

FORMALIZATION OF THE QUESTION-ANSWER RELATION  
(LOCATIVE QUESTIONS TO VERBS OF MOTION)

E. V. Rakhilina

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Intelligent information systems of the future are expected to conduct dialogs with the user in a natural language. The linguistic aspect of this problem rests primarily on the formalization of the question-answer relation, i.e., on formalizing the procedure generating a response to a query.

INTRODUCTORY NOTES

This study is concerned with locative questions to the verbs of motion in Russian. It proceeds from the theoretical model of question-answer relation suggested in [1,2]. The model is based on a logicosemantic representation of the question. Question with query words (or special questions) in locative semantics are treated as a request by the questioner addressed to the respondent and described by the formula:  $\lambda X \langle (X|X \in M) P(X) \rangle$  - "Do so that I know the value of a certain variable X selected from the set M of its values (this set actually defines the locative semantics of the variable) such that for that this value of the variable the statement P(X) holds," where P is the predicate within the semantic sphere of the action of the query word. The construction of a correct answer to the question, "Where did you get your law degree?" assumes, first, identifying the predicate group which falls within the sphere of action of the query word "where" (getting a law degree); second, identifying in the semantic structure of this group a variable of locative semantics (Y received a degree at X, where I is a locative variable); third, identifying the set of values of this variable (names of schools granting law degrees); and fourth, selecting from this set an element that satisfies the condition "listener obtained a law degree at X."

It can readily be seen that the key component of the procedure constructing an answer to a question is the search for the query variable, i.e., the variable linked with the query operator "?" (do so that I know). This procedure is nontrivial, as it is applicable only to a detailed description of the predicate lexeme (which is much more detailed than is common in lexicography): for example, such a description should cover not only all of the obligatory actants, but also at least some of the circumstants of the predicate. The procedure is entirely nontrivial for the verbs of motion, which describe situations where a body (or bodies, in situations with more than one participant) can have several different localizations represented by different locative variables in the semantic description of the verb. In each particular question, only one locative variable can be interrogative, i.e., linked by a query operator, but depending on which variable has this function, different query words are selected in the surface expression of the question in the natural - Russian - language.

This study is concerned with locative questions to verbs of motion, i.e.,

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verbs whose semantic representations include this semantic component: "cease to be at a certain place by means of a movement" and/or "begin to be present at a certain place by means of a movement" (compare a different, narrower interpretation of the term of "verbs of motion" in [3]). (For example, come, leave, fall, throw, drag, etc.)\*

The objective is to define the types of semantic variables which can become interrogative in questions including words "where," "where to," and "where from."

## 1. CLASSIFICATION OF THE VERBS OF MOTION

Before discussing the rules of construction of answers to questions of locative semantics with verbs of motion, a classification of these verbs must be constructed. One such possible classification is suggested below: this classification is constructed with the use of semantic and syntactic characteristics of the verbs of motion in general; on the other hand, it has a practical purpose - explaining the pattern of behavior of a verb in the context of "locative" questions. For this reason we decided not to represent the results of classification as interpretations of the verbs of motion, although the characteristics of the verbs determined by this classification are essential for their correct functioning in the language and must affect their interpretations. The goals of the present description, however, do not necessarily require explications of lexicographic data; that is a subject for a separate study.

In his amply cited work, Fillmore [4] proposed classifying verbs of motion according to their relation to time modifiers. He proceeded from the fact that for certain verbs, time modifiers indicate the beginning of a movement ("He left on Tuesday") for others the end of a movement ("He arrived in Chicago around midnight"), and for still others, the time of the movement ("He walked all day and all night\*\*"). Accordingly, the verbs of motion of the first type are called source-oriented, i.e., oriented at the starting point of the movement, denoted by Q; the verbs of the second type are called goal-oriented, i.e., oriented at the destination of the movement, denoted by R, and the verbs of the third type are called neutral.

Fillmore formulated the semantic principles distinguishing just two English verbs, go and come. For a continuous classification of verbs of motion according to such features, however, one would need a reliable diagnostic context with the same time modifier for all verbs. When-questions offer a better diagnostic context than Fillmore's time modifiers. These questions can refer to the time of the beginning of a movement (When did he go? When did he leave? When did it fall? When did he relinquish it?\*\*\*, etc.) if they correspond to a move-away verb, i.e., a verb interpreted with a semantic component "to cease being at Q." If the question refers to a verb of arrival, i.e., a verb whose interpretations

\*It may seem that this definition would not include verbs such as walk, drive, swim, etc. In reality, a semantic representation of these verbs should include the information about the point of departure and the destination of the movement concerned. See below for more details.

