space constraints do not allow the inclusion of all discourse and environmental context utilized in the semantic categorization of these utterances. The modal which is the focus of the example is underscored.

^b The various modalities are defined in Table 2.

^c Note for the deontic and epistemic modalities that the negative examples are ambiguous between necessary not (\Box -p) and not possible ($-\Diamond$ p) interpretations. Other cases are ambiguous between not necessary ($-\Box$ p) and possible not (\Diamond -p) interpretations, but are not included here for ease of exposition.

Table 4. The Frequencies of Modal Values Expressed in Preschoolers' Uses of Modals and Quasi-Modals

	<u>DYNAMIC</u>	<u>DEONTIC</u>	<u>EPISTEMIC</u>	<u>ALETHIC</u>	<u>TOTALS</u>
necessary	64	17	4	0	85
possible	10	42	201	0	253
necessary not	1			0	1
-----		(8) ^a	(5)	-----	(13) --
impossible	11			0	11
not necessary	3	0		0	3
-----			(6)	-----	(6) --
possible not	0	0		0	0
TOTALS PER MODALITY	89	67	217 ^b	0	373 ^b
PERCENT PER MODALITY OF TOTAL CODABLE ^c TERMS	24%	18%	58%	0%	100%

^a Numbers within parentheses for negative modal or quasi-modal uses refer to cases which are ambiguous between two different modal values within a modality.

^b One miscellaneous case is included in these column totals, ambiguous between de re and de dicto possibility ($\diamond -p$ and $-\diamond p$).

^c Twelve cases occurred which were ambiguous across modalities, and 33 cases were either incompleting utterances or inaudible.

Table 3. Modalities and Modal Values^a

<u>Symbolic Representation</u>	<u>DYNAMIC</u>	<u>DEONTIC</u>	<u>EPISTEMIC</u>	<u>ALETHIC</u>
$\square p$	necessary to do	obligated to do	necessary	necessary
$\diamond p$	possible to do	permitted to do	possible	possible
$\square \neg p$	necessary to not do	obligated to not do	necessary not	necessary not
$\neg \diamond p$	impossible to do	not permitted to do	impossible	impossible
$\neg \square p$	not necessary to do	not obligated to do	not necessary	not necessary
$\diamond \neg p$	possible to not do	permitted to not do	possible not	possible not

MODAL INTERDEFINABILITY: Either necessity or possibility may be treated as primitive, and the other term defined in terms of the primitive and negation. So, for necessity:

$$\square p = \neg \diamond \neg p \quad (p \text{ is necessary if and only if it is not possible that } p \text{ is not the case)}$$

and for possibility:

$$\diamond p = \neg \square \neg p \quad (p \text{ is possible if and only if it is not necessary that } p \text{ is not the case)}$$

¹The semantic categories which are common to all of the modalities in their logical form conform to a variant of the Aristotelian logical square which incorporates de re and de dicto negations, i.e., those of both narrow and wide scope (Pieraut-Le Bonniec, 1980). Traditionally, de re categories of the modalities have been neglected, but negations of different scope do have different logical status. Many natural language statements which involve scope of negation and modal value are ambiguous between two interpretations, even within a specific modality, such as "I can't go to the movie", which may mean either OBLIGATED TO NOT GO or NOT PERMITTED TO GO (de re necessity and de dicto possibility, respectively). The semantic category modal values may be symbolically represented in the same way, regardless of the modality. We have used the standard Lewis & Langford (1932) notation. KEY: " \square " = necessary; " \diamond " = possible; " \neg " = negation; "p" = any proposition.

Table 1. Modal and quasi-modal auxiliary verbs^a

<u>MODALS</u>	<u>QUASI-MODALS</u>
*can	going to/ *gonna
*cannot/*can't/can not	*not going to/ *not gonna
*could	*got to/ *gotta
could not/couldn't	don't got to/don't gotta
may	*had better
may not	had better not
must	*have to
must not	*have to not/*not have to
*need	ought to
need not/*not need	ought to not/ought not to
*might	*supposed to
might not	supposed to not/not supposed to
shall	
shall not/shan't	
*should	
should not	
*will	
will not/*won't	
*would	
would not/wouldn't	

^a Words or phrases marked by an asterisk occurred at least once in the corpus non-imitatively)