Towards an Optimality-Theoretic model of sense choice: The case of polysemous *gir-* 'enter' in Turkish

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1. Introduction

Polysemy can be roughly defined as having different but related senses. A polysemous verb corresponds to a wide set of senses that is the combination of properties including the exact, prototypical sense and non-prototypical senses which are weaker than the prototype sense. If a verb is associated with a set of senses, the way of telling which sense is chosen in a particular context is to determine the constraints in the frame of Optimality Theory (Prince & Smolensky 1991, 1993). Optimality Theory is a theory in which linguistic objects like pronunciations, syntactic structures and interpretations can compete with each other in how good they satisfy a system of ranked constraints. The object that best satisfies the constraints wins the competition, and it is the optimal outcome. Thus, for polysemy, the way of choosing the optimal sense from the candidates is to determine the constraints and to evaluate senses by means of the constraints (Zwart 2004). There are two kinds of constraints: *Faithfulness Constraints* and *Markedness Constraints*. Faithfulness Constraints require that input and output forms are identical. Violation of Faithfulness Constraints causes the difference between the input and the output (Blutner, Hoop & Hendriks 2005: 8). Markedness Constraints require that outputs are unmarked or simplified in the structure. Since constraints express the general statements related to the language, markedness is encoded with constraints and violation of constraints.

One of the most effective methods for determining the relatedness among the senses of polysemous words is to refer to the judgments of native speakers of a language (Caramazza & Grober 1976, Durkin & Manning 1989, Panman 1982). Following this view, a claim can be made: The native speakers' judgments can be referred to in order to determine the constraints for evaluating the senses of polysemous verbs. In this sense, in order to determine the constraints in Optimality Theory, the Classification Questionnaire was prepared following Jorgensen (1990) and implemented to the native speakers for the first time for Turkish. In this questionnaire, the subjects determined the criteria while grouping the senses of the polysemous verbs according to their similarities or differences. These criteria are the basis for determining the constraints. The questionnaire, the process and the results are given in the next section.

The main aim of this study is to define the concept of polysemy in Turkish and to determine which sense of a polysemous verb is used in which situation through the representation of the conceptual structures of 50 polysemous verbs. The verb *gir-* 'enter' with over 15 definition lines in Turkish Dictionaries (Türkçe Sözlük, TDK 2005; Türkçe

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Sözlük, Dil Derneği 2005) is considered as a representative verb for polysemous verbs in Turkish.

2. Method

2.1. The Classification Questionnaire

2.1.1. Subjects

12 undergraduate students and 5 graduate students from Mersin University, Department of English Linguistics were participated in the Classification Questionnaire. 13 out of 17 subjects were female and 4 were male. However, since 1 of the subjects completed only half of the questionnaire and 1 of them did not complete the questionnaire, the classifications of 15 subjects (12 females and 3 males) were evaluated.

2.1.2. Material

In the questionnaire, 50 polysemous bare verbs were used. The senses of polysemous verbs were determined according to the meaning lines which remained after eliminating the complex predicates (i.e. incorporation, light verb constructions), idioms and metaphors. Accordingly, 50 verbs having 7 and more meaning lines were used in the Classification Questionnaire.

2.1.3. Questionnaire form

In the questionnaire form, the senses of each verb were exemplified by simple sentences. Special attention was taken to the sample sentences for reflecting the example sentences in Turkish Dictionaries (Türkçe Sözlük, TDK 2005; Türkçe Sözlük, Dil Derneği 2005). The subjects were asked to classify the example sentences according to meaning or usage similarity of the underlined verb in the sentence. They were asked not to consider morphological properties since they had to examine the senses of the verbs according to similarities or differences while grouping the senses of verbs. They were asked to write the criteria or strategies which they used while grouping the senses and they were also asked to write a definition for each group they made. Besides, the subjects were asked to state when they thought that a sentence written for a verb was exactly the same for another sentence written for the same verb. They were warned not to look up a dictionary or any other source until they completed the questionnaire.