\*\*Fillmore's own illustration of this type - "He sailed from Vancouver to Hawaii last summer" - is an infelicitous example as it indicates the time of the event rather than the time of movement (see also the next footnote).

\*\*\*Some of these instances refer to the time of leaving Q, rather than the time of beginning of movement: instead of "When did the movement from Q start?", the question is "When did the subject cease to be at Q?" Compare "When did he move out?" with "When did he pull out?" These and other questions describe movements which begin before their subject ceases to be at Q.

include "to begin to be at R," it is perceived as a question about the time of arrival at R: When did he enter? When did he come? When did he put? When did he move? When did he bring? etc.

The when-questions with the verbs of motion such as drive, swing, run, fly, crawl, and others which, according to Fillmore, belong to the neutral group are interpreted as questions about the duration of the process of movement: "From what time point  $t_1$  till what time point  $t_2$  the action P took place."\*

Remark. For the so-called purely aspective word in Russian, the form of the perfect aspect should be used in diagnostic contexts; the verbs which do not have a purely aspective pair (which includes verbs of motion) are placed into the diagnostic context in the imperfective aspect: "When did he travel?" The corresponding prefixed Russian forms of the perfective form (poekhat' [to begin to drive], poletet' [to begin to fly], poplyt' [to begin to swim], etc.) belong to the group of move-away verbs ("to cease being present"). Compare [3,5, pp. 319] and the following.

The diagnostic context with when identifies an additional large group of verbs not covered by Fillmore's classification: come out, bring out, carry out, drop, jump<sub>1</sub> (= "jump somewhere"), fall<sub>1</sub> (= "from somewhere"), etc. When used in a when-question context with unfilled destination valency, they behave like move-away verbs: When did he leave? = "At what time did he cease to be present at Q?"; When did he drop it? = "At what time t did he let it slip out of hand?" etc. If the destination valency is filled, the question receives a different interpretation: When did the crowd go out into the square? = "At what time t did the crowd begin to be present in the square?" When did he fall on the ground? = "At what time t did he begin to be present on the ground?"\*\*

For each group of verbs, a diagnostic context indicates the local semantic valency which is strong and mandatory. The move-away verbs are verbs with a strong strong Q, while the arrival verbs must have R. In interpretations of the verbs of the latter group (such as "go out"), both valencies appear to be obligatory - Q and R.\*\*\* In Fillmore's terminology, these verbs should be defined as Q-oriented. Neutral motion verbs, on the contrary, are not oriented at either point; the variables Q and R are not obligatory for them.

With respect to the "strength" of the obligatory valencies, which can be expressed by the syntactic structure of the interpretation, the verbs of this group seem to stand closer to move-away verbs. For example, when Q and R are

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\*An additional interpretation is possible which would indicate the time segment (in standard absolute units such as year, week, day, hour, etc.) which includes the period  $t_1-t_0$  when the movement p took place: (1) "When was the last time you walked to work?" - "Thirty years ago." Similar interpretations are possible for other verbs of motion as well; (2) "When did they move?" - "Yesterday." (3) "When did he bring the book home?" - "Two weeks ago." In all these examples, the period indicated includes the beginning and the end of the movement.

\*\*If both the point Q and the point R are expressed by a verb, two interpretations are possible: "He went out of the room into the kitchen" and "When did he jump down from the roof onto the ledge of the second floor window? = "When did he cease to be present on the roof?" or "When did he begin to be present on the window ledge?" A simultaneous expression of these two valencies especially in an interrogative sentence is difficult and examples of this kind may seem contrived.

\*\*\*Compare [6, p.-262], where the possibility of trivalent description of the verb go out is considered; compare also observations in [7, p. 11].

not expressed, a when-question is still perceived as a question of the time of leaving Q. When substituted into a diagnostic context of the imperfective aspect of these verbs (durative value) - When was he leaving?; When did he drop it? - the question is also perceived as one about moving away or separation.