2.1.4. Procedure

The Classification Questionnaire was explained to the subjects in two groups as graduate and undergraduate students. The subjects were told that this questionnaire was developed

for a scientific research in order to assess the native speakers' judgments on polysemous verbs in Turkish and their classification and the written instructions in the questionnaire form were also explained orally to the subjects. There was no time limit on how long the subjects could spend on completing the questionnaire. They completed the questionnaire within approximately three weeks.

2.1.5. Data analysis

In order to generalize how each subject's mental lexicon works for determining the constraints and to determine the individual differences, the criteria that the subjects used for classification are first analyzed separately for each subject. The reason of this is to draw a frame for how the minds of each subject work to determine the criteria while classifying the senses of the verbs and to designate individual differences. As a matter of fact, when the questionnaire responses of the subjects are analyzed, it is seen that the subjects used similar criteria while classifying the verbs but when they realized a different point they stated it. Afterwards, the criteria that the subjects determined are analyzed for each verb. In the groups in which the subjects classified the senses of verbs based on a specific criterion, the common criteria and the idiosyncratic criteria are determined. The idiosyncratic criteria are generally the ones which are based on the world knowledge and experiences of the subjects (e.g. *olumsuz duygu* 'negative feeling', *eğlence amaçlı aktivite* 'activity for entertainment purposes' etc.); therefore, they are excluded from the analysis. Synonymous words and morphological representation of the meaning are taken into consideration for common criteria. For example, the criteria written by the subjects such as *bir şeyin gitmesine neden olma, bir şeyin uzaklaşmasına sebep olma, dışarıdan bir etki ile bir şeyin gitmesi, göndermek, fırlatmak* or *şiddetle vurma, güç uygulama, güç kullanma, fiziksel bir kuvvet uygulama, efor sarfetme* are considered as common criteria.

3. Findings and discussion

To classify the senses of polysemous verbs is an effective method for reaching the mental representations of verbs' senses in a similar way to the Meaning Production Questionnaire and the Semantic Relatedness Questionnaire as discussed in Uçar (2009). In the Classification Questionnaire, native speakers of Turkish based their classifications on the relatedness among the senses of the verbs and they wrote a definition that contained all the senses in that group by determining the criteria which were the basis for the relatedness among the senses of the verbs. The criteria written by the subjects also give clues about the structure of the mental lexicon. Besides, as Jorgensen (1990: 173) states that lexicographers "have relied on one individual's intuitions in most judgments"; however, "an advantage of having multiple judges lay in being able to evaluate interpersonal consistency". This consistency can be seen as an instrument for assessing the confidence of the subjects' intuitions for classifying the senses of verbs. Similar criteria were used in general while classifying the senses of the verbs. This similarity and consistency of the

criteria is important in that it shows that the mental lexicons of the subjects have similar properties and are structured similarly.

The Classification Questionnaire was implemented for determining the constraints in order to analyze the polysemous verbs in the frame of Optimality Theory. Criteria written by the subjects were considered as constraints because they reflect the mental lexicon of native speakers and they have both common and distinctive features for classification of senses of verbs. However, it is necessary to identify the constraints by linguistic definitions or terms instead of expressions like *bir nesnenin bütünlüğünü bozmak* or *bir şeye engel olmak*. In this connection, the criteria can be said to be compatible with *semantic primitives* and *conceptual functions* which Jackendoff (1983, 1990) identifies in Lexical Conceptual Structure. For this reason, in order to use the criteria as constraints and to name these constraints by linguistic terms, the basic categorization of Jackendoff's (1983, 1990) Conceptual Structure Hypothesis is made use of.

3.1. Constraints

There are two types of constraints: Faithfulness Constraints and Markedness Constraints. Faithfulness Constraints state that the input must be identical to the output. Violations of Faithfulness Constraints lead to differences between input and output (Blutner, de Hoop and Hendriks 2005: 8). Markedness Constraints require that outputs are unmarked or simplified in structure. Because constraints express general statements with respect to language, markedness is encoded via constraints and violations of constraints. The Faithfulness and Markedness Constraints proposed for the analysis of polysemous verbs in line with Optimality Theory are as in (1).