The main difference inside the group of the verbs of motion thus consists in the opposition of the arrival verbs (those whose interpretations contain the meaning "to begin to be present at R as a result of movement...") and the move-away verbs (i.e., those containing in their interpretations the meaning "to cease to be present at Q as a result of movement...").\* An independent group, distinct from either of the above, is formed by the verbs of "pure movement," such as walk, crawl, fly, etc.; their definitions include Q and R as optional units, i.e., in principle, the meaning of these verbs can be described without these variables, although they can be expressed for the "pure movement" verbs as well as for any other verbs of motion.

Remark. Apresyan in [9] suggests introducing for the Russian verb *ekhat'* [to travel] the valency of purpose (in our terminology, the valency of destination) R, which is obligatory since, first, Russian has a different verb for traveling without a purpose: *katat'sya* [to go on a pleasure ride], and, second, only persons purposefully deciding on a route of travel can *ekhat'* [travel]; otherwise, the expression would be *vezut* [to be transported (compare the subtle observation by Apresyan: it is impossible to say in Russian \**drova edut* [firewood is riding] one can only say *drova vezut* [firewood is being transported]). These correct observations could be given a different interpretation under which the verb *ikhat'*, with its semantic and syntactic properties and the general definition structure would be, in principle, similar to other verbs of the same group *idti* [walk], *plyt'* [swim], *letet'* [fly], and so forth. Note that the subject of *ekhat'* can be any wheeled vehicle such as a carriage, car, plane (on the runway), etc.; compare *brichka neuklyuzhe ekhala po doroge* [The buggy was clumsily driving down the road]. Under Apresyan's interpretation, we would have to assume a metaphoric transfer of purpose: it is the purpose of the passenger (if one exists) rather than of the subject of the sentence (as in "John is driving") that becomes the goal of the movement, i.e., the purpose is imposed by the pragmatics of the situation. Conversely, we could assume that the obligatory purpose, arising only in a context with an animate subject, is a consequence of the general (pragmatic) fact that when a vehicle is used by an individual, the latter must have a goal.

Arrival verbs and move-away verbs can be classified according to whether the second variable is obligatory (Q for the arrival verbs and R for the move-away verbs, respectively). This feature takes three values: "the variable in the definition is obligatory"; "the variable is not obligatory but possible" (optional); and the "variable does not appear in the definition." Accordingly, these subgroups can be identified in each of the (arrival and move-away) groups of verbs.

## I. Arrival Verbs

(a) Verbs describing the situation where the arrival at R is a consequence of moving away from Q; the definition of such verbs, in addition to the variable R, must include the variable Q.

\*Compare, in particular, the definitions of the verbs to fly in and to fly out in [6, p. 288]: to fly into A - by flying to begin, to be present, inside A; to fly out of A - to cease to be present inside A by flying; compare, also, the dictionary entry of the verbs go, leave, and others [8, p. 192]: "to cease to be present at a certain location by moving typically on foot."

The subgroup (a) includes the verbs to put down, to sink, to stand up, etc.

Compare: Z put down Y in (on) R ≈ "<individual> Z caused <object> Y which was present in the hands of Z(Q) to begin to be present in/on R (depending on whether R is a vessel or a surface) by means of movement."

For the verb to put down (as well as all the other verbs of this subgroup), the variable Q is an obligatory component of an interpretation but is not expressed at the surface level, i.e., in the proposition. This additional feature associated with the fixed quality of the variable will be discussed later.

(b) Verbs for which it is possible, but not mandatory, to specify the point of departure. This may be reflected in the definition, in particular, in order to distinguish the verbs of this group from group (c).

The group (b) contains the verbs such as come, arrive, run up to, bring, deliver, etc.

Compare: Z came to R (from Q) ≈ "Z by walking (and probably by ceasing to be present at Q) began to be present at R."

(c) Verbs for which it is impossible to specify the point of departure of the movement and whose definitions do not include the variable Q.

These are verbs such as to converge, to approach, to drive up to, and others.

Compare: Z converged at R (for P) ≈ "The group of persons Z, by moving from different directions, began to be present simultaneously at the location R (possibly with the purpose P)."

## II. Move-Away Verbs

(a) Verbs which describe the situation where, as a result of leaving Q, and subsequently moving, a body begins to be present at R. The definitions of such verbs always contain two variables: Q and R.

Examples include the verbs such as step aside, bring off, pull out (R is fixed), and others.

Compare: Z carried Y from Q to R ≈ "<person> Z by carrying <the object> Y caused Y to cease to be present at Q and to begin to be present at R."

(b) The verbs with definitions indicating the possibility but not obligation of specifying R.