(1) **Faithfulness Constraints (FC)**: The properties of the prototype sense of a polysemous verb are the Faithfulness Constraints.
Markedness Constraints (MC): The senses that do not carry the properties of prototype are the Markedness Constraints.

Since the prototype sense lies behind the Faithfulness and Markedness Constraints, which properties the prototype sense of each verb has become crucial. The properties of the prototype sense of each verb or the criteria determined in the Classification Questionnaire form the Faithfulness Constraints. Other criteria are the Markedness Constraints. The criteria determined by the subjects i.e. the constraints fall into the semantic fields which Jackendoff (1983, 1990) calls Spatial Semantic Field and Non-spatial Semantic Field. Hence, constraints are grouped into two as Spatial and Non-spatial constraints following Jackendoff's hypothesis and terms. Spatial constraints are identified separately for the polysemous verbs which describe Event or State. For example, the criteria which the subjects specified with expressions like *bir yerden ayrılma, belli bir yere gelme, yukarı doğru yönelme* form the constraint GO and the criteria like *konumunu koruma, sabit kalma, bir yerde durma* form the constraint STAY. Some criteria written by the subjects for polysemous verbs which describe Event and corresponding Spatial constraints are as in Table 1.

Table 1. Spatial constraints of polysemous verbs which describe Event

Constraints	**Some criteria written by the subjects**
GO	*Bir yerden ayrılma, belli bir yere gelme, yukarı doğru yönelme*
STAY	*Konumunu koruma, sabit kalma, bir yerde durma*
CAUSE	*Bir kişinin bir yerden ayrılmasını sağlama, belli bir yere döndürme*
MOVE	*Fiziksel hareket, bedensel hareket, bulunduğu yerde hareketlenme*
LET	*Serbest bırakma, birinin bir olayın olmasına izin vermesi, engelleme*
± Agent	*Birinin ileriye doğru gitmesi, kuşun havalanması*
± Author	*Bir yöne doğru istemsiz hareket, bir nesnenin hareket etmesi*
± Force	*Güç kullanarak yerinden etme, dışarıdan bir gücün nesneyi yerinden etmesi*
± Contact	*Temas etme, zeminle sürtünerek ilerleme, bir şeye dokunma*
± Manner	*Havada ilerlemek, bir şeyin aniden olması, aynı hızla hareketi tekrarlama, bir işin istek ile yapılması*
± Sound Emission	*Yansıma sesleri çıkarma, ses çıkmasına sebep olma*
± Body Part	*Bir şeyi elini kullanarak gerçekleştirmek, başını bir yöne doğru döndürmek*

Some criteria written by the subjects for polysemous verbs which describe State and corresponding Spatial constraints are as in Table 2.

Table 2. Spatial constraints of polysemous verbs which describe State

Constraints	**Some criteria written by the subjects**
BE	*Bulunma, bir yerde bir şeyin olması*
ORIENT	*Bir yönü bir tarafa bakma, bir noktaya yönelme*
GO_{Ext}	*Yayılma, bir alanı kaplama, bir uçtan bir uca uzanma*
FORM	*İçermek, içeriğin oluşması, bir maddenin içine dahil olma*
EMOTION	*Anlama, karar verme, heyecanlanma, psikolojik durum, rahatsız olma*
PERCEPTION	*Tatmak, hissetmek, acı hissi duyma, yakma hissi yaratmak*

Jackendoff (1983, 1990, 1992) uses many concepts in Spatial Semantic Field to identify the concepts in Non-spatial Semantic Field. Accordingly, Temporal, Possessional, Identificational, Circumstantial, Existential Fields in Non-spatial Semantic Field can be identified as Non-spatial constraints in the way that the primitives and functions in the Spatial Semantic Field are identified as Spatial constraints in line with the criteria determined by the subjects in the Classification Questionnaire. The Non-spatial constraints are formed as seen in Table 3. For example, the criteria like *belli bir zamanda olma, zamanın işlemesi, erteleme* form the Temporal constraint and the Possessional constraint are specified by the criteria like *edinme, elde etme, harcamak, parayı kenara koyma.* The Possessional constraint includes money exchange. Since this situation was emphasized by the subjects

with the expressions like *para ödemek, para vererek almak* etc., ± Money exchange is considered as a different constraint. A similar case is true for ± Value constraint. The Identificational constraint is related to the categorization of objects and ascription of properties to them and it is formed by the criteria like *nesnenin sahip olduğu özellik, durum değişikliği, farklı hale getirme, bütünlüğünü bozma.* While writing these criteria, the subjects particularly stated the ± Value criterion. So, ± Value constraint is considered as a different constraint, too.

Table 3. Non-spatial constraints

Constraints	**Some criteria written by the subjects**
Temporal	*Belli bir zamanda olma, zamanın işlemesi, erteleme*
Possessional	*Edinme, elde etme, harcamak, parayı kenara koyma, para karşılığı alma*
± Money exchange	*Para ödemek, para vererek almak, para karşılığı bir şeyi almak*
Identificational	*Nesnenin sahip olduğu özellik, durum değişikliği, farklı hale getirme*
± Value	*Sayıda azalma, miktarda azalma*
Circumstantial	*Bir işi yapıyor olmak, yapmaya başlamak, bir şey yapmayı durdurmak*
Existential	*Var olmak, yeni bir şeyin ortaya çıkması*

3.2. Constraints for *gir-* 'enter'

The criteria that the subjects wrote for classifying the senses of *gir-* 'enter' in the Classification Questionnaire are identified as the Faithfulness and Markedness Constraints as seen in Table 4. Accordingly, GO-PATH-Bounded Path-Goal (GBPG) and + Agent-Human (+ AH) which are the properties of the prototype sense of *gir-* 'enter' are determined as the Faithfulness Constraints. As for the Markedness Constraints, they are other properties which do not belong to the prototype sense.

Table 4. Faithfulness and Markedness Constraints for *gir-* 'enter'

Faithfulness Constraints			
GBPG	GO-PATH-Bounded Path-Goal		
+ AH	+ Agent - Human		
Markedness Constraints			
+ Au-I	Author - Inanimate	G_{Ident}	$GO_{Identificational}$
+ Au-A	Author - Animate	G_{Exist} (+)	$GO_{Existential}$ (+)
F	FORM	G_{Circ} (+)	$G_{Circumstantial}$ (+)
G_{Temp}	$GO_{Temporal}$	ES	Emotional State
G_{Poss}	$GO_{Possessional}$		

3.3. Optimizing the sense of *gir-* 'enter'

Dictionary entries of *gir-* 'enter', its etymology and native speakers' intuitions all suggest that the core sense of *gir-* 'enter' corresponds to the definition "to come or go into". The prototypical sense of *gir-* 'enter', as exemplified in the sentence *Bahçede oynayan çocuklar eve girdiler* (2), can be shown through the conceptual structure as in (3).

(2) *Bahçede oynayan çocuklar eve girdiler.*
'The children playing in the garden entered the house.'

(3) [Event GO ([Thing CHILDREN], [Path A ([Place EV])])]

As stated above, GBPG and + AH are the properties of the prototype sense of *gir-* 'enter' and these properties are also the Faithfulness Constraints. Considering the criteria written by the subjects in the Classification Questionnaire, the Faithfulness Constraints can be said to have stronger or weaker properties. The stronger constraint is due to fact that it is the criterion which is written or suggested both firstly and more frequently by the subjects. Besides, the strong properties are the constraints which are violated by most of the other senses of the verb. The senses which have stronger or weaker properties require that these properties should be in a hierarchy. As seen in (4), GBPG is a stronger constraint.

(4) GBPG >> + AH

Table 5 shows how some of the senses of *gir-* 'enter' are evaluated by means of the Faithfulness and Markedness Constraints and to what extent the senses violate these constraints.