These are verbs such as to leave, to lead away, to carry away, etc.

Compare: Z left Q (for R) ≈ "Z by walking ceased to be present at Q (and possibly began to be present at R)."

(c) The verbs whose definitions did not include R.

Examples are the verbs move apart, bring apart, move away, etc.

Compare: Z moved away from Q ≈ "Z by moving gradually ceased to be present at Q."

## 2. THE GENERAL RULE OF CONSTRUCTION OF LOCATIVE QUESTIONS VERBS WITH A FIXED ACTANT

The general rule of behavior of the verbs of motion in the context of local questions (see below for exceptions to this rule) is that if the definition of a verb includes the variable R, the verb allows a when-question (in that case, the answer would be to specify the value of the variable R).

Compare: (1) "Where did you put my shawl?" the Owl asked. "Was it a shawl? We did dump an old rug on the heap..." (2) "We received an order to start re-treating eight hours from now." "Where to?" "To Lyubavin Heights. We are supposed to dig in there and wait for support."

The relationship of wherefrom-questions and the variable Q is similar.

The inverse, however, is not true: whereto- and where-from questions can be forbidden, not only by the absence of a variable in a definition, but by other factors: in particular, a variable in a definition can be fixed by the verb's meaning, and then the starting point or the destination of movement is known beforehand. (This can also apply to obligatory variables of a definition, i.e., to the actants of the verb.) Examples of verbs with a fixed actant are to put down, to lean to, to seat, to sit down, to take out, to produce, etc. The point of departure of the movement in the situation with to put down is defined: the object is always in the hands of the person causing the movement; conversely, for the verbs to take out or pull out, it is the end point of the movement which is known in advance\*.

Remark. For the arrival verbs, such as to put down, to set, to lean upon, the information of the location is in the presumption of the definition. Compare: he has not put it down implies that the person is still holding the object in his hands. (The sentence of the type "Put the toys in place, why are you scattering them all over the room?" should be interpreted as "take the toys and put them in place.") Compare also the verbs *shkodit'* [to go and return] and *sbehat'* [to run and return]; the presumptions of these verbs include the information that before the movement the subject was at an exactly fixed location Q, such as at home. Compare: *Za tri chasa tak i ne skhodil v magazin* [in three hours he still hasn't made the trip to the store]: this means that during the three hours the subject remained in the same place Q known to the speaker.

As was to be expected, it is impossible to ask whereto- and wherefrom-questions in case of fixed R and Q: "\*from where did he lean? \*where to did he take it out? \*where from did he sit down?"; and \*otkuda sbehat' [wherefrom did he run (to a place) and returned?], and other similar situations.

## 3. INFORMATION ABOUT THE POSITION OF THE OBSERVER

The situation is more complicated with the verbs to go away, to go apart, to step aside, to subside, to come up, to run into, to carry into, to bring into, to barge in, etc. In contrast to the verbs of the putdown-takeout type, where R and Q are defined in advance and cannot have a surface expression with the corre-

\*Lexicographically, it is more convenient to describe Q and R as constants; for each verb their values are defined once for all occasions: compare the verbs to put down, to take out, for which the object at a certain point in the action being described is always in the hands of the person taking it out or putting it down. Yet, in terms of the extralinguistic situation, the actants Q and R are variables, since the causators of the situations and, therefore, the locations of the objects may vary.

sponding verbs (\*put down from the pocket, from the hands; \*take out onto the table, into the hands). The starting point of the movement can be indicated here and can easily be varied: went out of the house, stepped aside from the counter, etc. Yet, the corresponding interrogative sentences with these verbs are unacceptable, \*compare \*where did he leave from? \*where did he run into? where did he come up to? etc. (See also examples in [4, p. 223].)

This phenomenon can be explained by taking into account the place of the speaker or the observer in the situation of movement.\*\* The speaker is either present, or mentally places himself, at the point of departure or destination. The position of the observer presents lexicographic information of a special type; it should be included in the semantic description of a verb. Compare the following fragment of the entries for go, leave, etc., in the English-Russian dictionary of synonyms [8]: go, unlike other synonyms of its series, denotes movement on foot, where the speaker imagines himself or the observer present at the location from which the subject is departing" [8, p. 192]. Semantic information on the location of the speaker (or observer) with these verbs should be included in the presumptive component of the definition. The use by the speaker of this "deictic" predicate (regardless of whether the context is affirmative, negative, or interrogative) assumes that the speaker relates the situation of movement to his own location. This implies in particular that in the situation of the question, this point of the movement path (departure or destination); there is no set of choices and, therefore, the question cannot be perceived as one about the observer's location. Assuming that the speaker does not know the information he requests, the question should be combined with predicates containing no such presupposition. Compare: Where did he run to? with \*Where did he come into?

Remark. This refers to interpretations of dialogs with standard semantics [11,12]. In dialogs of nonstandard semantics, the questions Where did he leave from? Where has he come? may be acceptable.

First, they can be perceived as test questions which differ from those in that the questioner knows the answer; compare the example in [12, p. 103]: What three aggregate states of matter do you know?, where the very form of the question indicates that it is a test question (if the speaker knows that there are three aggregate states he is likely to know these states). The questions to verbs of motion, where the speaker is located (or imagines himself to be located) at a point along the path of movement about which the locative question is asked, can also be interpreted as a test question, because the speaker always knows the answer in advance. For example, the question Where did Napoleon retreat from after receiving the ultimatum? can apparently be asked only to test whether the listener knows the answer (already known to the speaker); otherwise, the very use of the word to retreat would be incorrect, if the speaker did not really know the location Q and would then be likely to ask Where was Napoleon at the time he received the ultimatum?

In addition, questions to variables of this type, can be used in the situation of a failed-communication dialog. Compare: "Aunt Polly! I have already come!" with "Who has come? Where has he come? I don't understand anything!"\*\*\*

\*Certain special contexts of such questions, where they acquire nonstandard semantics, for example, when used for tests, are an exception (see below).

\*\*For more details on the notion of the observer, see works by Apresyan, e.g., [9,10]; compare also [6].

\*\*\*An analysis of the linguistic specifics of responses of this class has been given in [13]; it was indicated that such replies respond to the modus, rather than the dictum of the question; compare also [14].

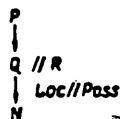
The wherefrom- and whereto- questions can be referred to a verb of motion at least in those cases where:

- 1) Its definition has semantic variables corresponding to the starting point or the destination Q and R;
  - 2) The Q or R point is not rigidly fixed and given priority in the definition and
  - 3) The Q or R point does not coincide with the observer's location.
4. A SPECIAL CASE OF SYNONYMY OF LOCATIVE QUESTIONS

The where-questions are sometimes synonymous with whereto- and wherefrom-questions. Does this mean that the query variable in a question Where P(X)? can fill the same locative valencies of the predicate P as in Whereto P(X)? and Where from P(X)? questions, i.e., does this mean that the query operator can link the variables R and Q also in the context of the interrogative word where?

Consider interrogative sentences: Where did the Tunguska meteorite fall? Where did you hang your coat? (- on the rack, on the first floor); Where did he put the money? (- on the table, near the candy bowl). The answers to such questions give information concerning the destination point, i.e., R. On the other hand, the questions such as Where did you have your tooth pulled? (- right here, to the right), Where did you put out this huge fish? (- in the black hole, behind the swamp) information about the point of departure Q is expected.

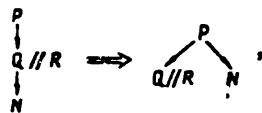
Note that the respondent does not always specify the departure or destination point but, rather, its general location, or the space where it is situated. If a fragment of the dependency tree is constructed, the query variable in the tree will appear not at the nodes Q and R corresponding to the arguments of the predicate P, but at the nodes associated with the predicate in an indirect way, i.e., linked with Q or R by a locative or possessive relation\*:



For this reason, the question-answer pairs with where-questions may be inadequate when the answer can be interpreted merely as designation of Q or R, i.e., an indication of the point of departure or destination rather than the position of this point. Compare:

- \*"Where did he put the money?"
- "In the pocket (in the hand, in the tree hole)"
- \*"Where did he hang it up?"

\*In some situations this valency can be split, e.g.,



Compare: Hung up his coat on the rack in the hallway.



"On a hook, on a nail."