Table 5 has three main columns. The first main column gives the prototype sense of the *gir-* 'enter' and other senses. The second and the third main columns give the Faithfulness and Markedness Constraints respectively. In the first column, the upper left corner of the table gives us the prototype sense exemplified by *Bahçede oynayan çocuklar eve girdiler.* Underneath this input, the possible interpretations of *gir-* 'enter' are given. The sentences which exemplify *gir-* 'enter' are the sentences given to the subjects in the Classification Questionnaire. In these sentences, each of the senses of the underlined *gir-* 'enter' is the candidate sense. These candidate senses are evaluated in how good they satisfy or violate the constraints and the optimal output is determined. The sense which satisfies all of the Faithfulness Constraints is the prototype sense and so it is the optimal output which is indicated by the pointing finger (☞). In the second main column, the senses that violate all of the Faithfulness Constraints, in other words, the senses that do not have the properties of the prototype sense are marked, and they are not considered as the sub-senses of the prototype sense. If a sense violates only one or two of the Faithfulness Constraints, as long as it does not violate all of the constraints, it is not considered as marked. The more a sense violates the Faithfulness Constraints, the farther it is from the prototype sense. Thus, the senses which do not violate all of the Faithfulness Constraints can be considered as the sub-senses of the prototype. For example, in Table 5, the sense in sentence 1 satisfies all of the Faithfulness Constraints. The senses in sentences 2, 7 and 16 all satisfy the GBPG constraint but they violate the + AH constraint.

Table 5. Faithfulness and Markedness Constraints for *gir-*

Dışarıdan içeriye gelmek	FC		MC								
	GBPG	+AH	+Au-I	+Au-A	F	G_{Temp}	G_{Poss}	G_{Ident}	G_{Exist} (+)	G_{Circ} (+)	ES
☞1. *Bahçede oynayan çocuklar eve girdiler.*			*	*	**	***	***	***	***	***	**
2. *Ayağım bu ayakkabıya girdi.* 7. *Kümes hayvanlarına kuş gribi girdi.* 16. *Günlerden beri ilk kez midesine sıcak yemek girdi.*		*		*	**	***	***	***	***	***	**
3. *Televizyon programında ateşli tartışmalara girdi.* 5. *Müfettişler raporun ayrıntılarına girdiler.* 6. *Uzun bir süre bekledikten sonra nihayet konuya girdi.* 12. *Birdenbire ilk rastladığı notadan şarkıya girdi.*	***		*	*	***	**	**	**	**		***
4. *Ordularımız Çanakkale'ye girdi.*	***		*	*	***	**		**	**	**	***
8. *İlkbahar girdi.*	***	*		*	***		**	**	**	**	***
9. *Başıma bir ağrı girdi.*	***	*		*	***	**	**	**		**	***
10. *Göğün morlaşan kenarları eriyor, menekşe rengine giriyordu.*	***	*		*	***	**	**		**	**	***
11. *Bu konu kafasına iyice girdi.*	**	*		*	**	***	***	***	***	***	
13. *Geçen hafta 25'ine girdi.*	***	*	*		***		**	**	**	**	***
14. *Üç grup madde camın bileşimine girer.*	**	*		*		***	***	***	***	***	**
15. *Terörle mücadele için birçok genç orduya girdi.*	***		*	*	***	**	**		**	**	***

According to the hierarchy of the constraints in (4), GBPG is a stronger constraint and these senses are related to the prototype sense.

The violations of the constraints are indicated by asterisks. One asterisk (*) indicates normal violations, two asterisks (**) important violations and three asterisks (***) fatal violations. Normal violations are the violations of constraints in the same constraint group which form the Spatial or Non-spatial constraints. Violations of constraints in different constraint groups which form the Spatial or Non-spatial constraints are important violations. Fatal violations emerge depending upon the violations of the Spatial and Non-spatial constraints. For example, if the sense of the verb satisfies the Spatial constraints, the violations of Non-spatial constraints are indicated by three asterisks (***). Two or more usages of *gir-* 'enter' can satisfy the same constraints. In this case, these senses are considered as the same and they are written in the same row of Table 5. According to the violations, the senses are differentiated. For example, the senses in the sentences 3 and 13 satisfy the GO_{Circ} (+) and GO_{Temp} constraints respectively. So, these two senses are different from each other. However, the senses in sentences 3, 5, 6 and 12 satisfy GO_{Circ} constraint. In the Classification Questionnaire, the subjects classified these four senses by similar criteria (e.g. *belli bir konuyu ele almaya başlamak, yapmaya başlamak* etc.) and they considered the senses in the same group. In this case, all the senses which are represented in different definition lines in Turkish Dictionaries can be considered as the same, in the same definition line.