Remark. Remarkably, the syntactic properties of the variables Q and R, on the one hand, and N, on the other, are different when used to indicate the beginning or the end of a movement. In the structure with dative possessive, only Q (or R) can be filled, while N cannot be filled (if Q or R are omitted). Compare: "hung it up on his neck" - *povesil emu na shevu* - accusative case/\**povesil emu na shee* [locative case]; in possessive structures with the preposition *u* [at] and a noun in the genitive case, to the contrary, only N is allowed, among the two possible ways of indicating the beginning or the end of a movement - N vs. Q and R: "put it down in his room on the bed" [*na krovati* - locative case] (\**polozhil u nego na krovat'* [accusative case].\*

The where-questions that are quasi-synonymous with wherefrom- and whereto-questions do not accept all verbs which have the variables Q and R in their structures. Compare: *Kuda zashel?* [Where did he stop by?], but \**Gde zashel?* [Where did he stop?]; *Kuda prines?* [Where did he bring it?], but \**Gde prines?*; *Otkuda ubezhal?* [Where did he escape from?], but \**Gde ubezhal?*. A special place among the verbs of motion is assigned to those which denote not merely the arrival (or causation of arrival) at a certain point R but the arrival with the purpose (normally) of a prolonged stay at that point. These could be defined as the verbs of "prolonged result": to sit down, to lie down, to plant, to lay down, to lean, to insert, to stand (on something), and similar verbs. The meaning of these verbs can be described as follows: "to move with the purpose of staying at R for a certain <prolonged> period and to begin to be present at R," as different from the verbs such as stop by, pass by, step in, come up, etc., which do not imply a long stay of the subject of movement at the endpoint R.

The situation with the verbs admitting wherefrom-questions is similar. If the semantic representation of the verb contains the information that the subject of movement remained at Q for a long time before beginning the movement, the where-question can be understood as a question about the location of Q. Compare verbs such as to pull out, to draw out, to take out, to produce, to move out, to retreat (military term), etc., as distinguished from to go away and to move away, which do not allow a similar understanding of a where-question.

## 5. QUESTIONS OF THE DIRECTION OF MOVEMENT

Some of the verbs of movement allow the direction of movement from or toward a certain point to be designated: approached from the direction of the railroad station; walked straight to the street car stop, etc. If a whereto- or wherefrom-question contains such a verb, the answer must specify not the points of the path - R and Q - but the direction of the movement toward or from a certain point: "Where are they advancing from?" "From the south"; "Where are you swimming to?" "Toward the shore," etc. The mark can be either the starting point or the endpoint of the movement or an intermediate point. If the intermediate point is specified, the initial (or end) point of the movement can no longer be indicated with the verb: \**came from the direction of the woods to the city*; \**went toward the woods (in the direction of the woods) from the city*.

\*Compare also the opposition of possessors for R and N in terms of animate/inanimate nouns, as in the following example: *polozhil tsvety poetu na koleni* [put the flowers in the poet's lap] (R), where the possessor for R can only be an animate object, versus *polozhil tsvety u poeta na kolenyakh* [locative case] (N), where the possessor of N can only be an inanimate object (i.e., the poet in this case must be interpreted as, for example, "the statue of the poet"). A comparative analysis of these structures has been given in [15].

It is not with all verbs that the direction of the movement can be specified: \*emerged in the direction of the river; \*entered from the direction of the market, etc. The verbs of movement - to walk, to drive, to swim, etc. - are preferred in this respect; the direction of the movement of the object can always be specified with these verbs. Noteworthy, only the direction R, i.e., the destination, can be indicated for verbs of causation of movement, such as to lead, to bring, to transport, etc., i.e., the direction toward which the movement occurs rather than the direction from Q (from which the movement occurs): he led him in the direction of the forest, but not \*he led him from the direction of the forest. With respect to the group of the verbs of motion in general, it seems desirable to introduce special optional semantic variables for the modeling of dialogs with whereto- and wherefrom-questions including these verbs; these variables could then be replaced by the query variable in wherefrom- and whereto-questions.\*

#### 6. SEMANTIC VARIABLE OF ENTRY-EXIT FROM A CLOSED SPACE

Some of the verbs of motion describe situations where Q and/or R is a closed space. The space has entrance (and exit) through which lies the path of the movement. The point of exit/entry of a closed space will be denoted by L. Different from Q and R, it is not identified in all situations of movement, although we believe it to be essential for constructing the semantic representations of many of the verbs of motion.\*\* There are verbs, for example, in which the path of the movement always lies through the point L. Compare pour out, to be poured out (the movement from a closed space), and to enter (movement into a closed space). In other instances, the closed space is not necessary but possible. Compare to throw into a basket - to throw onto a block; to throw out of the car - to throw down from the roof.

Our purpose was to determine: (1) whether the semantic variable L can become a query variable; and (2) what the form of the question should be in that case.

We found that the variable L can be interrogative. The question "Where did he throw the ball?" allows, along with answers such as "onto the roof" and "into the basket," also answers such as "out the window." The question "Where are these roaches crawling from?" can equally be answered with "from the basement" and "from cracks under the sink." Remarkably, the antonymic questions in these question-answer pairs - the whereto- and wherefrom-questions - can be asked about the same point of the path if it is the point L. In reality, there is no contradiction. According to the classification of [6, p. 298], whereto- and wherefrom-questions refer to spatial antonyms; for their description (as well as for the description of space prepositions and adverbs such as behind, beyond, ahead, in front of) a reference to the observer should apparently be used (see above), i.e., a participant of the situation should be introduced into the semantic representation, which in most cases is identical with the speaker, or with the questioner in case of an interrogative sentence.

\*Remarkably, Bulgarian has a special query word for questions about the direction: na k'de, compare Na k'de, pluva korab't? - "What is the direction of the movement of the ship?", as different from K'de pluva korab't? - "Where is the ship sailing to?" (i.e., "What is the destination of the movement of the ship?").

\*\*Compare, however, the study by Vsevolodova and Vladimirskiy, who describe the combinabilities of nouns with various classes of verbs (including the verbs of motion) and identify, in particular, "the meanings of openings, such as door, gate, window, turnstile, vent, breakthrough, etc." and also "the meanings of natural (and artificial) devices and through openings, such as hole, pipe, gill, slot, funnel, and fan" [16, p. 126].

Indeed, the question "Where did he emerge from?" in case the expected answer concerns L is the question asked by the speaker positioned outside the closed space Q. The question "Where did he exit?" is a question by a speaker situated inside the closed space. Similarly, the following dialog is a correct question-answer pair only if the speaker is outside a closed space: "Where did they throw it out of?" "From a window." If the speaker is inside a closed space, the question should be "Where did they throw it out?" and the answer would be "Out the window."

The verb "to throw," however, has a different structure than the verb "to exit." The closed space in this case can be either the starting point of the movement (Q) or the point of destination (R). With respect to the latter closed space (R), the observer can only be outside; compare the correct dialog for the following situation: "Where did they throw the rock?" "At the window." The observer cannot be inside the closed space. Imagine this situation: the speaker is in a room when a rock thrown from the street flies in through a window. He asks: "Where did they throw the rock from?" Linguistic intuition suggests that this would not be the question asked by a person who wants to know which of the openings in the wall the rock arrived through (balcony door, window, etc.). The following question-answer pair is obviously inadmissible in this situation: "Where did they throw the rock from?" "From the window." This pair will only be correct if the window is an exit from the closed space which is the point of departure of the movement and the speaker is located outside Q.

Assuming that this representation of the verbs of motion is correct, one should expect them to be capable of differentiation according to the observer's location and, therefore, according to the type of locative questions concerning L that may be asked (wherefrom- and whereto-questions).

We can illustrate this by several verbs of motion:

1. Movement into a closed space. The observer may be either outside or inside, i.e., on either side of L. These are verbs such as enter, run in, crawl in, etc. They allow whereto- and wherefrom-questions with L answers.
2. Movement into a closed space. The observer can be only outside. Verbs: crawl through, climb through, stick in, etc. Only whereto-questions are allowed.
3. Movement from a closed space. The observer can be on either side of L. Examples: crawl out, walk out, stick out, let out, etc. Whereto- and wherefrom-questions are possible.
4. Two closed spaces - Q and R - are possible and, therefore, two entry/exit points ( $L_1$  and  $L_2$ ). With respect to the first such point, the observer can be on either side - inside the closed space Q and outside it; with respect to the second point he can only be outside the closed space R. Examples of verbs: throw, fling, throw out. Whereto- and wherefrom-questions concerning  $L_1$  are possible but only whereto-questions can be asked about  $L_2$ .

The information about the position of the observer is apparently so important for verbs of this group that it has to be represented in the definition in some form. The notion of the movement will be incomplete if no indication of the point of view with respect to which the situation takes place is indicated among the other characteristics of the situation. Certain verbs of similar semantics are different precisely with respect to the observer's position. The only formal consequence of this difference is their unequal combinabilities with whereto- and wherefrom-questions. Unless the observer is included in the definition, certain prohibitions of locative questions would be difficult to describe.