Furthermore, the senses in the sentences 2, 7 and 16 satisfy the same Faithfulness and Markedness constraints: GBPG and + Au-I. These senses are defined in Turkish dictionaries as *sığmak, bulaşmak* and *yemek yemek* respectively. These senses seem to be the same when they are analyzed in terms of the constraints. But, these three senses are defined as *bir şeyin içine girmek* in line with the criteria determined by the subjects. If there is a difference among these three sentences, it seems that it is because of the agent. A virus like bird influenza has the ability to go to another host and in this sense it seems as an agent. However, the sense in the sentence 7 is thought to satisfy the + Au-I constraint in Table 5 since the subjects did not differentiate this situation and they determined the illness in this sentence as + Inanimate.

4. Conclusion

Polysemy which is a concept related to the lexicon of a language is one of the central problems in the study and description of a natural language. A word is said to be polysemous if it has more than one sense. A polysemous verb has different but related senses one of which is the prototype and the others are the senses different from the prototype. In other words, a polysemous verb corresponds to a wide set of senses that is the combination of properties including the strongest, prototypical sense and non-prototypical senses which are weaker than the prototype. Determining the constraints in the frame of Optimality Theory (Prince ve Smolensky 1991, 1993) seems to be the most effective way to identify and differentiate these strong and weak senses. In this study, constraints are the formalizations for identifying the senses of a polysemous verb more clearly. Optimality

Theory draws a general frame for determining how the senses compete with each other and which sense is the optimal output.

In the study, with the Classification Questionnaire implemented for the native speakers of Turkish for the first time, it is discovered that the subjects use criteria which are consistent with each other and reflect the conceptual structures of the verbs to classify the senses of polysemous verbs. This finding explains how native speakers understand and use the senses of polysemous verbs effortlessly. The criteria determined by the subjects structure the constraints used in the analysis of the polysemous verbs. It is observed that the senses of the polysemous verbs are connected directly to these constraints. Based on this connection, the Faithfulness and Markedness Constraints are determined to evaluate the senses of the verbs. For this study, it is proposed that the properties of the prototype sense of a verb are the Faithfulness Constraints and the properties of other senses are the Markedness Constraints. Since the constraints are determined by the judgments of the native speakers, the fact that these Faithfulness and Markedness Constraints are highly effective in identifying the senses of the verbs is one of the basic findings of this study. In the formalization process of the constraints, in the line with the judgments and definitions of native speakers, it is observed that the senses of the polysemous verbs are in the Spatial and Non-spatial fields.

The Faithfulness Constraints are listed in a hierarchy from the strong to the weaker one(s), based on the properties of the prototype sense and the criteria written firstly and more distinctly by the subjects. This hierarchy is essential for a polysemous verb to have senses other than the prototype and to represent the structure of senses from closer to farther from the prototype sense. If a sense violates the strongest Faithfulness Constraint at a normal level, that sense can be considered as a sub-sense of the prototype. If the violation is important, i.e. it is in different constraint groups which form the Spatial or Non-spatial constraints, then, it means that that sense is farther from the prototype sense. The senses which fatally violate the Faithfulness Constraints are the farthest senses from the prototype and these senses are in a different semantic field. The senses of a polysemous verb are identified in accordance with which Markedness Constraints are satisfied. Thus, senses which satisfy different Markedness Constraints are different from each other. If the senses of a verb, which are represented in different definition lines in Turkish Dictionaries, satisfy the same constraints, it can be said that these senses are the same in fact. As in the Faithfulness Constraints, in the Markedness Constraints, the gradational violation of constraints is effective in determining the closeness of senses with each other. While the senses which fatally violate the constraints are very far from each other, there is far less difference among the senses violating the constraints at a normal level.

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