For example, the verbs to flow out and to trickle out, in addition to the obvious differences in the mode of movement of the liquid, differ also in that the verb to trickle describes a situation where the observer can only be between Q and R - a constraint which is not imposed on the verb to flow out. In the following question-answer pair - "Where did the oil flow out?" "Through the crack in the bottom of the barrel." - it is impossible to substitute "trickle out" for "flow out" (assuming that the answer specifies L, which is part of Q).

The variable L can be replaced by a query variable also in where-questions. This is only possible if L is an obligatory variable in a definition, i.e., when the movement described by the verb always occurs through an orifice in a closed space. Compare "Where did he crawl through?" ("Where does it spill out," "flow out" ...), but "Where did he throw it out?" "\*out the window"; "Where did he drop it?" "\*through a crack." (See below concerning where-questions.)

The information about L can thus be obtained as an answer to any of the three "locative questions" for the same verb in some cases (namely, if the definition of this verb includes L as the obligatory semantic variable and the observer may be on either side of L): where, whereto, and wherefrom; compare "Where does the oil pour out?" "Where does the oil pour out to?" and "Where does the oil pour out from?"

## 7. PATHS OF MOVEMENT

The path of movement (T) is a semantic variable of verbs whose definitions include Q and R as optional variables, i.e., the verbs of locomotion (to walk, to crawl, to fly, to swim, etc.; compare to walk through the woods, to fly through clouds, to crawl between shell holes, etc.). No such combinations are allowed with verbs of motion of other type (see the classification in the opening section; compare \*came up/\*went away/\*came...through the woods, \*crawled up/\*crawled away/\*crawled off... between shell holes, \*flew up/\*flew away ... through the clouds. The actant T\* represents the path of movement of the subject; if the locomotion verb is causative (such as to drive, to drag) then T denotes the path traced by the causator of the movement: to drag through the woods is understood only as a contact causation; the causator moved through the woods together with the object of causation (compare to drag on one's shoulders) but not as distant causation (compare to drag from a swamp).

The query operator can link the variable T in where-questions; compare

"<The scouts stood around bent over a map.>

"Where did he walk through?"

"Probably through the woods and then along the ravine."

Compare also the questions "Where P(X)?" concerning the path of movement with verbs of contact causation - "Where did he drag?" "Where did he cart?" etc. In case of a distant causation, one cannot ask about the path of the movement of the object in a where-question. Compare:

\*"Where did he drag?"

"Across the river."

\*For the rationale for including this variable among the actants of the verb, see also [6, p. 126 ff.] and [17, pp. 2-73].

The position of an immobile causator in such contexts should be represented by a separate variable (denoted by K); it can become a query variable in wherefrom-questions; compare "wherefrom did he drag?" "wherefrom did he pull?", etc.

Remark. From the point of view of the movement of a body, the path is not the entire set of points of a trajectory but a series of isolated points pertinent to the description of the path of movement, including obstacles along this path. In this sense, specifying the entry/exit for a closed space (L) makes up part of a description of the path of movement, so that, generally, instead of two variables T and L, which are mutually exclusive (arrival and move-away verbs can contain only L, while locomotion verbs only T), a common variable could be introduced and connected with the query operator in a where-question.

## 8. CONCLUSIONS

The following semantic variables are differentiated in the semantic structure of a verb:

- 1) the point of departure (Q);
- 2) the endpoint of movement (R);
- 3) the direction of movement ( $H_1$  - movement away from Q;  $H_2$  - movement toward R);
- 4) the entry/exit point of a closed space (L);
- 5) the set of points forming the path of the movement (T);
- 6) the location of the immobile causator of movement (K);
- 7) a region of the space which includes the point of departure or the endpoint (N).

All these variables may become query variables, i.e., be connected with a query operator. The choice of a lexeme for each such variable yields an answer to a where-question (L, T, N), whereto-question (K,  $H_2$ , L), and wherefrom-question (Q,  $H_1$ , L, K).

With respect to where-questions, the verbs of motion allow all types of answers admissible with a broader category of verbs in addition to the above types of answers (specific for the verbs of motion). These are so-called partitive, circumstantial, and correlative-temporal answers.

Remark. "Nonlocal" usages of whereto- and wherefrom-questions with verbs of motion are outside the scope of this study. One common case is whereto-questions calling for an answer indicating the purpose of the movement: "Where are you going, Thomas?" "I'm going to mow the lawn."

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